ADVANCES in EDUCATIONAL TECHNOLOGIES

Proceedings of the 2014 International Conference on Education and Modern Educational Technologies (EMET 2014)

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All papers of the present volume were peer reviewed by no less than two independent reviewers. Acceptance was granted when both reviewers' recommendations were positive.

Series: Educational Technologies Series | 12

ISSN: 2227-4618
ISBN: 978-1-61804-238-5

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Indirect identification of transfer function specific to cell line dynamics

Corina C. Brîndușa, Philippe Dondon, and Cornelia A. Bulucea

***Abstract*—** Glioblastoma is the most common highest-grade and lethal type of brain tumor, causing a high rate of death each year worldwide. Given the resistance of this tumor to standard surgery, radiation and chemotherapy, the consistent efforts to comprehensively profile glioblastomas using latest technologies are addressing this need. In line with this idea, this paper focuses to enhancing an understanding of the potentially useful correlations between medicine field and electrical engineering, as parts of our knowledge about life, Nature and Universe. Analysis of variables specific to a biological system by type of tumor cell populations can be made by analogy with the electric structure of passive quadrupole type. The transfer function is determined directly through a complex electronic structures encompassing a *RC* (resistor, capacitance) quadrupole + operational amplifier *OA*. By evaluating *in vitro* of the cell line *GB9B*, derived from glioblastoma, (*GB*), and based on the analysis of residues is determined indirectly, and validates the transfer function. Mathematical model of transfer function type enables to simulate numerical *3D* of the expression of the output quantity. The findings of this work supports the belief in the power of science, demonstrating the strong links between the research in medicine field and the electrical engineering outcomes.

***Keywords*—** cell fraction, electric passive quadrupole, transfer function, tumor cells.

I. INTRODUCTION

The high incidence of multiform glioblastoma cases and special aggressiveness of such brain tumors have led to a large number of research papers in this area.

Multiform Glioblastoma is the most common type of primary malignant brain tumours, with a mean survival / patient for about a year. The adverse prognosis could be explained by the glioblastoma resistance to various disturbing factors. A negative aspect in the post-operative evolution, namely the surgical removal of tumour tissue is given by a high rate of recurrence of the tumour. Causality of this aspect of tumour recurrence is unknown. It is believed that endogenous tumour cells are the source of new tumour cells [1].

In an analysis of cell lines derived from glioblastoma, *GB*, one could note that such cells do not show contact inhibition. Also, such cells are resistant, in certain limits, to a number of perturbations that may occur in the biochemical cultivation process: they are less dependent on the absence of a continuous input of energy (can increase with fewer nutrients); are more resistant to temperature and *pH* shocks etc. Cells derived from *GB* belong to the class of immortal cells, ie they have theoretically the possibility to divide themselves indefinitely.

In literature we find models that describe the development of cell populations, rather we have models describing analytically the specific growth rate of the cell mass depending on the concentration of culture substrate *S*. A good correlation is offered by *Monod relationship,* expressing analytical dependence of the specific growth rate of cell mass, as a function of the concentration of the substrate. In situations where one of the components of the nutritious substrate starts to miss, developing of cell population is limited, a situation reflected by decreasing of specific growth rate of cell mass.

For *in vivo* investigations, it is known that the explosive growth of tumors, including glioblastomas, is related to the formation of vascular networks mimicry, *(VM)*. Vascular networks remarkably contribute to the aggressiveness of cancer cells in the body, the appearance of fast growing tumors, [2,3].

A number of studies emphasize the role of stem cells in tumor formation and development, including the formation of vascular networks mimicry, *VM*. So, the development of the tumor mass is accompanied by the appearance of their very intense vascular process [4,5,6].

Recent studies in *Clinical research laboratory of UMF Craiova* showed a high potential for proliferation of cell lines derived from glioblastoma.

Developing a complex mathematical model of cell fraction allows the *3D* numerical simulation, in order to obtain a expression of status estimators. One could note that it is possible to develop mathematical models for analyzing the cellular fraction of *GB* based on a so-called indirect construction process of the mathematical pattern. Further it must be noted that a residue analysis allows validating the mathematical model of the dynamics of cellular fraction, based on the mathematical pattern that is built on a complex electronic structures encompassing a *RC* quadrupole and an operational amplifier *OA*.

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ISBN: 978-1-61804-238-5

II. MATERIAL AND METHOD

Cell line *GB9B* was developed on the basis of tumor sections provided by Hospital *Bagdasar Arseni* in Bucharest, in patients with glioblastoma, according to standard procedures.

Standard culture medium, (Minimum Essential Medium - *MEM*), have been provided by the SIGMA – ALDRICH,.(St. Louis, USA).

Fetal bovine serum (*FBS*), and antibiotics have been provided by the GIBCO, (South America).

The process of dynamic cell proliferation type, on the cell line *GB9B* was performed in the *Laboratory CRL*.

Treatment of cells. The cell line was grown in modified standard medium MEM (which is containing 10% fetal bovine serum *(FBS)*, 1% antibiotics). The cells were grown in flasks (with size of 200ml), and were maintained in incubator at 37°C, 95% O_2 and 5% CO_2. At each interval of 4 days was imposed changing the standard *MEM*.

The cell line was incubated for a period of 12 days. Cell viability was determined by daily counting of the cells number in pre-marked areas.

III. RESULTS

Following the incubation process at which the cell line *GB9B* has been subjected, it has resulted a strong cell viability during the first 6 days from starting the incubation. The cell fraction of the *GB9B* line has a relatively small increase in the range of 7-8 days. Towards the end of the proliferation process the kinetic evolution is of landing. type This effect continues until the end of the experiment, according to **Table 1**. We set the system variables as follows: *cellular fraction* f_1 / *incubation time* ***t***.

Table 1. *Cellular fraction,* f */ Tumor cell line, GB9B*

Treatment day, ***n***	1	2	3	4	5	6
Incubation time, ***t****,(d)*	0	1	2	3	4	5
Cellular fraction, f_1	1	1.79	2.05	2.48	2.81	3.10
Fraction compensated, f_c	0	0.79	1.05	1.48	1.81	2.1
Treatment day, ***n***	7	8	9	10	11	12
Incubation time, ***t****,(d)*	6	7	8	9	10	11
Cellular fraction, f_1	3.44	3.65	3.79	3.80	3.82	3.83
Fraction compensated, f_c	2.44	2.65	2.79	2.8	2.82	2.83

Aspects of the specific geometrics of cell proliferation derived from *GB9B* are depicted in **Figure 1**.

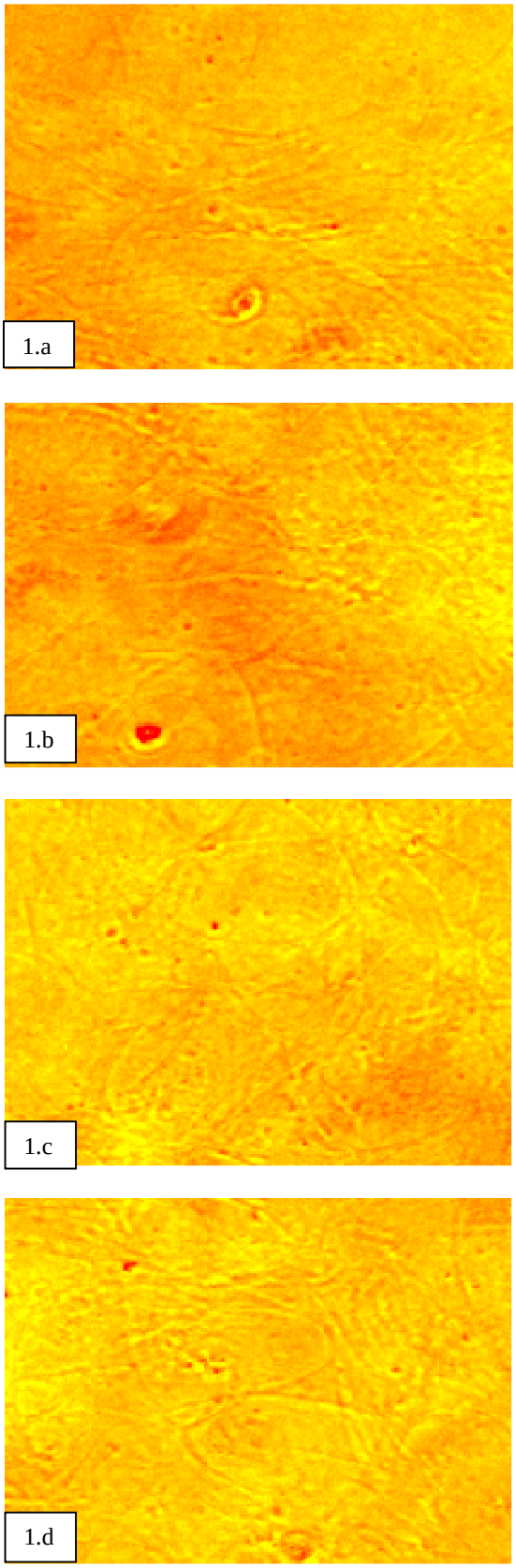

Figure 1. *Complex network of specific tumor cell line GB9B*

This paper focuses to enhancing an understanding of the potentially useful correlations between medicine field and electrical engineering, as parts of our knowledge about Life, Nature and Universe. We intended to search if two distinct processes, one falling in the medicine field (namely, related to in vitro tumor cell proliferation), and the other specific to electric field (ie the electric capacitor charging process at a constant voltage U_1 supply source) could admit the same mathematical model. One could note that mathematical pattern processes are described in both cases by transfer functions. We would like to consider it as an original idea of the authors.

Consequently, analysis of variables specific to a biological system by type of tumor cell populations can be made by analogy with the electric structure of passive quadrupole type.

In order to deal with construction of mathematical model for analyzing the cellular fraction of *GB* we follow an analogy with electrical structure of electric passive quadrupole type. Based on complex electronic structure represented in **Figure 2**, (composed mainly of the *RC* quadrupole, the signal repeater A_1, amplifier/ signal inverting A_2, A_3), we construct the mathematical model through operational calculus.

In the case of an electric circuit *RC* for the capacitor *C* (see **Figure 2**), the following equations had been taken into consideration:

$$u_1(t) = Ri + \frac{1}{C}\int idt \qquad (1)$$

$$u_C(t) = \frac{1}{C}\int idt \qquad (2)$$

$$u_1(t) = RC\frac{du_2}{dt} + u_2(t) \qquad (3)$$

$$u_2(t) = K_1K_2u_C(t) \qquad (4)$$

We based the calculation on the Laplace transformation, we have used the work in operational field, and the roots of the denominator represent the so-called poles.Based on the operational calculation, (through the operator *p*), it will result:

$$\frac{U_1}{p} = RCpU_2 + U_2 \qquad (5)$$

$$U_1 = p(RCp+1)U_2 \qquad (6)$$

$$\frac{U_2}{U_1} = H_{21} = \frac{1}{p(RCp+1)} \qquad (7)$$

The transfer function will be as the form:

$$H_{21}(p) = K_1 \cdot K_2 \cdot \frac{1}{\tau} \cdot \frac{1}{p\left(p + 1/\tau\right)} \qquad (8)$$

where: $\tau = RC$ (9)

$$K_1 = R_5/R_4 \qquad (10)$$

$$K_2 = R_8/R_7 \qquad (11)$$

$$R_3 = 0 \qquad (12)$$

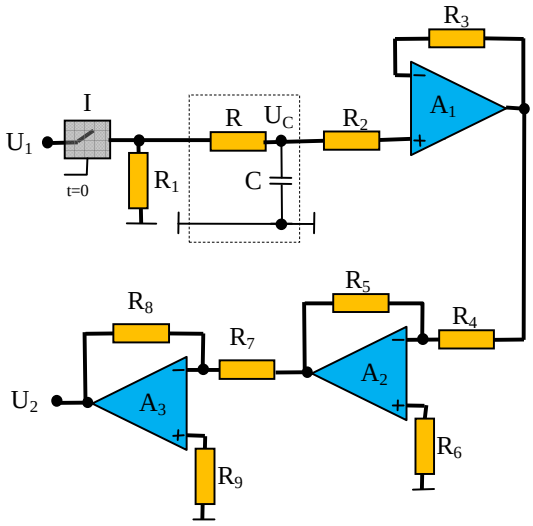

Figure 2*: Electronic structure: RC + OA.*
Observation: - the resistances R_1, R_2, R_6, R_9 are undefined;
- A_1, A_2, A_3 - precision OA with the input jFET;- I - CND;
- the scheme does not apply to direct measurements.

The transfer function is determined directly through a complex electronic structures encompassing a *RC*, (resistor, capacitance), quadrupole *RC* + operational amplifier *OA*. Near U_1 our configuration encompasses a switcher *I* having a normally opened contact. At the moment *t=0* this is switching and allows the capacitor *C* charging through the resistor, powered by U_1 from a *DC* supply source. Consequently, in **Figure 2** we didn't have elements related to the in vitro cultivation of tumor cells.

One could note that we took into consideration that A_2 and A_3 are affected by signals on the inverting input. So, if we would measure the voltage level after A_2 we would find out a negative level, (to the ground). This is the reason we introduced the inverter A_3 which allows obtaining a positive level at the output, (namely, U_2)

Since this paper is focusing on a holistic image of a similar evolution of the two considered processes, our study is intending to make an indirect assumption on the resistance values, namely on the basis of the relation $H_{21}(p)$ one could deduce, for instance, that $R_4=R_5$ and $R_7=R_8$.

The resistances R_1, R_2, R_6, R_9 are undefined, meaning that they are not important as dimensioning values in this electronic configuration. Rather we have introduced them in the electric circuit in order to emphasize that they could solve several disadvantages, such as:

- maintaining a relative fixed potential to the ground; avoiding the parasitic load of the capacitor *C*, (the case R_1);
- symbolic highlighting that the capacitor *C* is relatively non-connected to then on-inverting input of the operational amplifier A_1, (namely, R_2);
- achievement of a floating potential of the non-inverting inputs of the operational amplifiers A_2 and A_3, (R_6 and R_9).

ISBN: 978-1-61804-238-5

By evaluating *in vitro* of the cell line *GB9B*, derived from glioblastoma, (*GB*), and based on the analysis of residuues is determined indirectly, and validates the transfer function. Mathematical model of transfer function type enables to simulate numerical *3D* of the expression of the output quantity.

One could note that the notion of Residuues is introduced into the meaning of Induced in statistic analysis, which is a term specific in medicine research

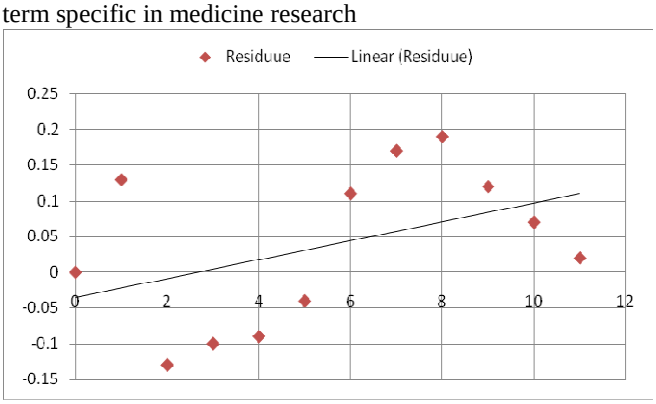

Figure 3. *Residuues diagram*

The transfer function $H_{21}(p)$ (8) contains two poles, as stability elements for the electronic system. When applying at the *RC* quadrupole input, (at *t=0*), an electric signal by magnitude U_1, at the output of the active structure will be obtained an electric signal that tends to the magnitude U_2, after a time interval that is a multiple of time constant τ.

Time constant of the *RC* quadrupole is $\tau = RC$. Taking into consideration the type of followed process, one could choose a time constant with a relatively large value, namely $\tau = 3d$. Further it must highlighted as required for the input signal of level type the value U_1. That means we can fill the second row of **Table 2** with the values calculated on basis of the model $\left[L^{-1}H_{21}(p)\right]_{t=0}^{t=4\tau}$. In our case these values are expected magnitudes. The observed values are filled in the third row, (as *fraction compensated* f_c in **Table 1**).

Table 2. *Calculation of residuues*

Time t, (1)	0	1	2	3	4	5
Predicted values (2)	0	0.66	1.18	1.58	1.90	2.14
Observed values (3)	0	0.79	1.05	1.48	1.81	2.1
Residuue values (4)	0	0.13	-0.13	-0.10	-0.09	-0.04
Residuues Std (5)	0	1.18	-1.18	-0.91	-0.82	-0.36
Time t, (1)	6	7	8	9	10	11
Predicted values (2)	2.33	2.48	2.60	2.68	2.75	2.81
Observed values (3)	2.44	2.65	2.79	2.8	2.82	2.83
Residuue values (4)	0.11	0.17	0.19	0.12	0.07	0.02
Residuues Std (5)	0.99	1.54	1.72	1.09	0.63	0.18

The fourth row contains the residue values. They represent the prediction error magnitude calculated as the difference between the observed and predicted values, according to **Figure 3**.

One must highlight that this paper deal with a culture on a tumor cell line, in vitro, but not with a tumor tissue

IV. DISCUSSION AND CONCLUSIONS

Cell line *GB9B* of type tumor cells *GB* was incubated in *Clinical research laboratory (CRL)* of UMF Craiova. The incubation process revealed a strong cell viability, accompanied by a large increase in the growth rate of the cell fraction dynamics.

In other research, conducted *in vivo* has been revealed the increase of tumor cell mass accompanied by microvascular proliferation of tumor tissues. The explanation is related to the need to ensure an optimal local energy resources [1]. This aspect of the optimum of local energy is defining in case of cultivation of cell lines derived from *GB*. It is required a constant refreshment of standard *MEM* culture medium (including fetal bovine serum - *FBS*, antibiotic), during the process of incubation.

The aspect of specific aggressivity of glioblastoma *(GB)* is supported by Wang R, et al. [7]. They pointed out a notable feature of *GB* ie an abnormal vascular network, which prints an enlarged tissue hyperplasia. Mechanisms of angiogenesis and tumor endothelial cell origin remain poorly defined.

Further on we would look for proving that a mathematical model described by a differential equation of order 2 with concentrated parameters could be accepted for a complex process of xenobiotic absorption [11]. Within the structure of a modulated absorption system, with a target type xenobiotic, one could identify specific elements of xenobiotic compounds dissipating type and of xenobiotic compounds accumulating type. As is already told, a mathematical model depicting a xenobiotic absorption process could be a differential equation of order 2 [13,15].

Continuous and sustained pursuit of subjects which have a xenobiotic induced retardation in speech is vital in the areas of permanent and intensive monitoring. Detection and quantification of retardation induced impermanent implementation on a subject affected by a xenobiotic can be implemented by using the elements of statistical analysis, more precise by watching crowd sounds appearances interrelated groups [12,14].

It is important in the study of tumor cell proliferation *in vitro* the construction of specific mathematical model of the process. We believe that the construction of the mathematical model in the form of the transfer function can be obtained by analogy with complex electronic structures, namely a *RC* quadrupole + an operational amplifier *OA*.

It is possible to develop mathematical models of cellular fraction *GB* analysis based on a so-called indirect construction process of mathematical model. The mathematical model for analyzing the cellular fraction of *GB* was built indirectly by analogy with the mathematical model of a passive quadrupole of *RC* type. It is important that during the construction of such a model to have a mathematical model validation stage.

ISBN: 978-1-61804-238-5

Residue analysis allows to validate a mathematical model of the dynamics of cellular fraction, based on the mathematical model built on complex electronic structure entailing a *RC* quadrupole + an operational amplifier *OA*.

The transfer function of electronic structure *RC* quadrupole + operational amplifier *OA* determines forecast values for the proliferation process of tumor cells gliblastoma. Based on the analysis of residues one could accept that such a mathematical model $H_{21}(p) = H_{GB} = K_1 \cdot K_2 \cdot \frac{1/\tau}{p\left(p + 1/\tau\right)}$ is valid for the proliferation process of the cell line,*GB9B*, of *GB* tumor cell type. It is believed that the process of proliferation of tumor cells *GB* is defined by the points: $[\tau,(1\text{-}e^{-1})]$, $[2\tau,(1\text{-}e^{-2})]$, $[3\tau,(1\text{-}e^{-3})]$.

Calculation of standard residues explains our choice to accept indirect construction of the mathematical model specific to this biochemical process by cell dynamic type on tumor cells *GB*.

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School Dropout Screening through Artificial Neural Networks based Systems

Margarida Figueiredo, Lídia Vicente, Henrique Vicente, and José Neves

***Abstract*—**School dropout is one of the major concerns of our society. Indeed, it is a complex phenomenon, resulting in economic and social losses, either to the individual, family or the community to which the person belongs. Academic difficulty and failure, poor attendance, retention, disengagement from school together with family and socio-economic reasons can lead to such occurrence. In this work Logic Programming was used for knowledge representation and reasoning, letting the modeling of the universe of discourse in terms of defective data, information and knowledge. Artificial Neural Networks were used in order to evaluate potential situations of school dropout and the degree of confidence that one has on such a happening.

***Keywords*—**Artificial Neuronal Networks, Knowledge Representation and Reasoning, Logic Programming, School Dropout.

I. Introduction

EDUCATION is a powerful driver of development and one of the soundest instruments for reducing countries poverty. Although there has been great progress in the last decade, a large number of young people that finished their education did it without acquiring basic skills necessary for work and life. This is particularly detrimental when unemployment is high and labour markets are demanding more skills than ever before [1].

In the 21st century, in all developed countries, education of children and young people is recognized as one of the core values. However, school dropout numbers are much higher than would be desirable. According to data from the official statistics institute EU in 2012, Portugal had a dropout rate of 20.8%. Spain, with 24.9%, and Malta, with 22.6%, these were the only European countries which that year showed the highest values. Despite the decline between 2005 and 2011 (from 38.8% to 20.8%), this rate is still far from the national goal of a 10% dropout in secondary schools for 2020 [2].

This work is funded by National Funds through the FCT - Fundação para a Ciência e a Tecnologia (Portuguese Foundation for Science and Technology) within projects PEst-OE/EEI/UI0752/2014 and PEst-OE/QUI/UI0619/2012.

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The reasons why young people have poor skills when they finish their school careers are many and diverse. Solving this problem requires detailed knowledge of the causes that lead to this situation. School dropout is one of those causes. It is a complex phenomenon, resulting in economic and social losses, either to the individual, family or the community to which the person belongs. If school dropout is large in a country or in a developed region, the consequences will be mainly damaging in terms of economic competitiveness and social environmental degradation [3].

Young people drop out of school for multiple reasons, and such decision rarely is a spur of the moment. Indeed, in large number of cases, young people drop out of school following a long process of disengagement and academic struggle. The factors behind the school dropout phenomenon can be grouped in four main generic groups, namely student related factors, family related factors, school related factors and community related factors [4], as illustrated in Fig. 1.

With regard to student related factors, poor school performance is a strong indicator of dropping out of school. Indeed, low test scores, course failure, and grade retention have been found to be strongly associated with school dropout [4], [5]. The causes for this are multiple and complex. Sometimes students get involved with gangs, drugs, alcohol, get pregnant and commit crimes. Many have a poor school attitude and are frequently bored by school. They are disconnected to their families, school and life. They do not see the reasons why they need to go to school. They are not involved in school activities and have lack of self-esteem [4], [5].

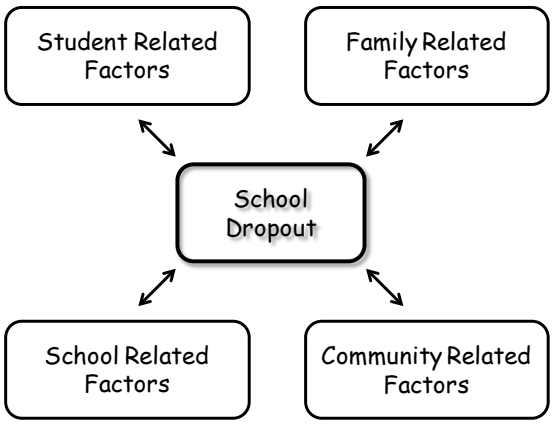


Fig. 1 Causes behind of the school dropout phenomenon

ISBN: 978-1-61804-238-5

Family related factors affecting heavily the school dropout situations. Students coming from families with low socio-economic backgrounds, where there are many other children, older children often have to go to work or have to stay at home to take care of younger siblings. Frequently, in these families, parents have also a history of school dropout [4], [5].

The policies followed by the schools are important in the involvement of students in the educational project. High number of students per class and overloaded schedules can contribute to disinterest students. Problematic students need adequate guidance counselling and alternative curricula properly tailored. The characteristics of the community where the student lives and where the school is located can also contribute to school dropout. Many students live in places where education is not valued, where there is low demand for qualifications by employers and where drugs, gangs and violence abound [4], [5].

Solving problems related to dropout requires a proactive strategy able to take into account all these factors. Thus, the development of models to evaluate the risk of dropout may be a way to solve or minimize the problem. This work introduces a computational system to evaluate potential situations of school dropout centred on logic programming to knowledge representation and reasoning, complemented with a computational framework based on Artificial Neural Networks.

II. Quality-of-Information versus Degree of Confidence

Due to the growing need to offer user support in decision making processes some studies have been presented [6], [7], related to the qualitative models and qualitative reasoning in Database Theory and in Artificial Intelligence research. With respect to the problem of knowledge representation and reasoning in Logic Programming (LP), a measure of the *Quality-of-Information* (*QoI*) of such programs has been object of some work with promising results [8], [9]. The *QoI* with respect to the extension of a predicate *i* will be given by a truth-value in the interval [0,1], i.e., if the information is *known* (*positive*) or *false* (*negative*) the *QoI* for the extension of *predicate*$_i$ is 1. For situations where the information is unknown, the *QoI* is given by:

$$QoI_i = lim_{N \to \infty} \frac{1}{N} = 0 \qquad (N \gg 0) \tag{1}$$

where *N* denotes the cardinality of the set of terms or clauses of the extension of *predicate*$_i$ that stand for the incompleteness under consideration. For situations where the extension of *predicate*$_i$ is unknown but can be taken from a set of values, the *QoI* is given by:

$$QoI_i = {}^{1}/_{Card} \tag{2}$$

where *Card* denotes the cardinality of the *abducibles* set for *i*, if the *abducibles* set is disjoint. If the *abducibles* set is not disjoint, the *QoI* is given by:

$$QoI_i = \frac{1}{C_1^{Card} + \cdots + C_{Card}^{Card}} \tag{3}$$

where C_{Card}^{Card} is a card-combination subset, with *Card* elements. The next element of the model to be considered is the relative importance that a predicate assigns to each of its attributes under observation, i.e., w_i^k, which stands for the relevance of attribute *k* in the extension of $predicate_i$. It is also assumed that the weights of all the attribute predicates are normalized, i.e.:

$$\sum_{1 \le k \le n} w_i^k = 1, \forall_i \tag{4}$$

where $\forall$ denotes the universal quantifier. It is now possible to define a predicate's scoring function $V_i(x)$ so that, for a value $x = (x_1, \cdots, x_n)$, defined in terms of the attributes of $predicate_i$, one may have:

$$V_i(x) = \sum_{1 \le k \le n} w_i^k \times QoI_i\,(x)/n \tag{5}$$

It is now possible to engender all the possible scenarios of the universe of discourse, according to the information given in the logic programs that endorse the information depicted in Fig. 3, i.e., in terms of the extensions of the predicates *General Characterization*, *Student Related Factors*, *Family Related Factors, School Related Factors Community Related Factors and School Dropout*.

It is now feasible to rewrite the extensions of the predicates referred to above, in terms of a set of possible scenarios according to productions of the type:

$$predicate_i\big((x_1, \cdots, x_n)\big) :: QoI \tag{6}$$

and evaluate the *Degree of Confidence* (*DoC*) given by $DoC = V_i(x_1, \cdots, x_n)/n$, which denotes one's confidence in a particular term of the extension of $predicate_i$.To be more general, let us suppose that the Universe of Discourse is described by the extension of the predicates:

$$a_1(\cdots), a_2(\cdots), \cdots, a_n(\cdots) \ \ where \qquad (n \ge 0) \tag{7}$$

Therefore, for a given *scenario*$_i$, one may have (where $\perp$ denotes an argument value of the type unknown; the values of the others arguments stand for themselves):

$$\begin{cases} \neg a_1(x_1, y_1, z_1) \leftarrow not\ a_1(x_1, y_1, z_1) \\ \quad a_1([3,5],\ \perp,\ 1.2) :: 0.85 \\ \quad \underbrace{[0,15][5,35][0,7.2]}_{\text{attribute`s domains for } x_1, y_1, z_1} \\ \\ \neg\ a_2(x_2, y_2, z_2) \leftarrow not\ a_2(x_2, y_2, z_2) \\ \quad a_2([13,22],\ [8,10],\ \perp) :: 0.7 \\ \quad \underbrace{[10,40]\ \ [6,14]\ \ [2,5]}_{\text{attribute`s domains for } x_2, y_2, z_2} \\ \\ \qquad \vdots \end{cases}$$

1st interaction: transition to continuous intervals

$$\begin{cases} \neg a_1(x_1, y_1, z_1) \leftarrow not\ a_1(x_1, y_1, z_1) \\ a_1([3,5],[5,35],[1.2,1.2]) :: 0.85 \\ \underbrace{[0,15][5,35]\quad[0,7.2]}_{\text{attribute`s domains for } x_1,y_1,z_1} \\ \\ \neg\ a_2(x_2, y_2, z_2) \leftarrow not\ a_2(x_2, y_2, z_2) \\ a_2([13,22],[8,10],[2,5]) :: 0.7 \\ \underbrace{[10,40]\ [6,14]\ [2,5]}_{\text{attribute`s domains for } x_2,y_2,z_2} \\ \\ \vdots \end{cases}$$

2nd interaction: normalization $\frac{Y - Y_{min}}{Y_{max} - Y_{min}}$

$$\begin{cases} \neg a_1(x_1, y_1, z_1) \leftarrow not\ a_1(x_1, y_1, z_1) \\ \\ a_1\left(\left[\frac{3-0}{15-0}, \frac{5-0}{15-0}\right], \left[\frac{5-5}{35-5}, \frac{35-5}{35-5}\right], \left[\frac{1.2-0}{7.2-0}, \frac{1.2-0}{7.2-0}\right]\right) \equiv \\ \\ a_1([0.2,0.33],[0,1],[0.17,0.17]) :: 0.85 \\ \underbrace{[0,1]\quad[0,1]\quad[0,1]}_{\text{attribute`s domains for } x_1,y_1,z_1} \\ \\ \neg\ a_2(x_2, y_2, z_2) \leftarrow not\ a_2(x_2, y_2, z_2) \\ \\ a_2\left(\left[\frac{13-10}{40-10}, \frac{22-10}{40-10}\right], \left[\frac{8-6}{14-6}, \frac{10-6}{14-6}\right], \left[\frac{2-2}{5-2}, \frac{5-2}{5-2}\right]\right) \equiv \\ \\ a_2([0.1,0.4],[0.25,0.5],[0,1]) :: 0.7 \\ \underbrace{[0,1]\quad[0,1]\quad[0,1]}_{\text{attribute`s domains for } x_2,y_2,z_2} \\ \\ \vdots \end{cases}$$

The *Degree of Confidence* (*DoC*) is evaluated using the equation $DoC = \sqrt{1 - \Delta l^2}$, as it is illustrated in Fig. 2. Here Δl stands for the length of the arguments' intervals, once normalized.

Below, one has the expected representation of the universe of discourse, where all the predicates´arguments are nominal. They speak for one´s confidence that the unknown values of the arguments fit into the correspondent intervals referred to above.

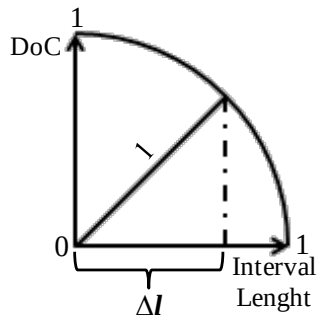


Fig. 2 *Degree of Confidence* evaluation

$$\begin{cases} \neg a_1(x_1, y_1, z_1) \leftarrow not\ a_1(x_1, y_1, z_1) \\ a_1(0,\ 0.75,\ 0.8) :: 0.9 \\ [0,1]\ [0,1]\ [0,1] \\ \\ \neg\ a_2(x_2, y_2, z_2) \leftarrow not\ a_2(x_2, y_2, z_2) \\ a_2(0.65,\ 0.7,\ 0) :: 0.85 \\ [0,1]\ [0,1][0,1] \\ \\ \vdots \end{cases}$$

III. Knowledge Representation and Reasoning

Many approaches for knowledge representation and reasoning have been proposed using the *Logic Programming* (*LP*) paradigm, namely in the area of Model Theory [10]–[12], and Proof Theory [13], [14]. We follow the proof theoretical approach and an extension to the *LP* language, to knowledge representation and reasoning. An *Extended Logic Program* (*ELP*) is a finite set of clauses in the form:

$$p \leftarrow p_1, \cdots, p_n, not\ q_1, \cdots, not\ q_m \tag{8}$$

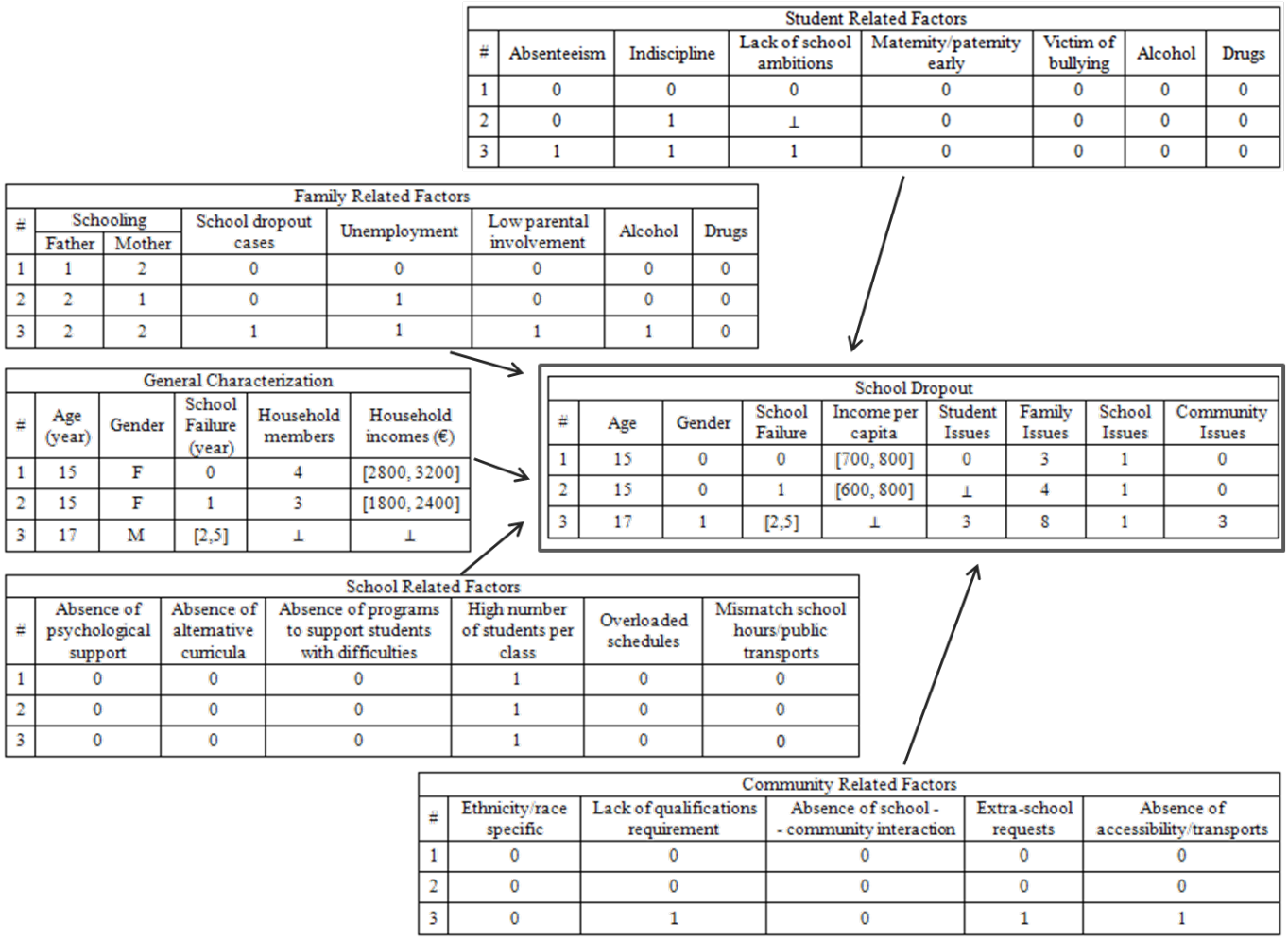
$$?\,(p_1, \cdots, p_n, not\ q_1, \cdots, not\ q_m)\ \ (n, m \geq 0) \tag{9}$$

where *?* is a domain atom denoting falsity, the p_i , q_j , and p are classical ground literals, i.e., either positive atoms or atoms preceded by the classical negation sign $\neg$ [14]. Under this representation formalism, every program is associated with a set of *abducibles* [10] [12], given here in the form of exceptions to the extensions of the predicates that make the program. Once again, LP emerged as an attractive formalism for knowledge representation and reasoning tasks, introducing an efficient search mechanism for problem solving. Therefore, and in order to exemplify the applicability of our model, we will look at the relational database model, since it provides a basic framework that fits into our expectations [15], and is understood as the genesis of the LP approach to knowledge representation and reasoning.

Consider, for instance, the scenario where a relational database is given in terms of the extensions of the relations or predicates depicted in Fig. 3, which stands for a situation where one has to manage information about school dropout. Under this scenario some incomplete data is also available. For instance, in *General Characterization* database the *Household incomes* for case 3 is unknown, while for example 1 ranges in the interval [2800,3200].

The values of the *Student*, *Family*, *School* and *Community Issues* in *School Dropout* database are the sum of the respective values, ranging between [0,7], [0,11], [0,6] and [0,5] respectively.

Now, we may consider the extensions of the relations given in Fig. 3 to populate the extension of the *dropout* predicate, given in the form:



Student Related Factors

#	Absenteeism	Indiscipline	Lack of school ambitions	Maternity/paternity early	Victim of bullying	Alcohol	Drugs
1	0	0	0	0	0	0	0
2	0	1	⊥	0	0	0	0
3	1	1	1	0	0	0	0

Family Related Factors

#	Schooling		School dropout cases	Unemployment	Low parental involvement	Alcohol	Drugs
	Father	Mother					
1	1	2	0	0	0	0	0
2	2	1	0	1	0	0	0
3	2	2	1	1	1	1	0

General Characterization

#	Age (year)	Gender	School Failure (year)	Household members	Household incomes (€)
1	15	F	0	4	[2800, 3200]
2	15	F	1	3	[1800, 2400]
3	17	M	[2,5]	⊥	⊥

School Dropout

#	Age	Gender	School Failure	Income per capita	Student Issues	Family Issues	School Issues	Community Issues
1	15	0	0	[700, 800]	0	3	1	0
2	15	0	1	[600, 800]	⊥	4	1	0
3	17	1	[2,5]	⊥	3	8	1	3

School Related Factors

#	Absence of psychological support	Absence of alternative curricula	Absence of programs to support students with difficulties	High number of students per class	Overloaded schedules	Mismatch school hours/public transports
1	0	0	0	1	0	0
2	0	0	0	1	0	0
3	0	0	0	1	0	0

Community Related Factors

#	Ethnicity/race specific	Lack of qualifications requirement	Absence of school - - community interaction	Extra-school requests	Absence of accessibility/transports
1	0	0	0	0	0
2	0	0	0	0	0
3	0	1	0	1	1

Fig. 3 An extension of the relational database model. In column *Gender* of *School Dropout* database, 0 (zero) and 1 (one) stand, respectively, for *female* and *male*. In column *Schooling* of *Family Related Factors* database, 0 (zero), 1 (one), 2 (two) and 3 (three) denote, respectively, *university course*, *secondary education*, *primary education* and *illiterate*. In the remaining columns of *Student*, *Family*, *School* and *Community Related Factors* 0 (zero) denotes *absence/no* and 1 (one) denotes *presence/yes*

$$dropout : Age, G_{ender}, S_{chool}F_{ailure}, Inc_{ome\ per\ capita}, Stud_{ent\ Issues}, Fam_{ily\ Issues}, Sch_{ool\ Issues}, Com_{munity\ Issues} \rightarrow \{0,1\}$$

where 0 (zero) and 1 (one) denote, respectively, the truth-values *false* and *true*. It is now possible to give the extension of the predicate *dropout*, in the form:

$$\{$$

$$\neg dropout\ (Age, G, SF, Inc, Stud, Fam, Sch, Com)$$

$$\leftarrow not\ dropout\ (Age, G, SF, Inc, Stud, Fam, Sch, Com)$$

$$dropout\ (15,\ 0,\ 0,\ [700,800],\ 0,\ 3,\ 1,\ 0) :: 1$$
$$[6,22][0,1][0,8][200,3000][0,7][0,11][0,6][0,5]$$

$$dropout\ (15,\ 0,\ 1,\ [600,800],\ \bot,\ 4,\ 1,\ 0) :: 1$$
$$[6,22][0,1][0,8][200,3000][0,7][0,11][0,6][0,5]$$

$$\}$$

In this program, the first clause denotes the closure of predicate *dropout*. The next clauses correspond to two terms taken from the extension of the *dropout* relation. It is now possible to have the arguments of the predicates extensions normalized to the interval [0, 1], in order to compute one's confidence that the nominal values of the arguments under considerations fit into the intervals depicted previously. One may have:

$$\{$$

$$\neg dropout\ (Age, G, SF, Inc, Stud, Fam, Sch, Com)$$

$$\leftarrow not\ dropout\ (Age, G, SF, Inc, Stud, Fam, Sch, Com)$$

$$dropout([0.56,0.56], [0,0], [0,0], [0.18,0.21], [0,0], [0.27,0.27], [0.17,0.17], [0,0]) :: 1$$
$$[0,1]\ \ [0,1]\ \ [0,1]\ \ [0,1]\ \ [0,1]\ \ [0,1]\ \ [0,1]\ \ [0,1]$$

$dropout([0.56,0.56],[0,0],[0.12,0.12],[0.14,0.21],$
$[0,1],[0.36,0.36],[0.17,0.17],\ [0,0])\ ::\ 1$
$[0,1]\quad [0,1]\quad [0,1]\quad [0,1]$
$[0,1]\quad [0,1]\quad [0,1]\quad [0,1]$
}

The logic program referred to above, is now presented in the form:

{
$\neg dropout_{DoC}(Age, G, SF, Inc, Stud, Fam, Sch, Com)$

$\leftarrow not\ dropout_{Doc}(Age, G, SF, Inc, Stud, Fam, Sch, Com)$

$dropout_{DoC}\ (1,1,1,0.9995,1,1,1,1)\ ::\ 1$
$dropout_{DoC}\ (1,1,1,0.9975,0,1,1,1)\ ::\ 1$
}

where its terms make the training and test sets of the Artificial Neural Network given below (Fig. 4).

IV. Artificial Neural Networks

In [16]–[18] it is shown how Artificial Neural Networks (ANNs) could be successfully used to model data and capture complex relationships between inputs and outputs. ANNs simulate the structure of the human brain being populated by multiple layers of neurons. As an example, let us consider the third case presented in Fig. 3, where one may have a situation that may lead to school dropout, which is given in the form:

{
$dropout\ attributes\ (Age, G, SF, Inc, Stud, Fam, Sch, Com)$

⇓

$dropout\ (17,\ 1,\ [2,5],\ \bot,\ 3,\ 8,\ 1,\ 3)\ ::\ 1$
$\underbrace{[6,22]\ [0,1][0,8][200,3000][0,7][0,11][0,6][0,5]}_{\text{attribute's domains}}$

⇓ *1st interaction: transition to continuous intervals*

$dropout([17,17],[1,1],[2,5],[200,3000],[3,3],[8,8],$
$[1,1],[3,3]$
$[6,22]\ [0,1]\ [0,8]\ [200,3000]\ [0,7]\ [0,11]$
$[0,6]\ [0,5]$
$\underbrace{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}_{\text{attribute's domains}}$

⇓ *2nd interaction: normalization* $\frac{Y - Y_{min}}{Y_{max} - Y_{min}}$

$dropout([0.69,0.69],[1,1],[0.25,0.62],[0,1],$
$[0.43,0.43],[0.73,0.73],[0.17,0.17],[0.6,0.6])\ ::\ 1$

⇓

$dropout_{DoC}\ (1,1,0.93,0,1,1,1,1)\ ::\ 1$
}

In Fig. 4 it is shown how the normalized values of the interval boundaries and their *DoC* values work as inputs to the ANN. The output translates the chance of a situation of school dropout to occur, and *DoC* the confidence that one has on such a happening. In addition, it also contributes to build a database of study cases that may be used to train and test the ANNs.

V. Conclusions and Future Work

The anticipation of situations that lead to school dropout is a hard and complex task, which needs to consider many different conditions with intricate relations among them. These characteristics put this problem into the area of problems that may be tackled by AI based methodologies and techniques to problem solving. Despite that, little to no work has been done in that direction. This work presents the founding of a computational framework that uses powerful knowledge representation and reasoning techniques to set the structure of the information and the associate inference mechanisms. This representation is above everything else, very versatile and capable of covering every possible instance by considering incomplete, contradictory, and even unknown data. The main contribution of this work is to be understood in terms of the evaluation of the *DoC*, and the possibility to address the issue of incomplete information. Indeed, the new paradigm of knowledge representation and reasoning enables the use of the normalized values of the interval boundaries and their *DoC* values, as inputs to the ANN. The output translates the chance of school dropout and the degree of confidence that one has on such a happening. Future work may recommend that the same problem must be approached using other computational frameworks like Case Based Reasoning or Particle Swarm, just to name a few.

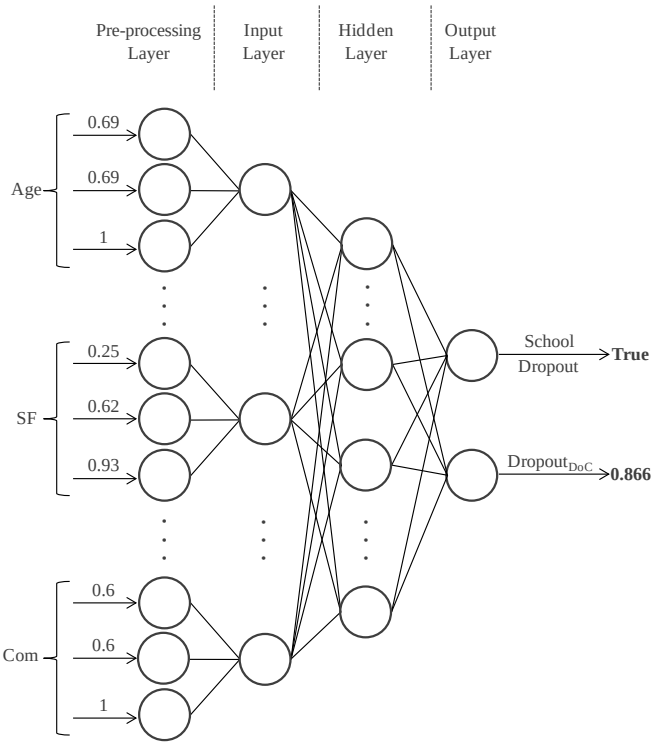


Fig. 4 A possible Artificial Neural Network topology

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Modelling student evaluation in the LMS using Petri nets

Zoltán Balogh, Martin Magdin, Milan Turčáni

***Abstract*—** The paper describes a universal model of an electronic course (e-course) in LMS (Learning Management System) created by the structure of Petri nets. The universal model is created in a way so that it reflects the student´s and the teacher´s needs, it is not too complicated, but modular and complex, and it is comprehensible and transparent. Then the paper provides the creation and the description the scoring an evaluation system of a student who passes the parts of the e-learning course. A module was designed into the created universal model – student scoring and assessment.

***Keywords*—** Learning Management System (LMS), Modeling, Petri nets, Evaluation, Universal model.

I. INTRODUCTION

Nowadays we live in a world of personal computers which are not restricted only to specialized workplaces. Almost everyone has now an access to them. Because of the rapid development of the Internet, the information technology has become more and more popular. It has found a way to education by online courses.

With the growth and evolution of the internet, online systems have increased. The education was not left behind and e-learning tools and platforms started to appear allowing managing educational process or even getting qualifications online [1]. With the development of Computer Based Training and Web Based Training, the distance learning provides the novel learning way different from traditional education and has become one of the important styles of modern education [2] [3]. Learning Management System (LMS) is a kind of web-based system that aims at supporting educational activities in distance or presence modalities. Currently various LMS platforms have been developed and made available, and also have been largely used in both distance learning and traditional classes [4].

The paper focuses on the evaluation modeling of the student passing the LMS. The scoring and assessment model of the student crossing the e-course was created into the universal model constructed in Petri nets [5-7].

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II. STRUCTURE OF THE UNIVERSAL MODEL

System modeling is an activity which on the bases of acquired knowledge enables thinking about the real world and thus consciously influences it. The notion of a system usually represents an abstraction of reality while the focus is on those facts which are relevant for this research. The modeled system has a certain structure, it is composed of elements (entities of the system) among which relations exist. In a dynamic system, the relations and the system set of elements may change [8].

In the sense of research technology, the core of the modeling is a substitution of the examined system by his model (a modeled system). The aim is to gain information about the original examined system by experimentation with the model [9].

Thus is system defined as a really or abstractly existing object to be examined, while during his existence it may develop and cooperate with other systems which form his surroundings [10].

As long as system modelling is concerned,it is represented in a different environment (e.g. in a language or form understandable for the computer) where it is crucial to think about the internal characteristics such as reciprocal interaction between the system and its environment [9] [11] [12].

When modeling the correct LMS system, it is useful to know as much information as possible. This means get to know its behaviour in certain situations, requirements for control, physical or other restrictions of the given system. Then it has to be clearly determined what the system has to perform and which are the primal actions to avoid collisions. The aim of the requirements is to have the best universal model which describes the dynamics of the given system [13].

With similar universal models similar e-learning courses would be created. The creation and construction of the universal model has already been described in some papers [5] [6].

Petri nets were used to create the universal model of the student passing the LMS. Process models can be also created using UML diagrams [14]. The structure diagram of the universal model is shown in Figure 1. To better understand the modeling and simulation concept it is essential to acquire the basic notions [15] [16].

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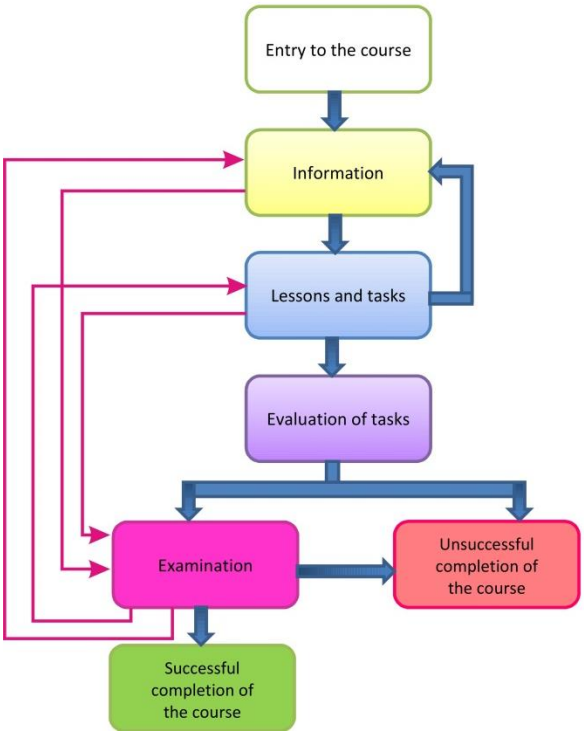
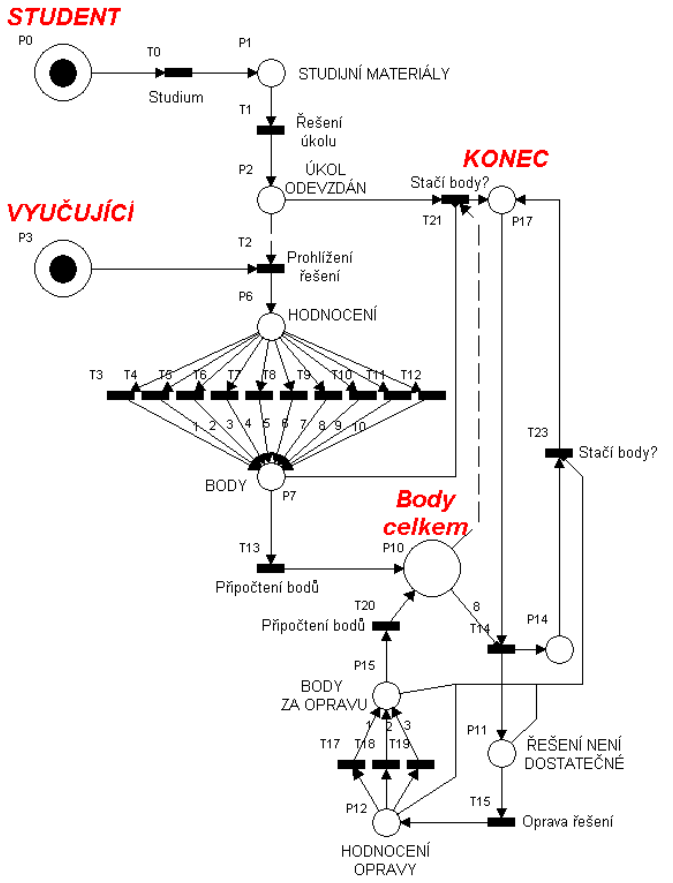


Fig.1 The structure diagram of the universal model exam

A. *The scoring and assessment*

The scoring model of a written task is a calculable function. Its input is the beginning of the work of a given task (student´s study of materials and the teacher´s waiting time for task submission). The output (the value) is the number of points gained by the student for solving the given task [17].

Figure 2 shows the scoring Petri nets of a written task. The maximum of points gained are 10 points with the requirement of gaining at least 8. At the moment of submiting the task (place P2) the T2 transition is implemented and the teacher may do the assessment of the task. Then he chooses a relevant number of points – are simulated by the choice of one from the transition T3 to T12. Thus in the place P7, 1 to 10 tokens appear, which consequently ascribe to the total number of points (place P10). As long as the student has not gained at least 8 points (the inhibitory arc conducting from the place P10 to transition T14 is testing it) he has to correct his solution (transition T15). The teacher decides how many points from 1 to 3 the student gains for his correction (again, choice from the transition T17 to T19). The points are ascribed to the total number of points (place P10). If the students number of point is still not sufficient (required 8 points), the situation is repeated – the students corrects his task and the teacher ascribes relevant points [17].



STUDENT – STUDENT, VYUČUJÍCÍ – TEACHER, Body celkem – Total Scoring, KONEC - END

Fig.2 Scoring model of one written task [17]

This model is a precise image about task scoring and according to this model it is possible to create a similar construction of scoring model which can be composed to the already created universal model.

III. Student Evaluation Model in LMS

If the student wants to pass the exam, he needs to fulfill two major requirements. First, he has to do all the tasks, submit them. Then he has to gain a sufficient number of points from them (in this case, 75% of points). There are four tasks in the model with the total number of points of 40. From this number, the 75% minimal limit is calculated which are 30 points. The availableness of the student to the exam is based on the two facts. By the inhibitory arcs, it is verified whether the lessons have already been opened (whether a token exists in the places P800, P820, P830, P840, P850) and whether all the tasks have been submitted (whether exists a teacher token in the places P822, P832, P842, P852). All these inhibitory arcs connect with one transition (T870) at the same time (Figure 3). The inhibitory arcs work conversely than the normal ones, and enable the transition to realize when the places connected to it does not contain any token. This means that if all the given places above are empty, the tasks are already submitted. Inspection is needed here to avoid

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"unsuccessful end of course" before submitting all the tasks. When submitted, in the place P870 a token appears which provides availableness of the place P514 from each lesson (from the end of information sector and each lesson through the transitions T160, T260, T360, T460, T560). It is the place of task assessment. If the point gain is sufficient inhibitory arc of P700 activates the transition T561, thus gets to the place P664 meaning unsuccessful end of course (Figure 4). The inhibitory arc has a value of 30, taking the place P700 as empty until it reaches the number of 30 tokens (points).

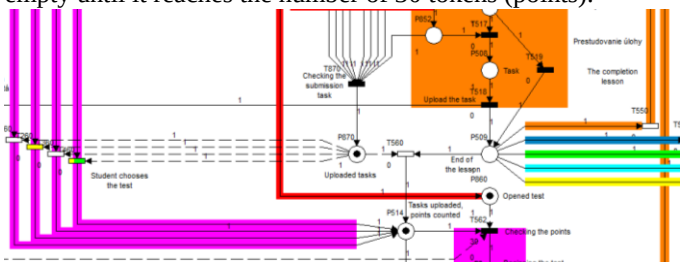

Fig.3 Before exam

If the limit of 30 points has been reached, moving ahead to the exam through transition T562 is available. The transition checks up the place P700 (Figure 4) by testing arc with the weight of 30, whether the 30 points exist there, and whether the teacher declassified the exam (whether the place P860 has a token). A testing arc was used instead of a normal one to keep the points gained from the tasks in the place P700. According to the place, it is possible to check up the correct system work anytime, even during the simulation. In the requirements, the form of the exam has not to be defined (whether it is an online testing, a written exam or a classic form of examination). The designed universal model contains an exam with a scoring from 2 to 20 points. The scoring was solved the same way as the task assessment. The token is waiting in the place P601 until the examination and the assessment end and the token in the place P602 starts the scoring of the exam by burning one of the 10 transitions from T662 to T680. In the place P604 points gained from the exam occurred. Originally, we got from P601 to P602, so no token has been left there. The new solution was made to not to unite the student activity simulation part (visible for the student) with the mathematic and the logical part (what is happening in the background, what is the LMS and the teacher doing). Thus their natural and original performance/behaviour has been maintained.

According to our laws a student has the right to have three attempts of examination. This means that such a net have had to be created in which it is possible to save the results of all attempts. The model counts the student´s attempt passing the exam, saves the gained points, shows the results, how the course ends. The student may study the desiderative lessons, materials, prepare himself for the next attempt, and again, be examined. The token in the place P603 shows, how many times the student has already been examined.

The testing arcs are connected with three transitions where each arc has a different weight (1, 2, 3 – numbers of attempt). The testing arcs provide that the token does not disappear from the place, and the place may count the attempts. When the place P603 gets the first token, the one-weight testing arc activates the transition T621 and gets the tokens into places P621 and P631. A token got to the place P621 and consequently it opened a possibility of saving the results of the first attempt from the place P604. Result savings makes the transitions T611, T612 and T613. They need to know which one of them has to save the results and they have to fulfil the requirements:

- they need to have points from the place P604,
- they need to have a token from the place P62X, where X is a number of the current experiment (with the use of testing arc),
- they need to have an empty place for the next experiment (with the use of inhibitory arc).

If the next place is not empty, it means that another experiment has been implemented and the next transition has to save the points. It is a crucial condition which, in fact, protects the results of the previous experiment.

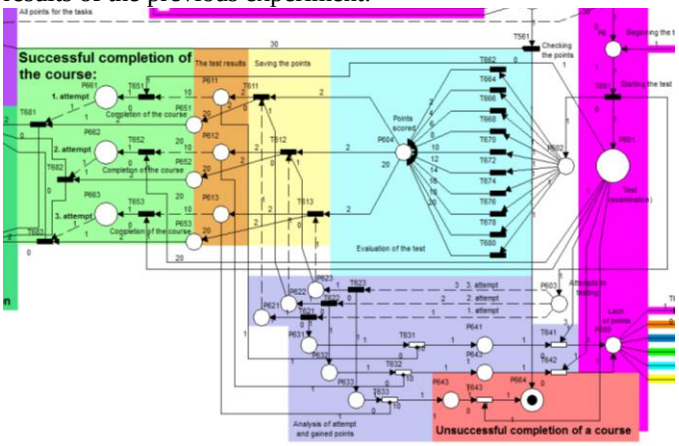

Fig.4 Exam progress model

If the transition T611 has been implemented, the number of points is presented in the place P611. Then if the half of the total number of points has been reached in an exam, the testing arc with the weight of 10 and the student´s token from P601 activates the transition T661. Thus the place P661 is reached, what is the first place of a successful end of the course. If on the exam the points do not reach the number of ten and in the place P611 there are less tokens than 10, the inhibitory arc activates the transition T631, and the token gets into the place P641. The transition T641 is connected to the place P601. The token in the place P601 represents the student´s action. It moves according to whether the student passed the exam (through the transitions T651, T652, T653 it gets to the state of successful end of the course) or he got a token from the place P641 (or P642), which means that he did not pass the exam and he may return to his materials and study again (T641, T642). Or in the case that the student did not pass the exam the third time, he finished the course unsuccessfully (T643).

Through the transition T641 (T642) he gets to the place P609, he can choose from the lessons by the transitions T6X0 where the X represents the number of a sector, or return to the

exam. If the student´s token returns to the exam sector, the transition T601 sends a token to the abacus P603 which activates the transition T622 with the testing arc with the weight of 2. Then it sends tokens to the places P622 and P632 and thus activates the point savings of the second experiment (T612). If the student reaches a sufficient number of points, he has the possibility to return to the lessons and materials. If the student does not pass the exam the second time, he may return to the same ways and try it the third time. After saving the points of the third attempt to the place P613, the only way is to end the course successfully, or through the transition T633 get to the place P644 where he ends the course unsuccessfully.

The testing arcs from the places P621, P622 and P623 have an interesting function. In these places, there is no need of tokens just to save points from the exam to the right place. The tokens are not necessary because they are the activation condition of transitions T611, T612 and T613 as it was in the condition of the teacher to open the lessons in the places P8X1. It is necessary to block the operation of testing arcs and the transition T62X because if after his unsuccessful examination the student returns to the lessons, the token from the place e.g. P63 would be removed. The testing arc from P603 would sent another token to this place through the transition T62X which would also get to the lessons and it would be repeated again and again until the whole model would fill up with tokens. As long as there are tokens in the places P62X, the transitions T62X do not let any token to the places P63X even if it is empty.

A. *Grading*

When modeling the student´s transition through the system, there is a visible part of the already presented exam model with an added function of assessment. The function has its own principles, as an input, just a solution of a successful exam is needed. The possible scoring evaluation has to be set according to the fact, how many points it is possible to gain on the exam.

In Figure 5 there is a particular example. After passing the exam, the student gained 16 points. The token of 16 points could appear in each grade, but it does just only in that one where both input limits have been fulfilled. For example, in the case of the grade D according to the testing arc of 12, the transition may implement, but the inhibitor has found more than 14 tokens in the place P681 which means that the transition has not implemented. In the case of a B, both requirements have been fulfilled and thus the token appeared in the correct place (P692).

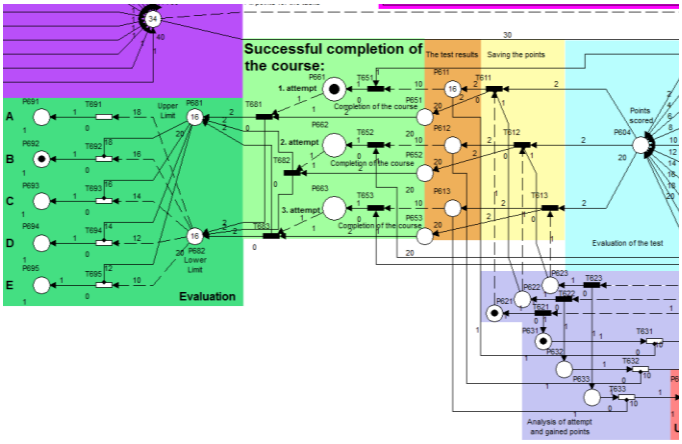

Fig.5 Grading according to performance during the whole semester

In Figure 6 there is the model of grading according to semestral performance. The function´s basis is the same, but it was necessary to add points gained from the tasks. Then the place P700 had to be duplicated which means that the content had to be copied into places P721 and P722. The purpose was to keep the role of this place and meanwhile to figure in its content to the points gained on the exam.

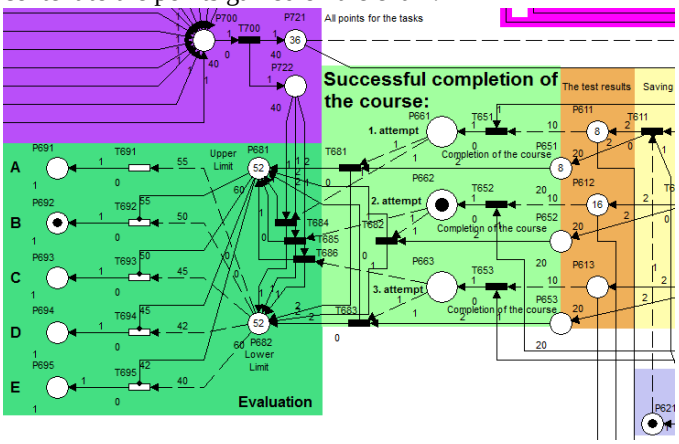

Fig.6 The model of grading according to semestral performance

Attention had to be paid when adding points gained in the tasks to the total number of points. It was crucial for the student to pass the exam first and then add the points gained in tasks by the use of transitions T684, T685, T686. In this version of the model the number of gained points is much more. That is the reason, why different point numbers are added to each place.

Deterministic transitions have to be used for correct function of grading in transitions T69X in order to start the grading only when the points gained have already been counted.

IV. Discussion

eLearning needs to evolve, and this evolution must take the student into consideration. Usually, in online learning processes, the student is conditioned by temporal issues, LMS technical constraints or an inefficient use of learning platforms features. If students are not placed at the centre of the eLearning processes, and if emerging technological and

sociological trends are forgotten, any eLearning activity will fail. To avoid this situation it will be necessary to open the presented LMS conception. LMSs should allow the integration of other tools and must be centred on the user [18].

To deploy a correct eLearning system for the users, it is essential to create a detailed model which covers all the particularities of the given system. The aim was to create a modular universal model of student communication control in LMS system by the use of Petri nets. It is possible to create other moduls by which the interaction between user and teacher can be improved. The benefit of modelling of educational processes using Petri nets is their formal description, which is complemented by a visual graphic depiction. This allows a precise and exact specification of the process, which facilitates elimination of ambiguity, vagueness and contradictions. Petri nets, besides the visual graphic expression, have also square defined mathematical fundaments, which can be suitably used in various software tools for the specification and analysis of computer-solved company processes.

In the paper, the model of student scoring and evaluation by the use of Petri nets is described. It was necessary to model the scoring evaluation of each task, test, final work, and exam. Since the scoring model depends on the type of the given task, a solution had to be found which is flexible and easily modifiable according to arbitrary requirements. In this case, also human factors play a big role: how the teacher images the course, how strict he is, whether he counts all the points gained through the semester, or he grades just the final exam, etc. When considering subject ending with an exam, it cannot be forgotten that the students has the rights for two correction terms. It means that together he has 3 attempts to pass the exam successfully. It may happen that after passing the exam, the student is not satisfied with his grade and he wants to correct it. But what happens if he gets a worse grade on his second attempt? Is it possible for him to keep the older and then better one? All these events, cases, and details are not possible to summarize into one model without losing overview. In this case, alternative versions (moduls) may be done. By the use of a universal model with relevant moduls created in Petri nets, it is possible to create practical electronic courses which will take into account all the aspects of a functional model. The created e-courses by the designed universal model can be then checked up (evaluated) by the use of various statistical methods [19] [20].

V. Conclusion

The paper describes the transition modeling of the student through an e-course in LMS by the use of Petri nets. At the beginning, a universal model of student transition through e-course has been created into which another modul was designed – student scoring and grading (evaluation). When modeling the modul, all aspects and possibilities were taken into consideration that may happen during the assessment. The benefit of modeling with Petri nets is the simplicity of modeling and the consequential simulation of a given model. Another benefit of educational process modelling using Petri nets is its formal description, which is complemented by a visual graphic depiction. This allows for a precise and exact specification of the process, which facilitates elimination of ambiguity, vagueness and contradictions. Petri nets, besides the visual graphic expression, have also square defined mathematical fundaments, which can suitably be used in various software tools for the specification and analysis of computer-solved company processes. On the abstract model, simulation experiments may be implemented which are gradually evaluated. On the basis of achieved results, the student´s transition through e-course can be simulated and consequently evaluate his activities. To control the educational process, the aim of the system is to lead the communication according to the student´s knowledge and skills and thus change the quantity and the demandingness of the materials provided for the student.

When creating the materials, authors starts to deal with only the technical improvements in the area of Web-based education, but also accentuate the implementation of pedagogical and psychological concepts into planning the electronic forms of education, such as learning, recurrence curve and curve of forgetfulness. Although, an ideal system which would be close for every student is utopian for sure. But it is possible to approach the perfect personalization of teaching by means of correctly designed models by the use of Petri nets.

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First A. Author (M'76–SM'81–F'87) and the other authors may include biographies at the end of regular papers. Biographies are often not included in conference-related papers. This author became a Member (M) of **CSCC** in 1976, a Senior Member (SM) in 1981, and a Fellow (F) in 1987. The first paragraph may contain a place and/or date of birth (list place, then date). Next, the author's educational background is listed. The degrees should be listed with type of degree in what field, which institution, city, state or country, and year degree was earned. The author's major field of study should be lower-cased.

The second paragraph uses the pronoun of the person (he or she) and not the author's last name. It lists military and work experience, including summer and fellowship jobs. Job titles are capitalized. The current job must have a location; previous positions may be listed without one. Information concerning previous publications may be included. Try not to list more than three books or published articles. The format for listing publishers of a book within the biography is: title of book (city, state: publisher name, year) similar to a reference. Current and previous research interests ends the paragraph.

The third paragraph begins with the author's title and last name (e.g., Dr. Smith, Prof. Jones, Mr. Kajor, Ms. Hunter). List any memberships in professional societies other than the **CSCC**. Finally, list any awards and work for **CSCC** committees and publications. If a photograph is provided, the biography will be indented around it. The photograph is placed at the top left of the biography. Personal hobbies will be deleted from the biography.

Model Validation Tools Web X.0 in Teaching and Learning

Nuno Miguel Cardoso Peixoto[1], Sónia Rolland Sobral[2]

Abstract — It is important to adapt current teaching methods to the new information society and knowledge dominated by digital technologies. The so-called traditional teaching methods and teachers need to readjust to this new reality. This will necessarily be by the use of the Internet and web tools systematically manipulated by the new digital society students. With this article we intend to create a model based on validation parameters carefully selected by the authors in previous studies, which to judge the degree of functionality in the teaching-learning of the five most used web tools in Portugal. The model will allow in future research to assess the degree of functionality of web tools preferably used either by teachers or by students, enabling the use of these more efficient and profitable in the learning process of students.

Keywords — models; web tools; teaching; learning

INTRODUCTION

In this new digital society, described by many authors as the information society or network society [1], knowledge society [2] or learning society [3], the construction of knowledge is another key device in the learning process, where the teacher must be a proactive participant who links and guid this construction.

The teacher using the correct devices, has more opportunity to understand the mental processes, the concepts and strategies used by the student and, with that knowledge, mediate and contribute more effectively in the knowledge construction process [4].

According to José Lencastre [5], we are in the era where teachers should be placed as teachers and learners, in the hope that through iteration established with students, learning takes place for both.

In this new society, the use of the Internet and web tools contribute to its constantly evolving, improving the quality of life of the individual when using this type of technology [6]. Also according to the International Commission on Education for the twenty-first century, in its report to UNESCO [7], students with difficulties in traditional education are more motivated when they have opportunities to use these technologies and can thus better reveal their talents.

According to Steven Maged Kamel Boulos and Wheeler [8], the appearance of platforms LMS (Learning Management System) provides new and exciting opportunities for teachers to create collaborative and communicative means of education for their students.

The big question around technology and online education for Margaret Honey and Babette Moeller [9] focuses on knowing how far it can facilitate the act of teaching and learning. The same authors reported that the most important thing is knowing when and how teachers will use technology in their classrooms and if their enthusiasm and convincing is real.

In this context, the objective of this research focuses on the construction of a model with which to judge the functionality degree of the most used web tools daily, many of them are essential and take integral part of the student's daily lives.

When evaluating web tools we enable teachers for a particular pedagogical content to know when and how they should use a particular tool as an aid in transmission.

This model will be a tool to accompany the technologies available to the teacher. Moreover it will be a didactic strategy to contribute to better experience the student may have on teaching and learning [10].

RESEARCH METHODOLOGY

Qualitative research is mainly descriptive. The collected data is more in words or figures format than in numbers. This data may include desk research, field notes, statements or other document form. The qualitative researcher tries to analyze the data in all its richness, respecting, as far as possible, the form of record or transcript. In investigative approach to qualitative context nothing is trivial, every manifestation has the potential to provide important clues in the construction and understanding of the phenomenon studied.

According to Augusto Triviños [11] the phenomena descriptions are imbued with meaning that you print environment, product of a subjective view. Thus, the interpretation of results is based on the perception of a phenomenon in context.

Thus, the character of this research will be of qualitative multimethodological second Norman Denzin and Yvonna Lincoln this type of methodology is based not only on the stage of collecting data for the study, but when you analyze them and interpret them, the multitude of theoretical frameworks that can underlies them [12].

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This investigation had two objects as the main sources of important research: the first focuses on the study of Nuno Peixoto and Sonia Sobral [13] on the Validation Parameters Tools Web X.0 in Teaching and Learning, and the second relating to documentary research and bibliographic used for constructing the model, according to Robert Yin [14], which is the technique of collecting more frequent data as a source of information in the case studies. This methodological approach is also referred to as Schmidt Arlinda Godoy [15] as one of three possible offered by the qualitative method.

The first source was focused on the scientific article written by the authors for the 9th Iberian Conference on Information Systems and Technology held in Barcelona. For documentary and bibliographic research, the main instrument used was the internet, tool currently used in the search for theses and scientific articles. This functions as an aid in the development of research and dissemination of knowledge. It is also responsible for retrieving large amounts of information published [16], still used to some concepts related to web tools and LMS type with all organizational aspect that involves teaching and learning.

RESEARCH FRAMEWORK

To create a template, Allen's Michael [17] [18] [19] and Donald Clark [20] describe five essential steps: Analyze, Draw, Develop, Implement and Evaluate (chart 1) .

A. Analyze

The analysis phase of this model has been performed previously by the authors of this research study on the Validation Parameters of Tools Web X.0 in Teaching and Learning [13].

In this preliminary study were analyzed important features related to the functionality of LMS tools most used in Portugal, which allowed to identify which parameters to be used in building the model validation of web tools.

This phase of model creation is very important, if not the most important. The fact that sometimes the requirements analysis of the model are not well equated, is the reason why many projects have no impact or even never arrive due to be held, being the reason of many deceptions .

For less pleasant situations occur during the other stages of model creation, Donald Clark [20] mentions that in the analysis step we must define a series of tasks: each with a specific goal and a time to be achieved .

By effectively consider this very important phase in addition to the previously mentioned study that allowed the parameters selection before had been drafted by the same researchers, another study that allowed the assessment base of the four pillars of the current trend of teaching and learning environments: the domains of knowledge, the connectivity theory, web tools (specifically the type LMS, learning Management System) directed to the earning management and the Bologna Declaration [21].

The pillars identified above, analyzed separately, their characteristics are different, but together they complement each other. Having been the basis of sustainability of selection parameters that will create the model that will validate web X.0 tools in supporting teaching and learning.

B. Draw

The design phase ensures the development of the experimental model, in which it performs the detailed definition of the global architecture of the model. This process derives from the results of the analysis phase and ending the sketch of the experimental model which will be developed in the future [20], the structured planning model consists of 4 steps:

1) Definition of constraints

It is important to identify the relevant constraints to the planning process of the model. In this case, restrictions are considered in the model relating to the scope and number of web tools to be validated.

Ideally there's no constraints in the model and include all the web tools that are daily used both internationally and nationally. But this would be virtually impossible. According to Rodolphe Ghiglione and Benjamin Matalon, is never possible to know everybody and what is gained in accuracy is minimal compared to a more reasonable sample [22].

Thus and for the first constraint, we chose to confine this study using only the web tools used in Portugal. For future considerations will be the same study, but internationally.

The second constraint and also for the sake of the feasibility study it will be analyzed only the five most used tools daily in Portugal.

2) Selection Criteria

Taking into account the restrictions set out the methods that must be defined to identify.

For the first criterion restrictions are well defined only considered if the web tools used in Portugal. The same can not be said for the second, the method used to identify the five most used tools in Portugal was based on information from Alexa - The Web Information Company [23]. This is an online company that provides data statistical of the hundred most used sites in Portugal, based on the daily average hits the last three months.

3) Specification of requirements

While the above steps let you draw a model successfully in this and the next you specify the criteria for the success of the model, the level of expected requirements expectations, choose the type of assessment that will be conducted.

According to what Roger Pressman [24] the requirements specification is the representation of the behavior of the model and an indication of performance requirements and assessment of this.

In this step the criteria that will be part of the evaluation method of the model will be identified.

4) Revision of specification

According to Shari Pfleeger [25] the specification requirements provides a way to validate the model and revision ensures that this purpose is achieved, and it is vital and necessary.

In this step based on the criteria identified in the previous step will set out the mathematical formula that will allow the model to assess quantitatively the degree of functionality of certain web tool for teaching and learning.

Carol Britton and Jill Doake [26] suggest that the revision/validation should be conducted throughout the lifting process and specification of requirements. Roger Pressman [24] states that the review should be conducted in a thorough manner to ensure that the specification is complete, consistent and accurate.

C. Develop

As regards Carlos Alberto Silva and Vine [27] modeling is the art and science of creating models of a certain reality, are idealized representations to real world situations [28].

At this stage the materialization of the design previously developed which includes all activities of developing and building the model itself is made. It is the transition of the intellectual development of the model for the development and physical development.

The purpose of this phase is the construction of the model to be implemented and evaluated. All features have been developed and tested according to the requirements and architectural constraints defined in the previous phases.

There are three main objectives in the development phase of the model:

1) Develop the solution: iteratively develop the model specified in the previous phases and leave it ready to implement and evaluated;

2) Minimize costs: resource optimization, avoiding rework and unnecessary activities.

3) Achieving adequate quality, speed and efficiency: adding value added at the end of implementation and evaluation.

D. Implement and Evaluate

These two final stages of creating the model are not within the scope of this study, but future investigations by the same authors. Evaluate the model will be made only at the end of development for web tools that make it up. The assessment itself with the tools most used by teachers and students will be held at a later study.

It should be emphasized that the implementation phase of the model is very important, being a culmination of the entire project. However evaluate it is too. You can never optimize a model if there are no well-defined what criteria it should produce. One can never have a good model if there are different criteria [29] [30].

According to Donald Clark [20], evaluation is an ongoing and adaptive process cannot be expected only through this phase to validate the model, otherwise the probability of error occurs is large (Chart 1).

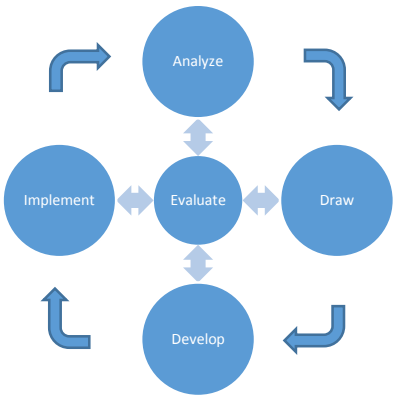

Chart 1 – Process of constructing a model, adapted from Donald Clark [20]

Indeed, the results obtained at a given point hardly will remain unchanged until the end of building the model. Exists in various occasions the need to amend or supplement aspects previously discussed, because of the importance of evaluation to be present at every stage of model building.

MODEL'S CONSTRUCTION

As mentioned, the scope of this research fits only in the design and development phases of Allen's Michael [17] and Donald Clark [20] (Chart 2) model, thus building the model will be to focus on these 2 phases

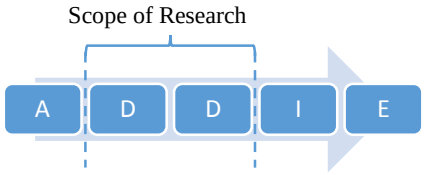

Chart 2 – Scope of Research, adapted from Allen´s Michael [17] and Donald Clark [20]

A. Drawing

The development of the model results of the structured planning conducted at this stage, the elements that will appear on your architecture are:

1) Validation parameters

From the analysis of Parameter Validation Web X.0 Tools in Teaching and Learning [13], 13 features were identified:

Forum - Activity that allows asynchronous dialogue on a topic.

Work - Allows the teacher to assign online or offline tasks.

Chat - Chance of synchronous communication via short messages between teachers and students.

Referendum - Activity where the teacher can create an issue of options for collecting students' opinions.

Dialogue - Allows a private asynchronous communication between the teacher and a student or between students.

Glossary - Possibility of the course participants create dictionaries of commonly used terms.

Lesson - Activity that lets you create and manage a set of

linked pages.

Test - The teacher can build a questions database with different answers formats.

Questionnaire - Allow building surveys to participants.

Wiki - The possibility of building a text for many participants, each of which provides support and / or revise the text.

Resources - Allow for the possibility of including content from various formats.

Workshop - Activity that allows the coordination of group work.

SCORM (Sharable Content Object Reference Model) - Allow to export and import content from other LMS platforms.

2) Restrictions

The five most used web tools in Portugal were the restrictions considered for the architecture model.

In research performed by Alexa - The Web Information Company [23], it was possible to measure the ten most used web tools in the last month in Portugal (Table 1). We chose to measure more than the necessary tools for building the model because some of them are the same type, and it is necessary to make some adjustments to achieve a more diverse list.

Top Ten	Web Tool			
	Name	URL	Linked Sites	Type
1	google.pt	www.google.pt/	9.843	Search
2	facebook.com	www.facebook.com/	6.912.060	Social
3	google.com	www.google.com/	3.566.557	Search
4	youtube.com	www.youtube.com/	3.580.860	Videos
5	sapo.pt	www.sapo.pt/	30.758	Search
6	neobux.com	www.neobux.com/	66.572	Business
7	wikipedia.org	www.wikipedia.org/	1.933.807	Encyclopedia
8	live.com	login.live.com/	88.778	E-mail
9	abola.pt	abola.pt/	2.862	Sports
10	xl.pt	www.xl.pt/	4.133	News

Table 1 – The 10 most used web tools in the last month in Portugal, adapted from Alexa [23]

In Table 1, Facebook excels not to be the tool of choice for the number of daily visits but because unquestionably binds with the highest number of sites. The perspective of the George Siemens theory about Connectivism [31], this web tool used appropriately in educational environments can make a difference in teaching and learning.

Based on Table 1, the web tools that will be part of the model are:

google.pt - Allows you to perform searches for information in the entire world of web type, pictures and video pages. It offers unique features in the search technology;

facebook.com - social network Tool that connects people and friends, allows sharing of photos, links and videos;

youtube.com - way of obtaining and sharing videos for all the internet users;

neobux.com - Provides a new business solution in which the internet user is paid for each mouse click; you can multiply the earnings just by viewing advertisements;

wikipedia.org - free encyclopedia built collaboratively by all internet users.

Were excluded from the initial list google.com and sapo.pt for being both the same type of tool google.pt. Thus the assessment will be achieved if the model having a set of more diverse and close to reality tools.

3) Requirements

To Celina Oliveira, Eliane Menezes Mercia and Moreira [32], evaluate is a process of specific situations of pre-established criteria.

To identify the criteria that will allow state the formula that will evaluate the tools, we met the validation parameters into three groups: Communication, Teaching and Learning Management and Review.

Communication - contain parameters which enable synchronous and asynchronous transmission of knowledge and learning between teacher and student or student and student. This group parameters: Forums, Chat and Dialogue.

Teaching and Learning Management - contain parameters that allow to monitor and assist the transmission of knowledge of the teaching-learning in students. This group parameters: Labor, Glossary, Quiz, Wiki, Resources and SCORM.

Review - gathers all parameters that enable the teacher to make a continuous evaluation of the student in the process of acquiring knowledge in teaching and learning. This group parameters: Referendum Lesson, Test and Workshop.

Each of these groups will have a different weight relative to the total percentage of assessing the degree of functionality of the web tool. This criterion is related to the fact that the group of parameters to be related or not to the teaching-learning process, the greater this percentage will be higher affinity which will contribute to the final result.

It was considered that the communication would be the group that provided less able the teacher to participate in the whole process of student learning. This group presents a contribution of 6% in the final evaluation of the web tool and each of its parameters 2%.

In Management learning group their parameters have strong features in the field of teaching and learning, therefore every parameter is assigned 7%, leaving the group with a total of 42%.

Consider the review group as a major contributor in the student learning process, not only by the evaluation component itself but also consider that the parameters are those that enable the teacher to better transmit and address the educational content. The group represents 52% of the total assessment of the functionality of web tools and their parameters 13% each.

The mathematical formulation for the evaluation of the degree of functionality of the web tools will be based on the criteria identified, we also consider how the groups have terminology, the group communication is attributed to the following nomenclature (1):

$$\mathrm{X} = \{\chi_1, \chi_2, \dots, \chi_n\}\, with\, \chi_i \subset \mathrm{X}\, \text{and}\, i \in \mathbb{Z}_0^+ \quad (1)$$

Where are χ_i parameters were present to review the web tool.

The learning management group attributed to the following nomenclature (2):

$$\mathrm{B} = \{\beta_1, \beta_2, \dots, \beta_n\}\, with\, \beta_i \subset \mathrm{B}\, \text{and}\, i \in \mathbb{Z}_0^+ \quad (2)$$

Where are β_i parameters were present to review the web tool.

The learning management group attributed to the following nomenclature (3):

$$\Upsilon = \{\upsilon_1, \upsilon_2, \dots, \upsilon_n\}\, with\, \upsilon_i \subset \Upsilon\, \text{and}\, i \in \mathbb{Z}_0^+ \quad (3)$$

Where are υ_i parameters were present to review the web tool.

Therefore, heuristic mathematical model that will allow the measure quantitatively the degree of functionality of certain web tool for teaching and learning is represented by the function $f(\mathrm{X}; \mathrm{B}; \Upsilon)$ (4):

$$f(\mathrm{X}; \mathrm{B}; \Upsilon) = 2\% * \sum \mathrm{X} + 7\% * \sum \mathrm{B} + 13\% * \sum \Upsilon \quad (4)$$

B. Development Model

Having defined the validation parameters, restrictions and requirements deemed necessary for the validation of web tools, the model proposed in this study is reproduced in Table 2.

The actual evaluation of the model will be made in the post-implementation phase. There will be analyzed not only the most used web tools in Portugal, but also those who teachers prefer to use in teaching-learning.

The assessment will be made in this investigation, and that is shown in Table 2, are intended to test the proposed formula. It will appeal to web tools which last month were the most used in Portugal.

		google.pt	**facebook.com**	**youtube.com**	**neobux.com**	**wikipedia.org**
Communication (6%)						
	Forums		✓	✓	✓	✓
	Chat		✓	✓		
	Dialogue		✓	✓		
			6%	6%	2%	2%
Management Learning (42%)						
	Labor	✓	✓	✓		✓
	Glossary					✓
	Quiz					
	Wiki					
	Resources		✓	✓		✓
	SCORM		✓	✓		
		7%	21%	21%		21%
Review (52%)						
	Referendum					
	Lesson					
	Test					
	Workshop					
Degree of functionality $f(\mathrm{X}; \mathrm{B}; \Upsilon)$		7%	27%	27%	2%	23%

Table 2– Model Validation Web X.0 Tools in Teaching and Learning

By the standards of LMS review and the parameters selected and included in the model, the degree of functionality of the web most used tools in the last month in Portugal is low. The three largest percentages are between 23 % and 27 %, with Learning Management Group which most contributes to the final result, 21 %.

The google.pt due to its characteristics of research, can be an important tool to aid in learning. However, as evidenced only in conducting this type of work that this search engine can be useful, and its degree of functionality of only 7 %.

Communication Group is the feature that most evidence and the only rating that is not present in any of the analyzed tools.

With the future implementation of the model will be possible to assess the degree of functionality of web tools most used by teachers and students in teaching and learning, probably with different end result.

CONCLUSIONS

To Pierre Lévy [33], the prevalence of certain technologies developed to ensure the man overcoming natural obstacles and survival with better quality of life, in every place and at every time, necessarily refer clients to new learning.

The time when the company is currently living man transiting culturally mediated by technologies that are contemporary to him. They change their ways of thinking, feeling and acting. Also change their ways to share and acquire knowledge [34].

Technological advancement are a reality, not only outside but inside schools. Increasingly the student is inserted in the universe of information easy, where the teacher needs to update itself to keep up to speed by which information is actually transmitted.

The new possibilities of access to information, communication and iteration, provided by computers, internet and web tools, give rise to new forms of learning.

With this research and the construction of the model, we sought to provide a new tool within the teachers reach, that assist in the process of imparting knowledge to students.

We measured the degree of functionality of the five most used web tools currently in Portugal, concluding that have a low vocation for teaching and learning, while the percentage of the three best classified tools are between 23 % and 27 %.

The construction of this model will be larger in future research, will be done their implementation that will allow us to know the functionality degree of the web tools more used by students or teachers, or any other web tool that a teacher find a suitable auxiliary to transmitting their educational content.

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New Features of Advanced Learning Space

K. Cisarova, I. Kopetschke, J. Vrany

***Abstract*—** Age of the first e-learning systems represented by mere categorized storages of static study materials has been long over. Modern trends emphasize study path definition with active participation of the tutor and teacher; this approach requires interactivity. Current boom of information technologies opened door for multimedia formats and for integration of up-till-now isolated systems. The same effort that is invested into quality content creation must be invested into the ways through which this content is made available to the students. In other words, distribution and ensuing communication are of the same importance as the production. The following text is aimed at several inseparable spheres that together make up the e-learning platform at the Technical University of Liberec. Automated acquiring of lecture recordings in a special format (rich media) will be described, as well as TUL's e-learning portal ALS which integrates several university services. In the latter part, solutions reflecting demands of the students with special needs, such as participants of distance learning or disabled students, will be discussed. In the conclusion, results of the survey studies among the students and the use of statistic data about the study journey of a student through the world of ALS will be the subject of reflection. These conclusions acknowledge the significance of deployed e-learning solution.

***Keywords*—** distance learning, e-learning, lectures recording, MediaSite, rich media format, students with handicap.

I. INTRODUCTION

This article presents results of two projects: Advanced Learning Space and Equal Opportunities. Both projects were supported by the Technical University of Liberec (TUL) and European Social Fund.

Since 2008, we have been creating a complex educational system. Our goal was to integrate several systems used at TUL to one single system.

One of the key improvements of our implementation is easy support for disabled students and for distance learning students. We connect a standard e-learning system together with a system for recording of lectures. Right after the lecture is over, the lecturer can decide how and when she or he wants to publish the recording. We took inspiration from MOOC systems and now we use several shorter recordings instead of one long. We found out that this system was very helpful for our students.

Second key achievement of the project is high automatization of the recording process itself. The recording can be taken and published very simply by one click. The postprocessing of the recording is of course available if needed.

We designed the web page of project with respect to special needs of handicapped students. We are using special sound version for purblind students. Every recording has the audio track in several formats. Selected study materials are converted to digital formats suitable for reading devices. Most of our university buildings have wheelchair accesses and with our Advanced Learning Space (ALS) we have been giving an equal study opportunity to the disabled.

During the past six years we have collected a lot of information about the learning process and the path of the students during the education. Nowadays we are working with this data and we are trying to use them of further improvement of our system. So far, especially students with handicap and distance learning students have been very active users of our system.

II. TUL ADVANCED LEARNING SPACE

Core of the system is Moodle 2.1 with our extending modules. We have been using these modules for the integration of all required information systems used at TUL.

The system is interconnected with Study Agenda (STAG) and with MediaSite data storage center. We have been using the MediaSite for lecture streaming and recording. Based on information provided by STAG, the system can automatically create e-learning courses and assign them to the students and educators. Using one single password. the user of ALS can easily access all the lecture streamings with no need of further interaction with MediaSite authorization procedure.

III. TECHNOLOGIES USED IN THE E-LEARNING SYSTEM

The development of a web based e-learning system is a complex and long process. As our main goals were different, we decide to use one of the existing systems. Based on our previous experience, we finally decided to use Moodle.

Moodle is an open source e-learning system, with large community of users from various educational institutions. It is very easily extendable and customizable thanks to the modular architecture. For our purposes we need to develop new auth

This work was implemented with the financial support of the ESF and the state budget of the Czech Republic within the framework of the projects Advanced Learning Space (2009-2012), reg. number: CZ.1.07/2.2.00/07.0008 and Equal Opportunities (2012-2014), reg. number: CZ.1.07./2.2.00/29.0011.

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user module, STAG connector module and MediaSite datastore connector module.

All records made by MediaSite are stored in a special storage, accessible only via proprietary web application. Due to copyright reasons, the MediaSite needs to be set to authorized only mode. In this mode, only authorized users are allowed to watch recordings, and download of the records is switch off. However, it is possible to use token based authentication for communication with the MediaSite storage - Ex Server. We used this principle in our module. Using this approach, we can easily allow access to stored records to all students and manage the access rights using Moodle and its LDAP based authorization.

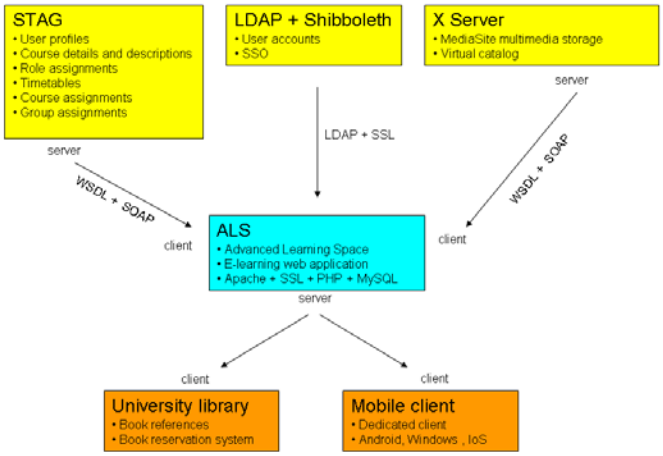

Fig. 1: Scheme of ALS integration into the university information system

IV. Overview of Lecture Streaming Formats

Nowadays, many formats, servers and services are available for creation and sharing of video recordings. Educational recordings are not excluded. Many of them can be found on the most popular video sharing service - YouTube. The story of Salman Khan, founder of Khan Academy, is well known. One of the biggest and most popular web based schools in the world started as a set of math learning videos for his cousin [1]. Thanks to many donations, Khan Academy nowadays provides thousands of videos to millions of students all around the world.

There are quite a lot of technologies available. And it depends on the budget, target audience and other requirements what to choose. Our goal was to present information in top possible quality - good audio and high resolution of presentations. Some lecturers use chalkboard very often and it became clear that recording of the blackboard contents would be necessary.

This can be done with the presence of camera operator, director etc. With full film crew, very high quality recordings can be executed, and there are many of good ones available publicly on the Internet (for example MIT Courseware or Stanford University online courses). This solution provides perfect quality, but is very costly, which can be a problem for many universities, including ours. Especially if we presume, that some subjects develop very quickly and continuous update of lectures is required to keep them up to date. It means that for such subjects the lectures are innovated every year and recordings need to be taken over and over.

One practical example from our university: On the Faculty of Mechanical Engineering, a high quality record of a lecture was created, available to students through a paid DVD. Now, after several years, the lecturer has changed, he teaches the subject in his own way. The DVD is consequently worthless.

We came to the conclusion that the above mentioned format suitable only for recordings of the most respected and influential people, e.g. Nobel Prize laureates. But for the daily use, we need cheaper and more flexible solution.

V. Live on the Web

Among the attributes described in previous paragraphs, we also found out that we needed a system which would allow us to publish the recordings live on the web. And to update the already published records. We presumed that there was no need of high quality record of the lecturer himself, as the students need the information.

Let's summarize all the requirements on the system:

- high quality audio recording of speech
- high quality recording of presentation
- possibility of chalk board recording
- format suitable for online publishing on the web

We tested several systems and finally decided that MediaSite solution was the best one for our needs. Our tests proved that MediaSite was easily usable for recording of lectures of TP - talk with presentation type. MediaSite uses its own format for records called rich media. In this format, there are separate data streams for audio, video and presentation [2].

During the first tests many discussions about practical usage of the system started. It was obvious, that without the possibility of chalk board recording, the system would not be adopted by many of our colleagues.

We identified four lecture-types and for each one we proposed a technical solution, which we later implemented. The four lecture types are:

- Talk with presentation (TP): the lecture is complemented with an electronic presentation with key points (usually PowerPoint or other presentation software commonly used today).
- Talk with the explanation written on the blackboard (PB) suitable for the courses of mathematics, physics and engineering - graphs, images, sketches etc.
- Lectures of IT courses (LIT): the lecture is complemented with demonstrations of programming, development environments, case systems, database servers, etc.
- Lectures with video presentations (LV): the lecture is complemented with video records of experiments,

ISBN: 978-1-61804-238-5

surgeries in medicine, technological and art animations, etc.

For each lecture type, we proposed necessary hardware and a control system in order to meet the demands placed on the quality of the university lectures recording [4]. In the original MediaSite technology, the data stream in the Web presentation had to be always the recording of the presentation. In our solution we could replace the presentation with any other output such as the recording of the written explanation from the blackboard or an animation. The negative impact of this extended functionality was the fact that the navigation coupled with the presentation slides was violated and had no meaning anymore. We applied special algorithms, which firstly analyzed and reduced overabundant slides and then automatically adjust the HTML page. The entire process of post-processing is quite complicated.

The chalk board recording problem was solved by using three technologies:

1. an e-beam technology, which allows recording of chalk board writing thanks to special pens.
2. a special roof camera which covers the teacher's table. This system has one big advantage – the teacher can write, and talk face to face with students.
3. a classic interactive electronic board, used in many educational institutes.

For recording of all types of lectures, it is necessary to connect the main information sources - computer, board, roof camera - with the data input stream. We designed a very simple interface for switching between the sources and record process control. Right after the start the system checks if all the sources are available. If not, it can - for example - alert the teacher to turn the microphone on. For teacher authorization

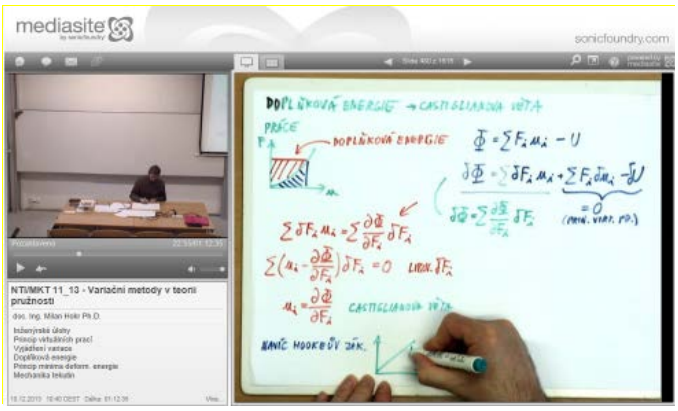

Fig. 2: Ordinary blackboard was replaced by writing under visualizer, "face to face" to the students; webpage screenshot

process we are using ITIC cards with MIFARE chip. Through this method, we can automatically identify the teacher and the lecture which will be recorded. This information is used for creating the record file on EX Server storage [2].

The recording is available right after the recording process is stopped by the teacher. It can be immediately published on ALS portal, or it can be post processed if needed. The post

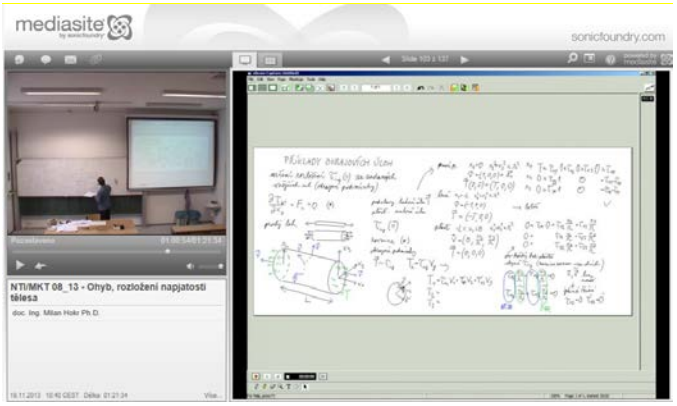

Fig. 3: Special board with e-beam technology projected on a large screen; webpage screenshot

processing is of course possible even for published records. As there are some technical problems and bugs in the records from time to time, we can easily fix them by special editor.

ALS portal is a full feature e-learning system. It means that apart for publishing of the recordings, the teacher can use it for many other tasks. He can put extra materials there, test the students by quizzes, assign them homework or self-test quizzes. Teachers and students can share the messages, create discussion boards or surveys.

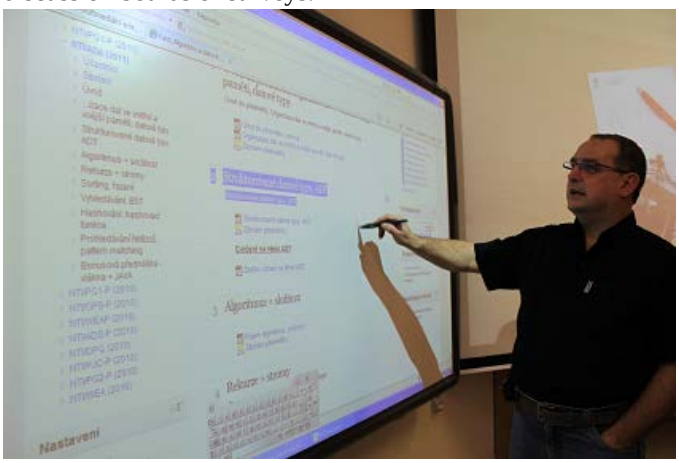

Fig. 4: Presentation of the teacher's desktop on the interactive board

VI. Improved STAG and ALS Intercommunication

Our first integration with STAG was a simple one. Each user of ALS was paired with his STAG account and this information gave him a role in the system (a teacher or a student). A teacher can create Moodle courses for his lectures or select one from the list created automatically by STAG based information about courses.

Many of the courses consist of one lecture and many seminar groups per week. Seminars can have different teachers than lectures do. Educational materials can be divided by groups in Moodle, but the teacher is required do the group split manually.

Therefore we improved STAG module for Moodle by

ISBN: 978-1-61804-238-5

automatic group splitting. This splitting is connected with class schedule of each user of our system. Manual corrections of course are possible if needed.

VII. EX-Server Module Improvements

Primary task of this module is the user authorization when accessing the EX server. Only relevant records are displayed to each user. We extended the functionality of the module by following improvements.

Fig. 5: Alternative skin of rich media presented through ALS

The dialog for adding the records to Moodle course was extended with automatic ordering of relevant content. At first place, there is the whole catalogue of records, then records for actual school term and finally all records from past. Second improvement is an extended record search. Now it is possible to search and filter all the records made by an individual teacher.

VIII. Central university register

The central register was created by continuous development of the university card center. The register contains basic information about all university students, teachers and other employees. After its creation we decided to use it as a primary authorization service for our system. Through this approach we can identify a user across many other systems.

Central register is a source of meta information for user profile, ID of the user in STAG and university library. ALS user account validations and expirations are also based on the information provided by central register. This information is then used for automatic deletion of expired user accounts.

IX. University Library interconnection

The university library catalogues provide plenty of useful information on huge list of publications. We developed a module allowing us to use this information directly in Moodle. The teacher can put links to publications to his courses and those links directly connect interested student to online reservation system of the library.

X. Further improvements of ALS

We have been continuously working on system improvements. Some are quite small, some are bigger, some are generally usable, and some are for our university only. Among the improvements described in previous sections, we also developed our own type of group assignment, special dynamic category tree, easy system for course copy to a new academic year, classification list and modules for better accessibility by handicapped students.

Now we are focused on mobile site version development as this is very often requested by our students. In the beginning of year 2013 we introduced first applications for Android and Windows Phone and we have been working on their further improvement ever since.

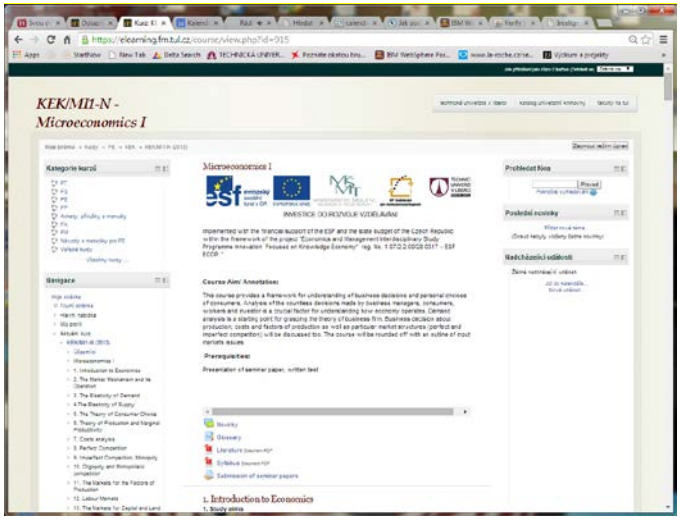

Fig. 6: Course page in TUL ALS portal

XI. ALS data analysis

Our analysis is based on three main data sources. The study agenda - STAG - provides study results of ALS system users. The EX server provides various statistical information about each stored record. And finally, ALS itself collects information about its usage.

Our analysis based on these sources proves that students have better studying results and better study experience when they use our system. We have also made a survey with more than 400 responses, and results of our analysis were confirmed by the responding students.

Let's take brief look at the survey responses.

- 89% of students responded that the system helps them to have better studying results.
- 95% found the lecture recordings being useful
- 8% of responses confess that they rather watch the recording instead of attending the lecture in person

Many of the students watch the lectures several times. One of our former students watched the records for more than 220 hours. Many of our very successful graduates were very active

ISBN: 978-1-61804-238-5

users of the system. The average usage time in this group is more than 50 hours.

We have detailed access statistic for each course. Comparing the data at the end of the semester and at the end of the exam period, we found some very interesting information. Some teachers were surprised how much their students use the provided materials and records during the semester and not only in the days before the final exam. More difficult topics have highest numbers of access. Therefore the usage statistics can be used by teachers for detection of such topics and further improvement of their teaching skills.

XII. Distanced Learning and Students with Handicap on ALS

There are no doubts that the ALS is for the distance students even more useful than for the regular students. They now have available all the materials in one place, any time they want [5]. In the past years, they were much more limited in their access to the study materials. Those students are very often much more motivated to study than regular students, and our system helps them in their effort.

Also the system usage statistics by students with handicap show, that they like to use the system and they use it very often. Thanks to the system they can study every time their health allows. Example being one of our students with heavy disability has used our system for more than 90 hours in past 8 months.

There are many kinds of handicaps and we trying to help our students as much as we can [3]. We developed special layout for purblind students. It consist of high size and high contrast control elements. We also added a sound identification of the control elements connected with mouseover event.

For the deaf students we have possibility of speech to text conversion in recordings. We are also capable of adding the sign language track to the lecture records. Our university has level access to most of buildings and two special study rooms for students with handicaps.

XIII. Conclusion

In this article, we have summarized six years of continuous work. Our university is relatively small (8500 students) and our faculty is even smaller (850 students). But we have very flexible colleagues willing to record their lectures and the number of active users of our system is constantly growing.

We have 375 different authors of the records on EX-Server. Apart from our core teachers, we recorded many of our respectable guests. We have 3396 records of lectures, guest talks and workshops. At the beginning of year 2014 we had 110550 unique accesses to the records. There are 65 courses recorded each academic year.

Of course there are some problems. Some teachers still refuse to record and publish their lectures. We have been trying to reduce their doubts and encourage them to share their knowledge. Many things can be done to educate high quality graduates. We are keen on streaming more lectures. In near future we want to create a virtual study room with e-book library and persuade our colleagues to publish their textbooks in ePub format.

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Software architecture for support of programming courses in university

Milen Y. Petrov, Dinio I. Dinev, and Adelina P. Aleksieva-Petrova

Abstract — Current paper will present description of software architecture for support of programming courses in universities. The main functionality provided by system and different approaches, taken into account for better technical and pedagogical implementation. Parts of these characteristics are related to the question "how university teacher can model the system"? It puts lights of software system capability in different configurations and development of new extensions. Definitions of new types of student work evaluation and adoption of existing plug-ins together with development of new ones. In addition it is concluded that adding enough preset functionalities in initial analysis, design and development work can allow integrating the work successfully in different universities around the world.

***Keywords*— e-learning systems, continuous assessment, software engineering**

I. Introduction

Programming courses in universities became part of educational process in the universities and its share and importance increases. For increasing quality of courses it is from crucial importance to have personal attention to each student, which leads to innovation, development and appliance of automation methods and supporting systems, which lowers the increased demand for human participation of teachers, and give teachers support to monitor, control and evaluate the work of their students.

Computer programming languages cannot be learned in a day. It is required long hours of repetitions, problem-solving of tasks and just work and have to fun with it in order to stay comfortable with the language and to be used in different contexts and different conditions. Therefore it is requirement to present to students small initial practical problems to be solved in the beginning and then gradually to become more complex. Homework and practical problems distributed to students should be reviewed, evaluated and graded. Due to the volume of the learning material that must be checked weekly and the emergence of new, often as a result, not paying attention and missing verification of these works leads to a drop in interest from students to practice the material and lack of desire for continuous improvement.

Despite that the same programming language at the university can be taught in a few courses that cover different levels and aspects of the programming language study or to examine various aspects of its diversity. That leads to needs of how to enable the teachers easily to change the system requirements, so that it can be changed to the objectives of the course. That is required to modern programming courses with live programming languages and technologies, which are continuously changing and improved. Example of such a course is World-Wide Web technologies, where technologies like HTML, CSS, JavaScript, Java and supporting tools, techniques and frameworks are changing literally each day. The best solution in our case is the system that must be capable of with minimal effort to be adapted to the course and NOT the course to be adapted against the system.

University students put their effort mainly on that what is evaluated and what is the final grade that is likely they to receive [1], means that more or less students learn what is measured, which is (not necessarily, but can be) different from the what is needed to be learned. When is applied continuous evaluation, i.e. the score is based on multiple control points during the whole programming course guaranties that students will exercise enough time duration of course itself and receive feedback on quality of their work just-in-time [2].

Learning a programming language can be supported in the most different ways. This can be done by test questions, open questions, tasks with visual responses, evaluation of home works in pairs between students (peer review) or by developing programming task. Many of these activities can be fully automated and thus assessment activities to be supported. According to Forisek [3] there are tasks that using automated checking is not the right approach, ie tasks whose correctness tests students can easily overcome. It is therefore necessary to combine automated verification with manual checking by the teacher, ie lead of the particular programming courses is

Research is supported by scientific research projects: "Software architecture for digitalization, storage and management of homework and exams in university and distance learning (DigPaper)", under number 135/2014 from state budget of Sofia University "St. Kliment Ohridski", Faculty of Mathematics and Informatics and by the European Social Fund through the Human Resource Development Operational Program under contract BG051PO001-3.3.06-0052 (2012/2014).

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recommended to see the evaluation of the system and can edit it. Furthermore, if the system returns a report on the evaluation of a task it is advisable to you with automated information to provide and one that is manually entered by the teacher. The influence and importance of this document for a student would be great because it will not just automatically generated document from one system.

II. RELATED WORK

There are many existing systems in the programming task evaluation, which are mainly closed [4]. Most of them are developed for specific university and their existence is in closed isolated environments in university of their authors. For purpose of our work – we do research of existing systems based on how often are they in search results in scientific databases like ACM Digital Library [5] and ResearchGate [6] with search strings: „Automatic Assessment Assignments“, “systems assessment“, „programming“. Another criterion is the degree to which systems are used in real-world scenario, and last but not least publically available information, as most of the systems are not open or it is used in closed university environment and information about those is limited.

On basis such selected criteria there are four selected for review systems, namely: Scheme-robo [7] , CourseMarker [8], BOSS [9], Web-CAT [10, 11]. Based on the review we detected different issues and best practices, which they provide, namely: fast evaluation and feedback, test data generation with different data, source code execution in sandbox environment, support of custom methods of evaluation, extensibility trough plug-ins, open for integration with external applications, using of Test-Driven Development (TDD). The positive points on the selected systems are:

- fast evaluation and quick feedback – Scheme-robo, CourseMarker, BOSS, Web-CAT;
- separate configuration on each lab (separate files)– CourseMarker;
- test data generation with different data - Scheme-robo;
- source code execution in ‘safe’ environment (known as sandbox) - Scheme-robo;
- support of custom methods of evaluation – BOSS;
- extensibility trough plug-ins – Web-CAT;
- open for integration with external applications – Web-CAT;
- Using of Test-Driven Development – Web-CAT.

Contacting students with the system is also carried out in different ways - in Scheme-robo, CourseMarker, BOSS, by uploading the system itself. In Scheme-robo is possible also via sending an email to the system Scheme-robo.

There are different restrictions in systems, namely: BOSS allows limited number of users to initiate concurrent evaluations in order to keep system from overloading. Scheme-robo is tightly integrated with Scheme language (and related to it programming courses), and is hard to be extended. In Scheme-robo and CourseMarker there are limitations on number of submissions to be made by the students.

III. ARCHITECTURE OF THE SUPPORT SYSTEM

One of the main features that the system should have is the ability to adapt to the changing environment. To design and implement such system must be able to allow an expandable mechanism, which by means of plugins, allowing an easy way to add new features. For this reason, the construction of proposed system is selected build tool system – Gradle [12]. It provides easy extensibility and scalability of build process, which is the process of helping, as in our case, we do not investigate on the code of a system, but on the code sent by students. Furthermore, the Gradle provides a powerful mechanism for managing the external files dependency - external libraries, made the successful opening of the transitive dependencies and allows management of cache in which extensions are stored. By using the language Groovy configuration allows easy and expressive way to express logic and settings on system behavior. Using Gradle system allows created extensions to be written in different languages such Java, Groovy, and Scala. Using existing plug-ins, available for Gradle allows users of the systems not to start from scratch in building the system. It is easy to use plugins to compose and expand further facilitates the process of reuse of once established logic.

Since not all tasks can be evaluated by automated tools and cannot be assessed with automated precision that different solutions are plagiarized from each other we need a module for automated inspection. It will allow the teacher to be involved in the examination and evaluation. It should be used in situations where the system cannot take the right decision or when verification of an assignment is impossible to be automated. For example, how much an html page created by the student has good look and feel design? As this is subjective decision – it must be left to the expert/human decision.

System requirements are changing with appearance of new courses at this university, for this reason, not all functionalities can be created in the beginning. In order to create a system plug-ins, it must clearly describe the way in which this can be done or so called user documentation or user requirements.

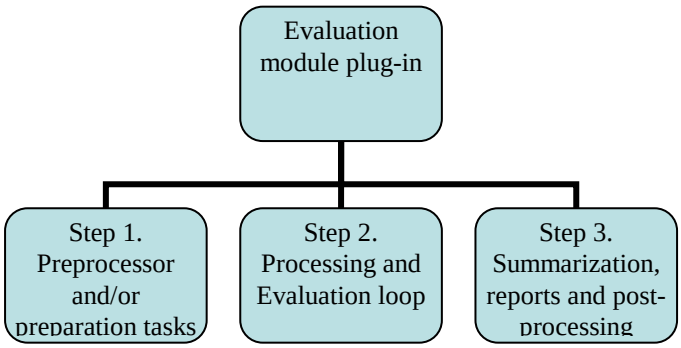

Fig.1 *Software decomposition of typical task evaluation module*

The implemented architecture and software system has

implemented module that performs document analysis, report generation and delivery in a convenient form for reading. Basic module functionality is depicted on figure 1. Typical module consists of several generally mandatory steps, as follows: step 1 – preprocessor activities – the work, that must be done, before real evaluation starts; step 2- evaluation activities – main (nested) loop for evaluation – typically first is iteration is by users, and second iteration is by processing tasks; step 3 – summarization and post-evaluation activities, distribution of scores etc.

To empower the users which used a system, it must provide them with a way to be able to change the behavior of the system or to give system to make self-modifications and improvements. Creating web application with graphical user interface that allows easy selection of the type and form of evaluations for assessing can lead to limitations of system usage. For situations that are not set out in the original design of this web application, you must create workarounds or to apply "hacking" approaches. Therefore, to maintain flexibility for automated support system is necessary to be able to manipulate and to be in the teachers hands. In this approach the system is selected to be performed on the Continuous Integration (CI) server.

The system must handle multiple external files and it is necessary to establish an effective way to obtain them. Different courses in different universities and nature of individual students are not uniform and it calls into question the construction of a single mechanism for retrieval of student solutions - whether by obtaining a mail retrieval from external repository or system such as Moodle, using a cloud service to access, etc. User should be limited and should decide for itself how to extract foreign student artifacts.

The file structure of a managed software system is very important to be properly organized, it can be easy to manipulate and maintain. It consists of a root directory where are located all the other subdirectories needed by the system in order to operate. One of the most important folders in the file system is *gradle* folder where it will be located wrapper. It allows users or CI servers to start build the system without the need for installation. Moreover, it allows you to embed an initialization script that can perform setup of the project, depending on its environment, which is implemented. It can be either run build on teachers' machine or continuous integration server. In the folder wrapper are generated by Gradle files - *gradle-wrapper.jar* and *gradle-wrapper.properties*. The first of these is a separate jar file that contains the necessary classes to be downloaded Gradle distribution. How it to be downloaded is determined by property *distributionUrl* located in the second file from the directory wrapper.

Entire directory with gradle scripts in the root directory, *gradlew* and *gradlew.bat* must be stored together with the code of the system in order system to be usable. The migration to new versions of used software is easy. When completing the migration to a new version of Gradle, the person responsible for maintenance of the system only needs to change the value of the distributionUrl property to indicate the desired version. In order to *be* undependable from the interruption of the Internet connection during build process is necessary to have local storage with Gradle distribution to be located at the university repository accessible from CI server in the intranet.

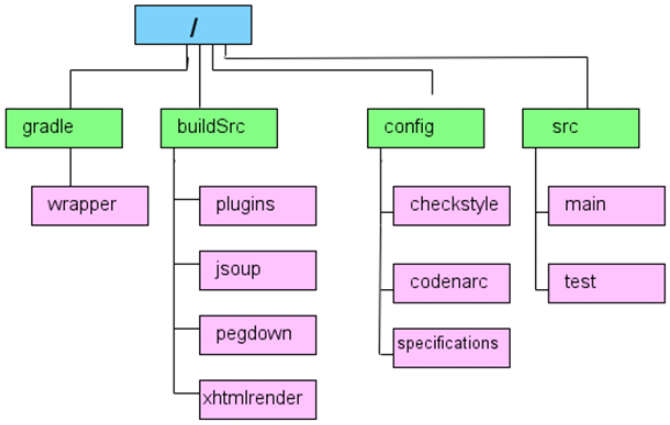

Fig. 2 *Core folders structure of evaluation system*

Another important directory in file structure of the system is *buildSrc (see Figure 2)*. It contains the basic logic that is necessary for the proper functioning of the automated support. It represents Gradle built mechanism that allows us to put the necessary functionality to be available at the start of the compilation of the system itself. A disadvantage of this approach is the inability of reusability of code that resides in the directory of the other projects. Activities for automated verification system must perform to take place in the build system. At this stage of the designed system functionality in *buildSrc* folder is not needed to be separated in one build, to produce various artifacts for post-processing. It is possible to perform this build subsequently, and to allow artefacts to be accessible from other projects.

IV. Experimental Results And Analyses

To demonstrate the effectiveness and feasibility of the system we evaluated students' projects, written on Java using the created java plugin, which, along with the functionality that adds these used the built-in java extension of Gradle system.

Configuration of the build to be performed is done via groovy script that setup various properties of the system, what extensions will be used (java) and others. In building these scripts can be used already existing/developed scripts – i.e. if an initial course in Java is done setting tools and functionality that will be used in building on this course you can develop, then in second level of programming the scripts can be "upgraded" and extended current version. Since the script you can define external files and repositories from which to take these files, all information needed to build configurable through them. Of course the use of external tools or extensions that require different configurations may be required and specifying and other files.

Relatively big volume of source code – namely - 319 zip

ISBN: 978-1-61804-238-5

archives with students projects and solutions is consequence by the fact that system try to model the real execution of the system, after last deadline, where all assignments are submitted in parallel. CI server allows to make periodic checks and in that way the course leader/administrator can set the initiating actions or in specific period – to initiate the evaluations of submitted work.

To developed java plug-in there applied number of external controls - pmd, checkstyle, findbugs. After performing the checks and analysis by the external tools – there are identified a number of problems associated with programming styles, and the presence of varying degrees of importance problems associated with using poor practices. Moreover we found 56 compilation errors that have blocked execution of specified analysis. Unfortunately, code that cannot be compiled – then java bytecode cannot be delivered, then evaluation, based bytecode analysis cannot be performed and it was skipped. But some of the tools - checkstyle, findBugs – can run analysis on available source code. Thus, students who submitted broken source code – also can receive feedback. After analysis of different factors of error – the largest number of errors are caused by errors in the code, ie students uploaded a solution that cannot be compiled. One explanation is they expect that their code will not be executed and errors will not be detected. By using the automated system, this practice will be terminated.

Next big number of problems – 13 is because of existence of files with same names in solutions for different tasks in same archive. The student doesn't use separation by java packages (and folders) and that leads to that problem – that leads to compile files successfully as ambiguity of the java files. This problem can be avoided by instructors - can give to student specific guidance and requirements to java projects. Still the system should be capable to handle such kind of problems.

One of the potential solutions is for each task by each archive to create an *sourceSet* which is compiled separately. So checks will now be performed on tasks rather than exercise. This would lead, however, to increase the generated files, since you will not have a report on the inspection of an exercise, and will lead to 3 reports for example – if we have three tasks.

Another large group of errors is related to improper use of the programming language. These are errors for:

- Incorrect implementation / use of abstract classes;
- Incorrect static method calls;
- Calling the method with different number / type of arguments defined;
- Incorrect call / construct constructors;
- Partial uploaded decision.

Two of the errors found in the system are caused by files with encoding UTF-8 with BOM, which implies the presence of a leading special character. It cannot be ignored by the Java compiler, and led to the failed execution. The student in this case cannot be blamed, as the editor or IDE is set to this format, and thus he does not have problems appear. Using this approach to work in real projects, however, will result in the same error. Therefore students should be instructed not to work with this encoding.

The system can output the system properties of the compiler to determine the encoding, but it certainly will not help. Therefore, the system must perform further convert the file to the desired format to be implemented additional functionality.

Very often when students use IDE when writing code, they have built IntelliSense assistant, who tells them available methods of a class, etc. Often, however, be carried out unintentionally selecting an unnecessary process, while adding a certain import. After removing unnecessary method students however forget to remove import, associated with the method. When it is from a library not available on the system it leads to compilation error. This problem can be eliminated by removing errors found by findBugs verification to demonstrate the presence of unused import.

Since evaluated course is intended for initial programming / core / fundamental courses, it is expected not to have many (if there any) external libraries. In one case of the evaluated projects, however, such is used. Since the system does not provide a way to specify the part of the student's desired external libraries it uses an external library cannot be available on the classpath of the compiler and inevitably leads to error.

V. Conclusions and Future Work

Basis for future work is foreseen in several dimensions, namely as 1) configuration artifacts, 2) plug-ins reusability facilities; 3) conventions and best practices; 4) self-configuration and adaptation of system.

Configuration artifacts: it is necessary to be built and described predefined standard model for conventions used in evaluation in specific university. For example what are configuration file names, in order to identify uniquely programming course in the system. If there is convention – it is easily to find given specific configuration file and to be reused in other course. Future definition and convention for uniqueness will lead to remove the problem with possible duplications.

Plug-ins reusability facilities: in order to use separate, already developed by us, existing plug-ins in separate project will allow different builds not to use common code base. This will lead to make possible to use own builds, which can use provided functionality of the system as convenient external dependency. To be done this requires private repository, where these artifacts to be published. In order to be published and reused in proper way – there is need for plug-ins conventions too.

Nevertheless planned work for the future – proposed system for support of programming courses in university is very promising toward building fully functional facility, according to initial work and early evaluations of the system.

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THE S.P.L.A.S.H Project – A Research and Experimental Project using Social Learning Environment in High School

Gianpaolo Chiarella, Antonio Guida

***Abstract*—** A research and experimental project using Social Learning Environment in High School has started in Bari, in two high schools (Ist. Marco Polo – Bari anche Ist. Leonardo Da Vinci – Cassano delle Murge (BA)) since Septemper 2013 and now is still in progress.
In this paper we want to explain the goal of the project and the underlying motivations. In a further publication we will explain the results of the research.
The goal of the project is to facilitate the training and educational path in school, and to enhance the effectiveness, developing research activities and studies in a new learning environment, combining disciplinary and inter-disciplinary, groups, individual and network approaches, with a whole integration of Information and Communications Technologies (ICT) in the didactical process, supporting informational learning, with different personalized access profiles on the contents produced.

***Keywords*—**social learning environment, informal learning, Peer-Learning , Peer Assessment.

I. INTRODUCTION

THIS Research, design and co-operational experiments, in which has been involved Software House, HIgh School, researchers and University, has lead to realize and customize a lot of services, including:

a. a web platform flexible, social, open source, which can be easily integrated with other software, to be used in the learning path of the student, in the educational practices of teachers, in the daily class activities, usable with the most popular mobile technology devices, such smartphone or tablet;
b. categorize contents in resources, folder, library, sharing any kind of multimedia information, such as videos, photos, mp3's, docs, pdf and so-on
c. give points for the activities done, earning a better "kharma"
d. e-library (e-book) of the original content produced;
e. e-portfolio of the students

The platform is designed for multilingual use, according to what stated in the *Knowledge System for Longlife Learning* and to the Italian ministerial guide lines.
In this learning area, Information and Communication Technologies allow to:

1. create, share, and organize a hyper-dimensional knowledge space, using the modern "social" way to interact with portals and other individual (Like, Unlike, writing on the "Facebook like" wall of the other, gaining access to groups public or private..)
2. give intelligent access to the "authenticated" and "certified" contents made by teachers or other field experts;
3. realize individual path in the knowledge acquisition field, giving value to personal attitude and talent
4. participate to the continuous evolution of the platform itself, throughout sharing of personal experiences,
5. define a *social model* for the authentication and aggregation of the multimedia contents, opened also to contents taken from the Web.

II. END USERS OF S.P.L.A.S.H.

The research is oriented to three groups of users: students, teachers, school:

1. The students can login to the platform, reading resource of interest freely or in a guided way. He can study also using "research games" and his work can be valuated using methodology like "peer-assessment". He also can obtain a judgment which certify his learning credits.
2. The teacher can login to the platform, preparing thematic lessons, creating classroom groups, advanced instruments for the evaluation according to

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the national research lines (INVALSI/OCSE-PISA), with a final certification

3. Every people of the school can freely login to the platform, publishing (with advanced editing tool) every news of interest, events, educational programs; everyone can interact with teachers (personal messaging, group posting) and students.

The project agree in principle with "Smart Education" lines, wich is been experimented in Italian School: a set of digital instruments to supply school services and to facilitate interactive learning using Information Technology and Digital Contents, giving also a support to the eco-sustenaibility.

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III. Improve the effectiveness of the learning/teaching Methods

The project aims to the analysis and experimentation of new methodologies and models of learning/teaching both at indivilual and classroom level, which facilitates the achievement of the school learning objectives by integrating the more traditional didactic tools with the ones based on ICT technologies. The research is directed to a model which affects significantly the teaching-learning relationship and the connected constraints of co-presence, the advanced techniques of evaluation and self-evaluation, the networking among different types and orders of schools and between these schools and the institutional and professional contexts. In such a research field the e-education tools addresses:

- the development of "object oriented" and "problem solving oriented" didactic tracks for a competence based training;
- the provision of flexibility to the teaching/learning processes, making them more easily adaptable to the individual and collective needs, and increasing interest, motivation and participation of the students
- the interconnection among the schools orders (secondary school of first and second orders) and the products (curriculum-based, personalised on the recover, enlargement, widening),
- the easing of digital literacy and the naturalization of the didactic technologies in the school context;
- the exploitation of the informal and ubiquitous learning possibilities, which overcome the times of the school didactic and the spaces devoted to the formal learning;
- the involvement of teachers and students in a practices communities which can contribute to innovate "from the bottom" the construction and sharing of knowledge.
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IV. Improve the efficacy of ICT tools for the learning/teaching

The objective is to sustain the innovation of the educational system and of the education and training, through the analysis of the development potentials of informative architectures, technological solutions and ICT system components, which empower and complete the didactic tools also through:

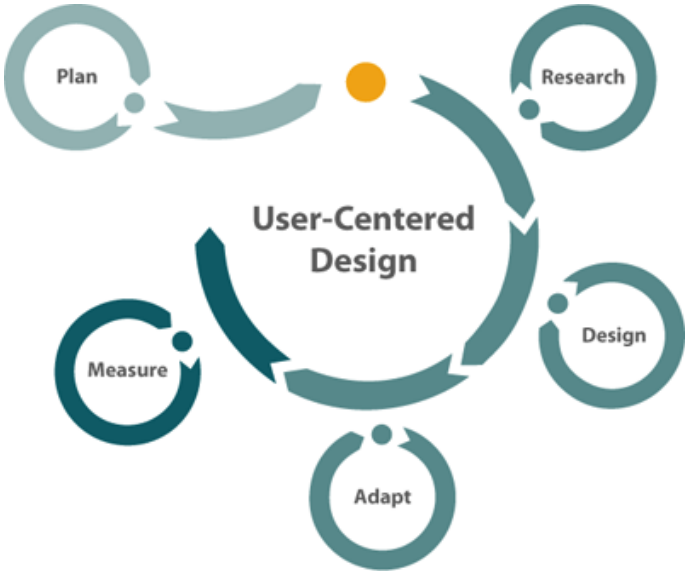
- the development of services of e-education which will optimize efficiency, reliability and control of the access operation to the information;
- the consolidation and simplification of strategies for merging contents, even heterogeneous contents for format and origin;
- the creation of rich context models which exploit transdisplinary contents specialising the role in different curriculum educational scenarios
- the development of networking tools for the involvement of users communities in the validation, dynamic elaboration in continuous auto-regulation and the spread of knowledge in social forms (teachers and learning network) in a constructivist learning conetxt of **co-development** of knowledge;
- the innovation in the indexing and trans-disciplinary cataloguing of contents toward new models of text book, more eco-sustainable models.

IV. The Approach

Design and implementation of SPLASH, of learning path and of the didactical activities belonging, lever upon main chief principles. First of all we must say what we mean for "End User". For End user we mean the final users of the web platform, i.e students, teachers, schools. To better engage end users, an ergonomic design approach based on **User Centered Design** has been adopted: the intellectual ability, the goals, the contest of the students and the teachers has been put in center of the design, with a special attention to accessibility, usability, making periodical revisions and test.

The difference between User Centered Design and other approaches is that UCD tries to optimize the product about the needs and the desires of the users, rather then force them to change the habits and behaviours.

ISBN: 978-1-61804-238-5



In the SPLASH project, the users has been involved in design and test since the first phase of the process, throughout the whole phase of the project. This approach typical of Agile Methodologyis in fact in perfect syntony with the Living Lab approach.

More precisely, the users have been involved in:

- Definitions of the goals, of every detail of experimental phase and of design of required functionalities.
- In specific phases of co-design. The users have been involved in the identification of the functions of the system, bringing their vision in research and experimental team.
- In test operation, where the user experience is very important, to make quantity and quality of feedback grow;
- In the achievement of the "user genereted contents" (the "resource" of the project), to produce multimedia content useful not only in the learning process but also in the testing process.

IV. The User's Needs Analysis and Understanding

To go beyond phases of involvement which carries normally dead time and inertial problems, we have established two teams: Experimentation Team and Guide Team, to whom took part end users, software factory, research representative (University), stakeholders in the field of learning and education. In particular, Experimentation Team had the role to facilitate the dialogue between end user, research and software factory, working on prototyping software more and more closer to the final software platform.

In the first phase of the project took place a survey on a sample of teachers and students, concerning the behaviours and opinions about the process to modify. More specifically, an auto-analysis about the use of the technology in Learning environment, permitting in this way the understanding and the sharing of the state of "digital" knowledge, which ICT technology daily used in classrooms and their correct use. This led to understand the potentialities to develop new competence in this field.

One of the instruments to better understand end users has been the **Thematic Panel/Forum**, on-line and in presence. Through these instruments the team has understood in a perspective key the needs and the opportunities of innovation to better support new methodology for teaching and learning.

Another instrument to facilitate the participation has been the use of **Focus group "open"** on the design theme, which have involved different kind of End Users.

In the first phase of working development, the interaction aimed to collect the general requirements of the platform, and the goal to be achieved. During this phase, the potential of innovation linked to common research of sustainable solutions came to light. The process, initially led by Experimentation Team, has become more and more open and *User Centered*, till becoming an autonomous capability to stimulate and support new challenges in the field of the "open innovation", typical of the "living lab" process. This process has been facilitate bye the availability of software prototype form the beginning of the phase, making the early test possible, not only in the field of software testing but also the "adoption" testing.

An important role has played by ten "workshops", (almost one every 15 days) which took place in a Demo Lab established in the High School.

All these actions have been worked together to elicitate the knowledge on behaviour and way of use of the Web Portal, Software and new technology devices such Smartphones and Tablets.

Anyway, to complete the set of instruments has also been done a Web Portal of the project (www.livinglabsplash.it) to sharing every kind of document, memorandum, note, design sheet, and a prototype of the platform immediately usable.

As all the project activities, also the analysis and comprehension of the end user are based on actions with strong operational character, with the aim to overcome the dead times of the involvement process and participation. In this phase it will be of high value the composition and the facilitator role of the experimentation team which aims to stimulate the discussion of the emergent requirements, both through prototypes that are more and more near to the prototype that will be finally developed .

In the first phase of the project an investigation on the representations, the feelings and opinions of the users related to the processes that are intended to be modified has been undertaken. In particular, a selected example of end users has been produced, that is an auto-analysis and a functional analysis on the usage of the technology in the didactic context.

This will allow to understand the competence heritage available, the linguistic codes and the potentiality of development of new competences.
Further, with a strong operational character, we have activated an effective process of iterative co-design, in which the stimulus and suggestions can be verified quickly in terms of feasibility and adopted in prototype contexts useful to make better the comprehension and the realisation.. This approach derives from the experiences developed from the SME involved in the project, namely INFOR2000, in the use of an approach strongly professional to the management of complex projects with a not accurate definition of the requirements.
The idea of an iterative co-development will follow the whole path of experimentation and will allow not only the best results but also important suggestions for the future exploitation of the experimented solutions.

V. The Prototyped Solution

The aim of the prototyping process to build a platform of Social Learning, with the following requirements:

1. Web-based platform built with the competence of experts of the didactic sector (didactic, pedagogy and psycology) and ICT experts (analists, developers with multi-annual experience, ssystem developers of secure and innovative platforms) ;
2. open source: the source code of the web platform will be available for the public domain and will be distributed in an open source mode, to allow to other schools a large scale deployment without use licence or pay-per-use problems.
3. high level of authonomy of the teachers and their collaborators in the didacti planning, in the management and fruition of teh didactic resources in monitoring the online activities of the students;
4. adoption of web2.0 for communication, collaboration and interaction. Therfore, there have been adopted dynamic tools of collaboration, typical of social platforms such as Facebook or Linkedin and of collaborative building of didactuic resources, such as the ones available in the MOODLE platform (wiki, blog, forum, chat), in a way to create a space of virtual aggregation among students and teachers, both of the involved schools and the external schools.
5. which covers the main areas of social learning such as:
    a. shared learning through a web platform
    b. co-development of knowledge
    c. tagging and social bookmarking, linkshare
    d. e-learning
    e. ebook construction and production
    f. student portfolio building - area of competence certification
6. which can be used by mobile platforms.

The platform has been developed in a PHP language, with advanced technologies such as JAVASCRIPT, AJAX, JQUERY.

Currently, there exist different and several platform of social network, some very "open source", some with the main part "open source" but with plug-ins at payment.
There have been performed several studies on the functionalities of the open source platforms both for the e-learning and the social networking: none is a complete platform for SOCIAL LEARNING and the functionalities that are expected..
In the context of S.P.L.A.S.H. project the main role is not the "technology" but we believe that it is nmore appropriate to talk about a "lerning environment", namely a "social learning environment".
In the current state-of-the-art there are no solutions in the market able to answer to all the learning requirements expressed by the end users and able to merge the formal learning and informal learning.

VI. Test and Experimentation

The aim of test and experimentation is not only to verify the efficacy of the new ICT technologies applied to Education & Training, but also the approach which sees at the center the user-student and it is strongly oriented toward new applied models and paradigms.
The development of the communication technologies deeply influenced our life style in last years by introducing rapid and irreversible changes in the society. Today, tablets and smartphones are tools to remain always connected expecially for the new generation.
The prototype is very intuitive in order to facilitate the use and learning with similar social network platforms used by the school population.
The test and the experimentation have been performed both with the teachers and the classes (end users).
The tests and the evaluations have been developed through constant interaction with the end user. It has been important to evaluate how the used technologies are able to exploit the relationship between language and creativity that is ignored by several multimedia products, resulting less interesting for the public.
The platform has been provided with contents and resources generated by the teachers and students and is useful in every application context.
The test has been performed in the first phase within the DEMOLAB, by the experimentation team with the involvement of specific users groups.
The test activities are part of the prototype development process following the User Centered Design, and then following the cycle Plan, Research, Design, Adapt e Measure. This results in a better quality and quantity of feedback, in a development phase in which changes can be allocated.
Focus Group specific to the test and experimentation phase have been activated, and in the DEMOLAB have been made available "suggestions boxes" useful to formalise the users feedback.

ISBN: 978-1-61804-238-5

VI. DEMOLAB AND DEMONSTRATION PHASE

The prototypes solutions are presented with the DEMOLAB mode at:

- Istituto Marco Polo di Bari;
- IIS di Cassano delle Murge;

with the participation of six classes involved in the experimentation and teachers, the project group, the University of Bari and Foggia, the school managers , the MIUR, Apulia Region, Bari Province, Regional School Office of Bari and l'INDIRE and further stakeholders of the territory, such as training bodies, Confindustria, managing editors.

ACKNOWLEDGMENT

This work has been funded by Apulia Region, Area Politiche per lo Sviluppo, il Lavoro e l'Innovazione, Servizio di Ricerca Industriale e Innovazione, Ufficio servizi die Government e ICT and realized in collaboration with InnovaPuglia, under P.O. FESR PUGLIA 2007-2013 – Asse 1 – Linea di Intervento 1.4 A zione 1.4.2 – Investiamo nel vostro futuro, Supporto alla crescita e allo sviluppo di PMI specializzate nell'offerta di contenuti e servizi digitali Apulian ICT Living Labs – Verso Puglia Digitale 2020.

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Split-teaching: Frontier Tools for Classroom Instruction

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Abstract—one of the greatest challenges of today's digital and the entertainment era is how to keep the student's attention in the classroom lecture. Even in today's smart classrooms, students are always equipped with the weapons of mass distraction, such as cell phones, I- Pad, I-Pod and Tablet. It is a daunting problem for those teachers who are struggling to translate the classroom teaching into students' academic success. The concept of teaching is associated with the flow of knowledge from a teacher to students. The availability of knowledge is a deterministic parameter for the respect of a teacher (server). In this paper, we describe various teaching techniques and source of knowledge. We propose Split-teaching and compare with various currently available teaching techniques.

Keywords- Split Protocol; Protocol splitting; Multiple Clients/ Single Server; Multiple Clients/ Multiple Servers); Split-teaching**.**

1 INTRODUCTION

With changing technology and aggressive marketing effect, our life has taken a 360-degree turn. We lose our capability to sit one place and focus on our work or study. Now we are becoming used to move our finger from one site to another site on our smart phones. We keep surfing from one webpage to another webpage either on a laptop or Smartphone. We have lost our patience and stamina to focus on one subject. Today overall HBCU students feel that STEM courses are not for them; simply they are not willing to study any strenuous courses. We have a very hard time to convince them to pursue computer science courses. The nationwide dropping rate of enrollment in computer science courses, in HBCU universities, is a monumental challenge. We need an effective instrument to attract these students and make the teaching of computer science courses more effective and market (job) oriented.

The Split-protocol concept stemmed from splitting an HTTP/TCP protocol in Web server applications. A single monolithic HTTP/TCP protocol that is standard in a Web server can be split into two portions, and each portion can be independently run on a different Web server, thus constituting dual servers. These servers communicate across a network by using inter-server messages or delegate messages. A server can delegate a request to another server or it can process the request in its entirety. It has been demonstrated that the split dual server performance is much better than a non-split server pair (about 10-25% and in some case it was around 84% [2]. We discovered that the split concept has broader implications and impact in computing and also in real world applications. This paper will explore such implications of a split concept in teaching computer sciences courses though it is applicable any courses Figure 1. describes the Split-protocol.

We can demonstrate the split teaching concept by teaching one course by multiple instructors. Courses would be taught by instructors from the academia and industry. The main objective in this paper is to highlight the technique to prepare students for future market needs. Instructors from industries can offer hands-on training such as UNIX Administrator, System Administrator, and Web developer, Java Developer, System Analyst and Database Administrator, and instructors from academia compliment with the knowledge of the underlying theories.

Even though, the same course is taught by two different instructors, the student learning outcomes are entirely different. If we teach a course with two instructors the student learning outcome will be better from these two instructors. We have purposed, in one hour fifteen mints class, each instructor will teach 35 minutes, in the same classroom. We are considering the facts that how long a human brain can retain the attention (active process, specific information present in our environment). Various studies suggest that our brain functions better in a smaller interval,

and if it is associated with different objects [8].

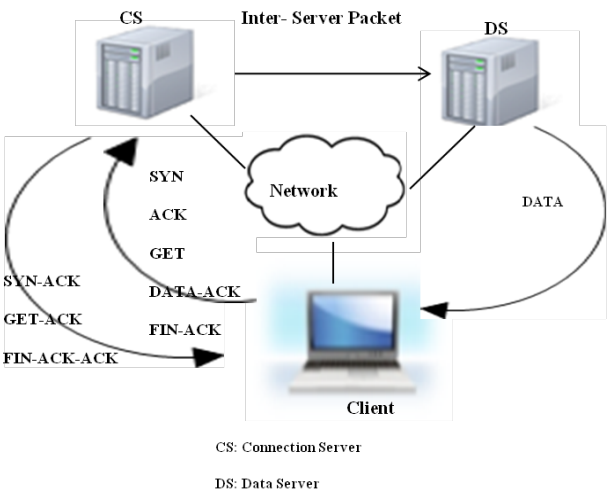

Figure 1.Split-protocol.

We are not going to discuss or study cognitive psychology; however, we will introduce the concept Split-teaching, what this means to students that they can get the opportunity to learn from instructors of other institutions, example, they will learn part from University A instructors and part from University / Industry B instructors.

But at this point we are focusing within a single department at University A. In this model, the curriculum prepares a student for a given career track based on his/her interests and performance. The industry is also looking for people with particular skills and knowledge. The research paper will focus on market demand, therequirement of core skills required to perform the job in a given industry. IT/Computer Science field offers a number of career tracks, one can focus student learning based on focused career track. As the industry very much focuses on hiring students with a specialized skill, the proposed solution should work better. During summer research students, will be exposed to industry certifications like CCNA and SAS.

2 RELATED WORKS

To maintain common ground and the standard of teaching, particularly in computer and information sciences the ACM and IEEE Computer Society curriculums [3, 5, and 6] over the years have used a different type of approach, which is based on courses and fields that have emerged over the years and has no stability in its mission. The Split-protocolhas demonstrated that when we split the task between two servers, the performance achieved was much higher than the sum of two separate servers. The same principle is also applicable to the teaching task[1].The career teaching concepts identified some career tracks in database and networks from Web sources [4]. In today's industrial careers, apart from theoretical degree certifications are vital components. Certifications such as A+, Network+,CCNA, CCNA, CISSP, and Security+ [7] are required for some jobs. These certifications cover a wide array of topics and sometimes span across many areas.

3 DIFFERENT TEACHING METHODOLOGIES.

A. Co-teaching

Co-teaching: two or more people sharing responsibility for teaching some or all of the students assigned to a classroom. It involves the distribution of responsibility among people for planning, instruction, and evaluation in a classroom of students. Another way of saying this is that co-teaching is a fun way for students to learn from two or more people who may have different ways of thinking or teaching [13].

Co-teaching is an artistic way to connect with children and help them to learn. Co-teaching could be a way to make schools more effective. Co-teaching can be compared to a partnership. Partners must establish trust, develop, work, communicate, share the chores, collaborate and work together creatively to overcome certain challenges or problems. Things that are done within the partnership are done for the greater good of the students.

In co-teaching, two or more persons decide to work together and agree on at least one common goal. They each as individuals have the expertise that will help the group as a whole to be successful. Everyone works together and one person being the leader is not a priority. Each member treats the others with respect and they are perceived the same. There are certain aspects that each teacher will be responsible for more than the other because of their expertise. Some might have better communication skills, and can talk with parents about their children and the work that is expected. The teacher can work with that parent or family member to help the student to achieve their goals in class. All members of the co-teaching will share in the teaching of the lessons, but other duties that occur can be divided equally or rotated between the co-teachers at different times.

Strengths and Weaknesses

According to Cushman [13], Co-teachers create the feeling that they are equally responsible for the learning of all students to whom they are now assigned and that they

can best carry out their responsibilities by pooling their diverse knowledge, skills, and material resources. There are thestrengths and weaknesses involved when co-teaching takes place. Both of these can be identified and discussed before starting the project. Identifying these strengths and weaknesses can be done by listing likes and dislikes as well as listing the strengths and weaknesses of the teachers. This will help to differentiate the instruction to meet the needs of a larger group more frequently within the classroom as well as allowing for individualized instruction. Identifying teaching styles are very important because it will also help with recognizing strengths and weaknesses. These factors need identification in order to combine styles to create a cohesive classroom. A balance is needed to make everyone comfortable in the learning environment. This helps to create a cohesive classroom with consistent expectations when both teachers are on the same page for instruction and discipline styles.

Co-teaching provides a safety net when you take risks in your instruction. When you try something new and it doesn't work, you have another teacher in the room which can step in with another technique or lesson that works, or point out the area of difficulty, or assist in redirecting the lesson. When you are the only teacher in the room and a lesson bombs, you often have to stop and move on and then analyze later why the lesson fell apart - without the assistance of someone else in the room observing the lesson [14].

Strategies

There are strategies that can lead to an effective and positive relationship building between co-teachers. In order for co-teaching to be successful, each partner needs to feel comfortable in the working relationship. This starts with building rapport. The teachers need to get to know each other, build a trust and learn to share in the responsibilities. Co-teachers need to know what is expected of them for each lesson: the less doubt, the more successful the co-teaching. Another good strategy for co-teaching is that the instructional role of the co-teachers should vary. Students need to see both teachers in a leadership role. Communication is the key to making the experience good for the co-teachers as well as for the students. Ongoing conversation will solidify the relationship and show a united front to students. Planning together and then debriefing lessons clarifies responsibilities, keeps both partner's alert to student needs, and allows you to confront concerns before they become problems. Last, but not least, develop a planning protocol that both teachers can agree upon. Don't assume that just because a lesson is over and has gone well that there is nothing to talk about and learn from debriefing together. Catching each other quickly between lessons is not sufficient for co-teaching success [12].

In conclusion, co-teaching is a model that emphasizes collaboration and communication among all members of a team to meet the needs of all students. It requires that those involved are open to creating a successful co-teaching relationship and maintain an open communication with an ongoing trust building. Co-teaching is great for the students. It improves teaching, pushes those to think beyond one's own opinions, allows teachers to get two sets of eyes on the student's progress, gives them someone to bounce ideas off of, and helps manage behavior. The benefits of co-teaching go on and on [12].

B. One teacher with multiple students (Single Server /Multiple Clients)

This technique has been very traditional in practice over thousands of years in Asian countries, one teacher gives anentire knowledge need to succeed in our social or political life. This teacher is kind of the coach, and students spend their significant time of their life in learning different aspects of life. One can find the story of such teacher in Mahabharata. In this learning paradigm teacher is a central source for knowledge. The student gain necessary knowledge from a single teacher staying with a teacher over the period 10 to 15 years until the student becomes an adult and takes his own social/political responsibilities.Figure 2.describes one teacher with multiple students teaching method.

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Figure 2. One teacher with multiple students

C. *One student and multiple teachers (Multiple Clients/ Single Server):*

In this technique of teaching, one student learns different aspects of like, politics, social life and skill for battlefield form different legend teachers. As especially royal families and their children used to get such teaching in ancient India and Asian countries. Ramayana is a great book which illustrates several teaching and learning experiments. Students go to different teachers to gain knowledge in a different field. Still student need to go thesource of knowledge and teachers are different sources of knowledge. Figure 3.describesone student and multiple teachers teaching method.

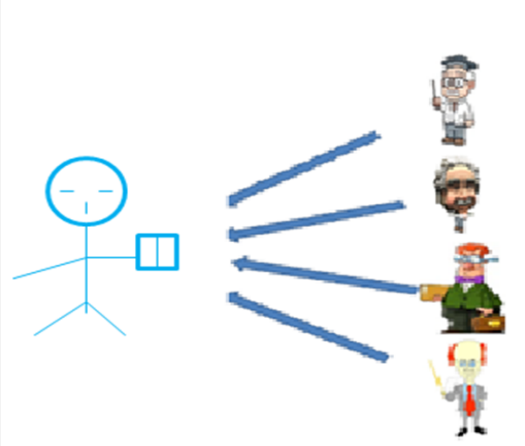

Figure 3. One student and multiple teachers

D. *Many students, many teachers (Multiple Clients /Multiple Server)*

This is a group type of teaching environment and is normally found large laboratories where multiple instructors teach one lab, and students can ask the help of those instructors. All instructors are well qualified to help any student in a lab or classroom. In this paradigm, still teachers are sources of knowledge, and knowledge is scattered among the teachers. Figure 4.describes Split-teaching teaching method.

A. *Group learning*

A learning community is a group of people who share common emotions, values or beliefs are actively engaged in learning together from each other, and by habituation. Such communities have become the template for a cohort-based, interdisciplinary approach to higher education [9]. In this paradigm knowledge is shared between, a group of students and teacher.Figure 5.describes Group learning teaching method.

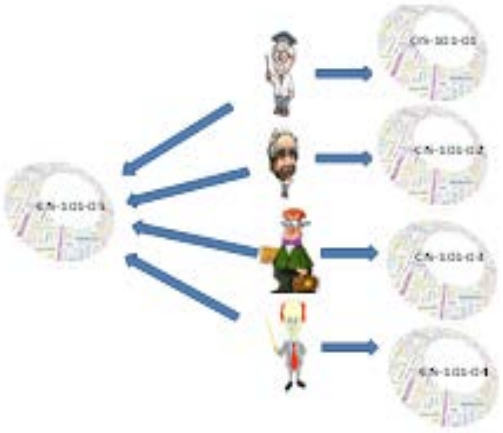

Figure 4. Split-teaching

Figure 5. Group learning [8].

B. *Split classes:*

"Multi-age classrooms or composite classes are classrooms with students from more than one grade level. They are created when either there are too many students for one class - but not enough to form two classes of the same grade level, or as an educational choice by the school" [10] .

Combined or split class refers to a class that is made up of students from two or more grades. Combined classes occur most frequently in elementary schools and are the combination of students in two different grades with one teacher teaching both curricula [11].

ISBN: 978-1-61804-238-5

G. Group Teaching

Group of teachers go to a classroom or lab to teach to the students. In this method, student can ask a question to any teacher or instructors. All teacher or instructors are capable of explaining students. It is not compulsory that you ask to the same teacher from whom you learned yesterday. The student has access to learn from multiple instructors. This is different from group learning, where students from a small or large group and learn from single instructors. Also, they learn from group dynamics, and ability of learning in group varies. Some students are better, more understanding some topics well than the other.

H. Split- teaching

Is the concept of service in which single service (job) is accomplished with multiple servers. Split-teaching approach breaks down a single course into multiple modules and each module is taught by different instructors.

4 MOST POPULAR MODERN TEACHING STYLES THAT ARE USED IN THE CLASSROOM

A. Authority Figure:

In this technique the teacher isthe center of attention and an entire class pays attention at what the teacher is doing. This is practically widely used teaching technique. The knowledge that the students receive comes directly from the teacher. The teacher controls entire student activities. Generally in this style, once a student passes or move to thenext level teacher loses control over a student.

B. Authority Model:

The group of teachers goes to classrooms or labs to teach to the students. In this method, the student can ask a question to any teacher or instructors. All teacher or instructors are capable of explaining students. It is not compulsory that you ask to the same teacher from whom you learned yesterday. The student has access to learn from multiple instructors. This is different from group learning, where students from a small or large group and learn from single instructors. Also, they learn from group dynamics, and ability of learning in group varies. Some students are better, more understanding some topics well than the other.

C. Student-Centric:

Student-centric teaching stylefocuses heavily on the individual student's academic need. This model work in a small group and teacher spent more time with his students. The knowledge that the students receive comes from the teacher and peer group.

D. Delegator

This technique relies on self-learning. Instructor provides a complex and challenging problem for students and they learn themselves as an individual or group. Group activities allow students to learn to work together to solve a complex problem. The teacher is there to provide guidance and support for students to resolve arising issues.

E. Facilitator

The last technique is similar to the present classroom technique. It is the student's responsibility himself read the book and complete material that is given in an outline format. The teacher usually gives alecture in the classroom, and only available for questions. Students work through their own read books, do library research to attempt to complete the material and pass tests that are given by instructor.

Every student has a different learning style, and teachers should vary their teaching methods to accommodate the students' learning habits. For students and teachers succeed, they both must learn to adapt to each other.

Current education and curriculum in the global world is changing rapidly in many dimensions. There is a big debate on online versus on-campus education and there is no clear consensus on this issue. The cost of education for students and their parents is becoming increasingly unaffordable. The competition from the world markets is forcing students to quickly adapt to new technology, tools and emerging applications. Countries like India and China are producing information technology (IT) professionals in masses and in a fast pace to quickly get them into the job market. Some of these professionals may not have a traditional IT degree, but they do perform well at work and cope with the changing environment. The international workforce is quickly replacing the domestic elites in the current IT industry.

There are tremendous commonality and repetition in many of the fields such as computer science, information

ISBN: 978-1-61804-238-5

systems, information technology and related areas in most countries. All these disciplines can be simply classified under a large umbrella referred to as a unified information technology (SPLIT).

The current educational world curriculum is changing rapidly. Online education, versus on campus is a big debate; there is no clear consensus on this issue. The cost of education for students and their parents become expensive day by day. Competition in the global market force students quickly adapts to new technologies, tools and applications. Countries like India and China to get them quickly to the job market experts in the public and high speed (IT) and information technology products. Some of these professionals have a degree existing IT may not be, but they also perform in the workplace does not deal with the changing environment. International personnel in the IT industry are rapidly replacing the national elite.

This computer science, information systems, information technology and related fields, such as in most countries have in common with a huge number of fields to be repeated. Simply integrate all these areas of information technology (Split-teaching) can be classified as a big umbrella, also known as.

The teaching approach that will be adopted in this curriculum would use different teachers drawn from academia, research and industry. It would consist of academicians, industry supervisors or domain experts and researchers. Another area is worth considering the idea of a new curriculum for the split-teaching. In the medical field, the four-year curriculum is divided into two parts, where students study for two years in the classroom and work for two years on rotations (hands-on) to select a specific field. Similarly, in some engineering disciplines, the curriculum uses a common curriculum for two years and 2-3 years to specialize in a given field. These models provide motivation to develop a curriculum for Split-teaching.

According to Roshan Bapna “if you see another, hear, feel, and most processed by the brain’s short-term memory, on-the-go. Only other again and again and again and fix whatever goes any long-term memory the initial learning decreases rapidly after. Sadly, psychologists have studied what the average 82% of students have proved forgotten... in the first 24 hours! Are you even studying what you do not remember the fifth means, and worse: after one month, you only have to remember most of the 5%.most of the students how to systematically modify the number of times (teacher / coaching of) does not teach, so many of their efforts are wasted” [11].

5 IMPLEMENTATION

This paper has two major objectives: First encouraging participation of students in STEM course, like computer information science by employing innovative pedagogy. Second is to conduct research to measure the effectiveness of split-teaching approach. This BP project will improve problem solving skills in CIS courses. It should be noted that we are proposing the absolutely novel phenomena, which is derived from the Split-protocol concept, and was invented during the PI’s doctoral dissertation in Information Technology. We are focusing on integrating the task delegation (Split-protocol) into pedagogy. A large number of minority students find computer science courses uninteresting and too challenging, and drop `Social Sciences. Hands-on activities of the project will result in a higher retention rate in CIS courses.

6 PLAN OF ACTIONS

Normally, universities offer multiple sections of general education courses. For example, undergraduate course, like CIS 101: Introduction to Computers. For our research, we will peak five sections including one online section, four sections will be taught by four different instructors and section number 5 will jointly teach by a group of these four instructors. All instructors will use same teaching materials and common test.

The course will be divided into four modules, module 1 will include three chapters from Microsoft Word 2010, module 2 will include three chapters in from Microsoft Excel 2010, and module 3 will include three chapters in from Microsoft PDF 2010, module 4 will include three chapters in from Microsoft Access 2010.

Each section will have 25 students, and divided into groups of five students.

Four students will participate in this project. One or two instructors (mentors) will work with each project. A research project on selected topics will be conducted throughout the summer period of ten weeks. If the topic is large enough, it may be continued on to the academic year. New topics will be chosen in each summer. Each student gets an opportunity to work with at least two mentors, and at least with one other student at the project site.

ISBN: 978-1-61804-238-5

Students will be given an opportunity to contribute to the project in a variety of ways based on their interest and skill set. They can conduct literature searches, come up with new ideas and hypotheses, develop architecture for a given project, write software in assembly or C level, test and verify the existing module, and analyze an existing module. However, during the summer each student must gain some hands-on experience for at least four weeks. Each student will be given an opportunity to present his/her work to other student and faculty on a monthly basis. Students will also be given an opportunity to participate in writing research papers and publications.

Students can choose their own topic from a pool of topics presented by faculty. They should write a small proposal and plan to conduct their research during the ten-week period. At the end of summer, each student will be given feedback by their mentors on their progress in the project. Students' research contributions will be acknowledged by co-authoring with faculty in their publications related to the work done in the summer.

Examples of possible undergraduate research projects are given in more detail. It is assumed that most students will initially have little or no knowledge of the research problem or area (other than a general idea about the topic and some computer science or information systems background that is typical for a major at the sophomore, junior level). While the specific approach to mentoring a student in the research project will depend on the individual mentor(s), the academic strengths of the student(s), and the nature of the project, the following five steps will be used as a general guideline:

Ground Classes

Teaching Methodology
Prof A - Chap 1- 3
Prof B Chap 4- 6
Prof C Chap 7 -9
Prof D Chap 10- 12
In addition, everybody teaches whole class
Assessment: The same Exam & Group Projects (with thesame Rubric) Hands on learning
Class of 20 = 5 students Group Leader
Delegation for Project (Each group / a group leader is assigned to a different instructor)

Online Classes

Pros and Cons:The proposed curriculum is novel and is not evolutionary in nature as such; it will face resistance in its implementation. It needs a strong collaboration between academia and industry. However, this collaboration will be hard to achieve as an industry is not in the business of educating students. The Split-teaching offers many benefits in spite of the above drawbacks. Students get a full education and training from a bottom-up approach along with hands-on experience and needed certificates. When a student graduates, he/she is ready for a real world job. Industry benefits immensely as they can hire students who don't need much training. The academic institutions can reduce their permanent faculty and overhead as supervisors and researchers take some of the teaching load in applied experience, research experience and certifications. Students will get better jobs in the industry, possibly with the companies they were already associated with during their education. Fundamentals or theoretical knowledge acquired by students will remain with students for long. The Split-teaching requires further research and pilot sites to understand and study the implementation issues.

7 CONCLUSION

This paper proposed a Split-teaching concept that has a broader impact on education. The Split-teaching approach is described in detail. Fourtypes of teaching models are presented to capture their concepts. Some sample examples of career tracks are illustrated to describe the new curriculum. The implementation issues and the pros and cons of this concept are outlined. The curriculum proposed here requires further research and demonstration through some pilot sites to demonstrate its feasibility.

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Education and Training projects of Apulian ICT LivingLab

Giovanna Avellis, Adriana Agrimi, Gaetano Grasso, Marco Di Ciano, Francesco Surico

Abstract— The Living Lab concept developed at MIT, Boston, Prof William Mitchell, MediaLab and School of Architecture and city planning, represents a research methodology for sensing, validating and refining complex solutions in multiple and evolving real life contexts [17]. Here, innovations, such as new services, products or application enhancements, are validated in empirical environments within specific regional contexts. Apulia region decided to foster this approach in Apulian ICT Livinglabs and the follow up programme LivingLab SMART PUGLIA 2020 to facilitate the growth and the development of Apulian SMEs specialized in the Information and Communications Technology (ICT) field, digital services and contents. The action Apulian ICT LivingLab aims to implement the open innovation paradigm, where end users co-design a solution to the user needs in collaboration with a SME and a research laboratory. This paper introduces the projects in Education and Training (E&T) domain of Apulian ICT Living Lab and reports the themes and the technologies developed to address the end user needs. It also underlines the more innovative and emerging technologies which can be put in place to satisfy such end users needs in advanced environments and paradigms in E&T.

***Keywords*—**livinglabs, social learning, robotics, augumented reality and virtual reality.

I. Introduction

THE Living Labs stimulate the social and organisational innovation as they transfer the Research & Development (R&D) from the close of the companies laboratories toward contexts of real life, where the citizens and the users become themselves "co-developers". This new approach is emerging in several productive situations at international levels as defined by the ENoLL network (European Network of Living Labs) [2] and allows the Small and Medium Enterprises (SMEs) in particular to create experimentation on the real scale in "pilot market", to advance the current prototypes and anticipate the problems in post-sale phase.

This work was supported in part by the Apiulian ICT Living Labs project.
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The projects in Education &Training domain of Apulian ICT Living Labs [3] share the LivingLab approach, that is a process which focus the attention on the end user's needs, expectations and needs with respect to the final product. The user is therefore placed at the center of each step of the development process in order to maximize the usability and the acceptance of the product, optimizing it around the needs of the users. As a result, the design methodology adopted in the E&T projects has mostly been the User Centred Design (UCD) methodology, that is a design philosophy characterized by a multi-level co-design and problem solving process which requires designers not only to analyse and foresee how the user utilize the final product, but also to test and validate at the same time their assumptions by taking into consideration the end user's behaviour during the usability and accessability tests (test of user-experience) into the real world. The UCD methodology arrives at the creation of the final product through an interactive process that provides the development of a first prototype and a following test and assessment stage on the basis of which to proceed with the development of the next prototype. Each cycle therefore leads to the creation of product that is closed to the real and practical needs of the users.

However, the core advantage of the Living Lab concept over traditional user-centric methodologies is its multi-contextual sphere in which product and service development and evaluation takes place.

One of the crucial aspects of the LivingLab approach [6] is the fact that the evaluation will be performed in the daily life context and that users are involved in all stages of R&D and all stages of the product development lifecycle, not just at the end phases as, for example, in more classical field trials or user testing of products. The foremost required element for the successful operation of a Living Lab is the participation not only of the potential customers but also of all other stakeholders along the value-chain.

A Living Lab needs to bring access to state-of-the art technology not of only one kind but often of competing technologies delivered through different business models, according to [19] .

The ability to interact with the users in his private environment is what distinguishes the Living Lab approach from other supplier-customer partnerships, or previously seen cross-disciplinary approaches.

The user experience focus involves areas of user interface design and ergonomics as well as user acceptance, extending to user co-design process, finally leading to service or product creation. Value is captured on an individual level as well as on

the organisation level. Emerging value distribution and changes of existing value chains are analysed. Culture and site specific features are identified when innovative applications are transferred across borders to different diverse contexts and cultures. Mass customisation models are planned in deployment and in European/global exploitation [21], the original concept is currently adapted to the information and communication technology area within the Apulian ICT LivingLabs.

Apulian ICT LivingLabs is an action of the FESR 2007-2013 of the Apulia Region, which allocated 15 ml of € of funding to Apulian SMEs to experiment innovative ICT solutions and prototypes of new products and services, through shared knowledge and exchange of researchers, enterprises and organized groups of citizens. The projects in Apulian ICT Living Labs concern eight domains of reference, as follows:

1) Environment
2) Education and Training
3) Cultural Heritage and Tourism
4) Creative Industry
5) Active aging and Health
6) Mobility and Transport
7) E-government
8) Energy

In the first and second call, the activated laboratories are thirty four, while the planned investments overcome 15,7 million of euro against 8,5 million of euro of public resources.

By adopting this methodology, the Apulian region provides the operative SMEs of the sector some financial instruments provided from the Programme FESR 2007-2013 Convergence Objective "We invest in your future" Axis 1 Line 1.4 Action 1.4.2 "Support the growth and development of SMEs specialized in the offer of contents and digital services".

The aim is to develop and exploit new products and services for the enterprises and families of the whole region. The project entrusted to InnovaPuglia for the execution, uses the thematic procedures of the management of the regional calls of the portal for the development and promotion of territory and enterprises "Sistema Puglia" is organized in two phases:

- Phase 1: Mapping of the End User Needs and Partner Catalogue of Living Lab
  We have published calls for the collection and catalogue of themes, needs and issues expressed by the end users. In the next phase, such issues can be used for experimentation for finding innovative solutions. Qualification of the end users and the research laboratories for building the experimentation for finding innovative solution is performed in the Partner Catalogue, where the interested bodies are included and are available to be involved in the second phase of experimentation.
- Phase 2 : Publication of a second Public notice to assign funding to the ICT enterprises, on the basis of the proposals presented together with the bodies selected from "Living Lab catalogue partner". Activation of the living labs of 12 months duration to start the experimentation of the identified prototyped solutions.

LIVING LABS SMARTPUGLIA2020 [1] is the follow up of Apulian ICT Living Lab and is framed in the building process of the Regional Strategy for the research and innovation based on Smart Specialisation for the programming cycle 2014-2020 with the objective to involve all the regional innovation system in the logic of the four helics, respectively:

1. Public Administrations
2. Enperprises
3. Research Centers
4. Citzens/Users

SMARTPUGLIA is a future vision proposal finalized to collective and progressive empower capability of dialogue and listening through an intelligent, inclusive and sustainable use of the technologies. LIVING LAB SMARTPUGLIA2020 intends to extend the experience of the first phase of the Apulian ICT Living Lab by involving the three main territorial reference systems in the process of building of a SMARTPUGLIA2020, that is the following:

1. The regional system of the Public Administration (PA) – also called SMART CITIES&COMMUNITIES
2. The regional system of the Knowledge – KNOWLEDGE COMMUNITY
3. The regional system of the economic and productive development – BUSINESS COMMUNITY

The projects SMARTPUGLIA2020 will encompasses three types of sectors, respectively:

1. Apulian SMEs developers of innovative digital solutions (the proposers)
2. End Users belonging to the three reference Communities (SMART COMMUNITY, KNOWLEDGE COMMUNITY, BUSINESS COMMUNITY) of the Partner Catalogue
3. Regional Research Laboratory of the partner Catalogue.

This paper reports a summary of the projects in Apulian ICT LivingLabs coming from the E&T domain. This domain has resulted very complex to perform users needs analysis because expressed users needs show several and different themes in fields that cover from the food education program to odontophobia, from the HW and SW infrastructure needs in the schools to the continuing education needs of ICT in Cultural Heritage [5].

Section 2 describes the projects of the whole E&T domain in Apulian ICT LivingLabs.

Section 3 summarizes the main aims of the projects currently under development of the LivingLabs SMART PUGLIA2020 in the E&T domain.

Conclusions suggests some clustering in Apulian LivingLab Education and LivingLabs SMART PUGLIA 2020, which is going to be submitted to ENoLL.

II. E&T Projects in Aplulian ICT Living labs

A. SPLASH (SMART PLATFORM for LEARNING and ACTIVE SOCIAL HABITAT)

The project [23] facilitates education and training paths in the school and enhances their effectiveness by developing a combination of disciplinary and transdisciplinary approaches,

class, individual and network with full integration and development of ICT technologies. Through research, participatory design and experimental development, the realization of an enabling platform for the Social Learning has been achieved, for the use of schools (teachers, students, families, experts) and that meets the following requirements :
a. web platform flexible, integrated, social, open source, for the implementation of the process of teaching and training of the students, teachers and schools, and for its integration with the classroom activities;
b . e-library of self-produced content;
c . e-portfolio, with services for the certification of skills, and the acquisition of credits
d. services for students with SLD (specific learning disabilities)
e. integration with platforms market-place for the socialization of the products.
In this context, ICT tools can help to support the construction and management of a hyper -dimensional space of knowledge, access "intelligent" content authorship and authenticated by the experts, the creation of individual paths in the acquisition of knowledge and skills, enhancing aptitudes and potential of individuals, participation and sharing of the users, with the aim of a continuous development of the instrument, as well as the definition of a social model for the aggregation and authentication of multimedia content, which includes open content can be acquired from the Web.

B. EDIL_LEARNING (EDIL-LEARNING PER LA FORMAZIONE NEL SETTORE EDILE)

EDIL_LEARNING [8] is an open source social learning platform able to support training in the building industrial sector, besides the schools. The solution consists of modular and integrated functionalities in order to support formal and informal, individual and social learning processes.
Throughout the development project co-design methodology has been adopted, involving partners (i.e. Building schools, ...) and customers in the design of the platform. Focus groups and permanent panels / forums have been activated with consumers, in order to test the system with a wide audience and, therefore, to get qualitative and quantitative feedbacks about the product in terms of:

- adequacy and completeness of its functional and non-functional specifications;
- correctness of the application logic that will be implemented;

level of user satisfaction that can be reached by the solution.

C. ROBIN (ROBot Interaction system for visuo-spatial data presentation for effective learning)

The adoption of robotics technology to address the dydlexic children educational issues is the focus of the ROBIN project [20]. It includes a platform of Learning Management System interfaced with tablets, PC, Smartphone and robotic multimedial systems for personalized learning and the production of educational ad hoc contents, for students with specific disabilities, such as dyslexic which involves the 4-5% of the school population, on average every class of 20 students. The kit produced in this cluster will include an anthropomorphic robot which interface itself with several hardware systems such as tablets , Pc and Noteboks and a LMS platform hosted in a remote server connected via Internet. The hardware systems will have a constant dialogue with the server which will contain all the educational contents and will register all the progresses made by the students during the execution. The server, furthermore, will allow the communication and sharing of information among the several actors involved: the teachers and pedagogists can have data on the effectiveness and use of the different didactic modules, the parents on the competence level and progresses made by their children, the public administrations on the activities developed by the schools and the obtained results.

The some anthropomorphic robot and hardware systems tablet PC and Notebooks, as technological aids for children in the school and pre-school age, affected by the troubles of the autistic spectrum are included in this cluster. Instrument for the educational and rehabilitative activities will play as a mean of socialization, reducing the stress introduced by the emotional inferences. The system will operate as domestic tool allowing the educator to operate in teleworking, assisted by a parent.

D. INRL

The project [17] investigates the web3.0 and new media tools, such as augumented reality and informal learning which become a dominant aspect in the evolution of e-learning from the past virtual learning environments, based on the use of LMS/LCMS, with more communicative and flexible personal learning environments. These are user-centred environments supporting informal learning, derived from the resources that can be founded and produced on the web, and formal learning based on well defined schemes of elearning platforms. It also manages the development, testing and integration of specific training modules within elearning platforms already in the market, or “pills interactive/experiential” which allow users to know, using interactive technologies-cognitive and smart (3D augumented reality and interaction) the concept of learning by interacting and remote collaborative learning. AN interactive area is dedicated to students and teachers and is the real innovation of the project. It is an immersive virtual space where there are proposed new interactive learning modules, in order to stimulate in the user a high understanding of the content. This area, in line with most modern learning theories, promotes the development of training activities through the integration of learning-interaction-experimentation–game modes. The advantage of the recreational-experiential approach, measured in terms of involvement and the motivation of the learner reduce the amount of time for learning.

E. EP_LAB

The virtual reality and the augumented reality do not intend to substitute the sensorial experience on the field, but can amplify the possibilities of experimentation and the accessability to different types of users. In the didactic field the virtual applications allow the teacher and the students to

jointly participate to the creation of the knowledge. The student should directly experiment to know a cognitive field, that is this theory are parts of the recent applications of Embodied Cognition. The virtual reality and the augumented reality try to reproduce the primary conditions of the cognitive behaviour, the perceptive-motorio behaviour. Frtom here the need to experiment new tools for interaction, which allows the integration of new learning objects in the didactic models from one side, and the experimentation of new technological prototypes with the aim to augument a laboratory context inside a didactic context. Through the integration between theory and critics, research and experimentation, continuous interaction among students, teachers, enterprices and research, trhe main objective of the EP_LAB [9] project is a prototype of GiS based mobile application, which makes use of Augumented Reality and Virtual Reality to define a new paradigm of laboratory and didactic education, but at the same time a versatile platform to be used by the network of museums of the University of Salento.

F. AGRIPOINTER

Apulia region has some rural areas where there is space for agricultural production and traditional food products development. To help to achieve this goal the project [1] aims to introduce a new integrated technological system that will help all involved parts. The system supports all steps of the agricultural activities that are currently recorded in "farm books" and other law enforced books. The farmer will record all activities and their progress that should be recorded to comply with law requirements. Furthermore, agricultural engineers will be able to access the system remotely and provide feedback and consultancy using the information recorded. They will be able to follow treatment progress and activities (i.e. fertilizer selection). The system will allow the generation of reports to comply with law certification on farm products origin. This is quite important for tracking down organic and non organic food production chain. An important feature of the project is to support farming of regional raw products. Another, as important, is to sustain and promote post-processing of the harvested material in order to produce high quality traditional products such as olive oil, wine etc.

III. SUMMARY OF E&T PROJECTS IN LIVINGLABS SMART PUGLIA 2020

The project [7] approved in the Call LivingLabs SMART PUGLIA 2020 encompasses an integrated platform for the digital identity recognition of the student and teacher, the use of WIFI networks, the publication of multimedia and elearning contents, the electronic registry management, and the social interaction with all the actors involved in the learning and training process. Further, [11] includes a technological platform for the schools, which provides integrated administrative and didactic services to the school, realised by an open philosophy responding to transparent and accessible criteria, to the norms of the Digital Administration, of personal data protection and administrative simplification, as well as the most innovative principles of school training.

Finally, the project [16] fosters an innovative method of e-learning to experiment means, and innovative and effective methods of orienteering and promotion of positive role models of women in the research field, in the technology and start up creation. The system will provide a profiling action where the analysis of the personal characteristics of the user is performed, e behaviour recording action, where the behaviour during the execution of the learning process is encoded, a planning action, where the structure, visualisation, recounting and re-planning the didactic sequences is implemented. The semantic analysis of the flow diagram of the learning maps and the knowledge activities, associated to the social network (or scanning action) will complete the didactic paths.

The robotics technology introduced by ROBIN will be applied to another user's needs, namely the dyslexic children in [4] which involves 1 child over 100 born children and represents the type of most characteristic generalised pervasive problems of children development. Such a children, although present a lot of functional deficits, often are able to use in a surprising way the new technologies, such as computers, MP3, electronic games, all instruments used at home and sometimes at school. The aim of ASTRO (Autism Support Therapy by RObot Interaction) is a product as technological help to children in school or pre-school age affected by dyslexia, which can be used as an instruments for educational and rehabilitation activity. This will be achieved by extending the functionality of the LMS OMNIALEARN with an anthropomorphic robot and hardware systems such as PC and tablets.

The most innovative project [2] is based on the paradigm of adaptive learning, ….

IV. CONCLUSIONS

Living Labs have thus shown the ability to mould the opportunities offered by new ICT to the specific needs and aspirations of local contexts, cultures, and innovation potentials [14], [18]. This approach is shaping the agenda of Regional Policy and Territorial Cooperation for 2014-2020, but also HORIZON2020 and the "Smart Specialisation" conditionality requirement, engaging all EU regions. The Living Labs gives the schools the opportunity to overcome the traditional concept of classroom, to create a learning space open to the world, in which to realise a smart, sustainable and inclusive growth, that is Europe 2020 [12], and Innovation Union [European Commission, 2010], which sets out an integrated and strategic approach exploiting and leveraging Europe strengths in new and productive ways. In Europe 13, the potential and opportunities generated by a Public-Private-People Partnership from ENOLL shifted the scope of Living Labs from pure academic experiences to regional or national innovation systems [15].

Opportunity of economic, social and cultural development in all Europe, the LivingLabs are about 227 which stimulate the innovation, transferring the research from the laboratories to the real life, where the citizens and the users themselves become "co-developers".

The model Apulian ICT Living Lab has been conceived as an "open ecosystem" where the user actively participate to the research and experimentation process of innovative solutions, devised through the use of the ICT. To generate a continuous process of active participation of the socio-economic system for the analysis definition of the territorial context and the design of the European Digital Agenda 2020, it was established to make it open the public consultation on the Phase 1 until 31/12/2015 of the users needs and the Phase 2 of the public catalogue of the bodies which can experiment innovative solutions following the Living Lab approach.
The project encompasses the building of a partnership consisting at least of three bodies localized or with head office in Apulia Region one for each of three categories as follows:

1. Research Laboratories – Universities, Public Research Bodies, ENEA, Laboratory networks

Promoted by the Research Agreement of CIPE 35/2005 Programme Framework, technological districts recognised by the MIUR, Research Centers enrolled in MIUR

2. Public Bodies and Associations – Public Bodies (Commons, Provinces, ASL, Training Institutes, ecc.) of the regional social-economic system represented by entities active in one or more reference domains. Associations and bodies representing collective bodies, production districts and unions.
3. ICT enterprises – SMEs operating in the sector of ICT (development, production and/or integration of software and hardware, micro and nano systems, sensor systems, electric and electronical mechanical devises, transmission systems, information management, etc.).

To address the user's needs in [5] we formulated two clusters of livinglabs that have been funded in Apulian ICT LivingLab project and in LivingLab SMARTPUGLAI 2020: together they will constitute the Apulian Livinglabs Education. The clusters are based on the same technology, theme, and end users. Namely, they are the Innovative Learning cluster and the New Media and Robotics cluster, where in Innovative Learning cluster we address the social learning and adaptive learning paradigms and in the New Media and Robotics cluster we address the Augumented and Virtual Reality environments and robotics multimedia technologies. To the first cluster belong the livinglabs S.P.L.A.S.H. [23] and EDIL_LEARNING [8] addressing the social learning issue, SCUOLA APERTA [22], CLIOedu2.0 [7], and ICT and ELEARNING [16] addressing the School 2.0 issues, and ALL [2]addressing the Adaptive Learning issue. To the second cluster belong the livinglabs ROBIN (ROBot Interaction system for visuo-spatial data presentation for effective learning) ASTRO [4], EP_LAB [9] and INRL [17] addressing the augumented reality and virtual reality technology, ROBIN and ASTRO referring to the same robotic technology but addressing two different types of end users such as dyslexic and autistic children.

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ACKNOWLEDGMENT

Authors thanks all the partners of the E&T projects in Apulian ICT Living Labs and LivingLabs SMART PUGLIA 2020. This work has been funded by Apulia Region, Area Politiche per lo Sviluppo, il Lavoro e l'Innovazione, Servizio di Ricerca Industriale e Innovazione, Ufficio servizi die Government e ICT and realized in collaboration with InnovaPuglia, under P.O. FESR PUGLIA 2007-2013 – Asse 1 – Linea di Intervento 1.4 A zione 1.4.2 – Investiamo nel vostro futuro, Supporto alla crescita e allo sviluppo di PMI specializzate nell'offerta di contenuti e servizi digitali Apulian ICT Living Labs – Verso Puglia Digitale 2020.

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Planning new teaching experiences in collaboration with relief generations

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***Abstract*—** This work presents the preliminary planning of activities and reflections on the teaching collaboration between lecturers with experience of over ten years and relief generations. The proposed project has been carried out by a group of lecturers from the Department of Chemical and Environmental Engineering of the University of the Basque Country (UPV/EHU) and will take place during the academic year 2014/2015.

The experience of the participating lecturers shows the full agreement in that the collaboration between lecturers involves the optimization of the teaching staff resources and a great implication in the tasks to perform. The mistakes clearly identified and analyzed with respect can always be rectified

***Keywords*—** Intergenerational, teaching Chemical Engineering, technical education.

I. INTRODUCTION

THE Bologna Declaration (1999) encourages European co-operation in the quality assurance of higher education with a view to developing comparable criteria and methodologies. Other important goals agreed in Bologna are readily comparable degrees, a system based on two main degree cycles (a third cycle has subsequently been included), a common European system of credits and the mobility of students and teachers.

Although the implementation of the Bologna Process needs to be consolidated and built on progress, budgets for higher education have been cut in almost all European countries since 2008, with the most severe being up to fifty percent. In the face of the current financial and economic crisis, a solution that many institutions have turned to involves heavily subscribed courses, as a way of adjusting to budgetary constraints and reduced staffing.

The authors are members of the department of Chemical and Environmental Engineering at the University of the Basque Country UPV/EHU. Their teaching experience as a group involves three subjects (namely Biotechnology, Chemistry and Chemical Technology) studied within the degree programmes in Environmental Engineering, Industrial Technology Engineering, Industrial Management, Engineering, Mechanical, Electrical and Electronic Engineering. They have actively participated in projects on pedagogical innovation resources during the last 5 years.

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Regarding teaching staff resources, collaboration between novice and veteran teachers is essential for successful teaching. Although teaching refers to the process of imparting knowledge and skills from an instructor to a learner, it is a profession based on collaboration where new generations of teachers are important actors in the process of educational innovation

This document gathers together the reflections of a group of lecturers previous to the development of a novel experience based on the intergenerational teaching.

The technical teaching, aimed at a large number of students from various groups, represents a great challenge, both for the experienced and junior faculty, in maintaining the continued interest of students.

Regarding the training of junior faculty, the publication of Zeichner (1988) [1], who applies a specific program for novice lecturers in universities, is well-known. Similarly, Slavin, R. E. (2012) [2] proposes some strategies for training junior faculty, always based on the experience of expert lecturers.

The purpose of this project is to join the baggage that experienced lecturers have and the new energy and training provided by the junior faculty, in such a way that the "symbiotic" relationship between the two generations results in an enrichment of the teaching activity in both directions.

This junior faculty, that often has even been student of one of the experienced lecturers, has knowledge and experiences that the practicing lecturer does not know.

On the other hand, expert lecturers have tools and teaching strategies that novice lecturers may not know or do not know how to implement.

Therefore, the aim is to achieve an exchange of knowledge and views between generations which, undoubtedly, will conclude in the continuous improvement of the university teaching faculty of both generations.

It is desirable that all lecturers develop the task with interest along the course. With this objective in mind, this group of lecturers has conducted a series of meetings that the present work intends to convey.

The steps carried out before the approach of the project were as follows:

ISBN: 978-1-61804-238-5

I. Sensitization and identification of the work environment.

II. Contributions of experiences on key issues of the teaching to impart.

III. Reflection on mistakes and successes in everyday own teaching.

Fig. 1 Pooling previous to the project approach

In the work planning, it is important to note that in many cases the same subject is taught in different degrees, aspect to be considered in all approaches. This pre-project phase has tried to promote positive attitudes and values, as well as attitudes of personal and interpersonal growth with colleagues. In addition, we have tried to know the expectations that the group members have to perform the activity, the challenges that may arise, etc.

From this first meeting the interest in the project was confirmed, always aiming the relative improvement with respect not only to students, but also to the lecturers who must carry out their activity in a safe and convenient way, and with continuous improvements which, in this case, will be conducted in collaboration with young and experienced colleagues of the teaching area.

It was proposed to omit in the communications and regular meetings the frequent complaints sentences concerning the level of students coming to the taught subjects. The general intention was to make a constructive criticism that enables to work on aspects that have been considered weak: act, grow and improve.

Merge training to the development of the profession is not a recent phenomenon. We want the formation to look like a constant learning, bringing it to the development of professional activities and to the professional practice.

II. CO-TEACHING PROJECT

The development of the teaching in multi-group subjects has focused efforts in general to get agreements of the lecturers both in the program to teach and in the evaluation of the subjects.

There are more aspects that can be enhanced by the collaboration between lecturers, especially if there are different generations of lecturers who can bring different views. The proposed project is dedicated to all of them.

After the pooling of the first ideas, the proposed stages were as follows:

I. Contributions of lecturers. Pooling with colleagues external to the working group. External advice if necessary.
II. Teaching environment. Key issues in the degree of implementation.
III. Support seminars and reflection on mistakes and successes of everyday teaching practice.
IV. Exchange of experience and comprehensive analysis of teaching situations.
V. Preparation of diaries of the new teaching activities.
VI. Monitoring activities in real situations. Simulation of teaching situations. Collaborative analysis. Decision making.
VII. Dissemination of the experience in the UPV/EHU University and in expert forums.

The activity to be performed in the first year of development will demand the lecturers for an effort in the time of dedication. It will be necessary to make regular meetings to discuss advances and problems, and to promote dynamically supervised activities related to classroom programming, student body teaching and their evaluation.

Moreover, a series of specific objectives of the activity to be performed are proposed:

- To complete the faculty training process constituting a constant learning.
- To transmit institutional values in order to ensure the identification with the mission and vision of the UPV/EHU University ***Eman ta zabal zazu (Give and spread it)***.
- To incorporate new resources to the faculty of the University, already existing in their lecturers, but proved to be underutilized.

III. CHARACTERISTICS OF THE TEACHING STAFF COMPONENTS

The faculty components must have some basic characteristics that favor the development of the project. It is assumed that they have the theoretical and practical aspects of the specific skills of the subject to be taught. It will be very helpful to have already taught at least 1 year the subject to which the experience will be applied.

It is also important to have experience in implementing effective solutions to learning problems, with the knowledge of methods, materials and strategies that result in feasible solutions. They must have the ability to critically analyze learning problems with possible current solutions.

Lecturers must be willing to review the methods, materials and strategies of their teaching plan, being willing to receive feedback and be criticized, always constructively. It is of great interest in technical education that lecturers promote the interrelationship between theory and reality, the rigorous systematization in the acquisition and processing of data, as well as in the defense of arguments to set out conclusions.

Furthermore, in the field of technical education it is important that lecturers keep in mind that the educational activity always takes awareness about social issues. All these attitudes are focused on keeping the students in direct contact with the current situation, maintaining their interest in the subject and with direct interaction of the faculty involved.

Lecturers must promote respect to encourage learning,

ISBN: 978-1-61804-238-5

performance and professional fulfillment in colleagues and students. Teamwork based on mutual respect and valuing diversity and pluralism will be promoted. The faculty must be willing to participate in activities with students, acting with patience, acceptance, openness and harmony.

Finally, participants are expected to increase their levels of commitment to the project according to items requirement.

IV. SOME INDIVIDUAL BENEFITS EXPECTED TO BE OBTAINED

The benefits expected from this experience arise from the modification of attitudes and skills acquired by students. This project is specially devoted to the pedagogic improvement of medium-sized groups and to the use of teaching techniques of direct and personal interaction between lecturer and students.

Examples of specific skills we expect the participant lecturer (Slavin, R. E. (2012)) to modify after the project are as follows:

- Ability to increase students' motivation. This involves improving the previous sensitization of students in relation to the topic, indicating the objective pursued and stimulating students' abilities, so as to engage them fully in the teaching-learning process.
- Ability to stimulate student participation in the teaching-learning process. For example, confirming and congratulating students who demonstrate mastery of the raised learning and guiding them in case of detecting errors.
- Ability to monitor comprehension. This is improved by increasing the sensitivity of the lecturer in relation to students' reactions.
- Ability to promote a better group intercommunication. With that aim, for instance, the lecturer can link sequences of questions, placing appropriately complex and discriminatory questions.
- Ability to improve the transfer and retention of information. To do this, the lecturer can use images and appropriate examples, which implies that the lecturer dominates techniques to expose the matter and he or she is able to achieve a programmed reiteration of the subject.
- Ability to vary the stimuli. This implies, among others, the ability to diversify the intellectual participation of students by the lecturer's movements, gesticulation, the use of emphatic exclamations, avoiding monologues and changing sensory channels for the transfer of information.
- Ability to resort to silence and non-verbal communication. This involves the capability to allow students to reflect on what has been said and, at the same time, avoid the teacher to continually intervene in the discussion.
- Ability to make a recapitulation and an integration of knowledge transferred to students. This does not consist in a quick review of what has been seen in a session, but the ability to make a synthesis of the essential and to establish a cognitive link between the old and the new knowledge, also to encourage students to conduct themselves this integration.

Among all the tasks involved in the project we must consider that many stages are cyclical and linked together. Thus, after the pre-diagnosis it is very important to be aware of the imperfections, their implementation and the formative assessment to overcome the identified shortcomings.

V. CONCLUSION

At this time, we are not in a position to include conclusions, but intentions. The project is being planned and will be held in the next academic year. We can state that the approach has helped us to reflect on our teaching activity and, what is more important, on the interest of continuous improvement and interaction between lecturers from different generations, which will affect the students in our charge.

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Virtual Learning and Experimental Environment as an Innovative Strategy of Technical Education

Artur Rogach

This article gives a description how virtual learning and experimental environment can help to create a new learning strategy. The main criterion of the new strategy is the results of research and management of real physical phenomena in order to receive data and make their further processing, to test the hypothesis.

Keywords— labview, google api, virtual learning.

I. INTRODUCTION

Nowadays modern society challenges in higher engineering education's area, processes of informatization, creation of virtual learning environments directs to revalue the importance of creating the special conditions, hardware and software tools for training students of engineering speciality.

It should be noted that researchers do not practically concentrate attention on the qualitative differences between virtual learning environments (VLE) of humanitarian and technical directions when they try to define them. Thus, in the definition "Virtual Learning Environment" (VLE) established by University of Oxford, it is indicated that VLE is a system for providing educational materials for students via the Internet, which includes knowledge evaluation tools, monitoring of student's activity, collaboration and communication tools. It allows organizing both traditional full-time instruction and teaching the one who cannot regularly attend campus because of geographical, temporal or physical limitations[1].

A more general definition can be found in the tutorial of Moscow State Regional University [2]: "Virtual learning environment is the information content and communication potentialities of local, corporate and global computer networks which are formed and used for educational purposes by all participants in the educational process".

On the 25th of April in 2013 the Ministry of Education and Science of Ukraine approved the "Regulations of distance education (DE)", where the concept VLE is absent at all. Instead of this separate functional elements of the educational process such as distance courses (DC), information and communications technology (ICT), remote learning management system (LMS), trainers and laboratories without their systemic interconnection are used. It should be understood that in the regulation instead of VLE the concept "Web-environment of distance education (DE)" as a systematic organized block of discipline's (curriculum's) Web resources, software (SW) of Web resources' management, means of interaction between DE's individuals and DE management is used [3].

As we should understand from the approved regulation of DE, virtual labs and virtual trainers along of methodological recommendations concerning their implementation and application refer to the systems engineering software of DE in this case. However, in sub-section 3.6 it is emphasized that laboratory lesson can be conducted in specially equipped educational labs or remotely using appropriate virtual trainers and labs. The logical question about target audience of such educational form and its organization is arisen. During conducting intramural laboratory lesson education is transformed from distance into compound one. Such sections of the population as persons with disabilities, the individuals with temporary or permanent spatial and time restrictions of access to full-time participation in the educational process drop out of the proposed knowledge acquisition scheme.

Such disputed paragraphs of regulation are connected with the fact that today the development of laboratory practical works with remote access based on modern hard- and software remain the most undeveloped area DE for students of engineering speciality in Ukraine. Such area stands in need of work out own concept and of considerable intellectual and property expenses.

Therefore, we propose the concept of virtual learning and experimental environment (VLEE) as an innovative strategy for the DE development of future engineers. VLEE is Web-oriented system of organization and management of DE engineering specialty students. Such system consists of special structure and content DE, system of remote knowledge diagnosis based on specialized algorithms and methods, virtual laboratory works of remote access for control the real technological objects or their stand models using modern hardware, web-oriented computerized training complexes and virtual laboratory classrooms.

Probably, none of experienced teacher and engineer has any doubts that the laboratory works play an important role in science and world's cognition [4]. The same statement concerns to the laboratory stands and installations. Everyone knows that the laboratory stand or installation must represent an objective and adequate model of the real engineering object or system, but in the simplified form. It depends on the circumstances it is not always possible to provide appropriate equipment for each laboratory. "All right, but we can" – you may say about your university, but in return I being the student of Ivano-Frankivsk National Technical University

ISBN: 978-1-61804-238-5

of Oil and Gas (IFNTUOG) conducted experimental investigations and laboratory assignments using equipment what had been produced in Soviet Union days. The next question arises: Can the future engineer gain professional competitive knowledge and skills, studying at the outdated equipment and then work on modern production and operate hard-and software complexes, which are not similar "visually and physically" to their previous versions at all? Somebody will say that it is possible. The sceptics will say it is impossible. How can we solve such problem? Of course, there are people who learn very quickly and they will not have any problems during adaptation at the beginning of their professional activities. In many cases, managers of modern enterprises in various branches of industry accuse the Ukrainian higher education institutes of low standard of future specialists – engineers' education, considerable gaps between often completely theoretical and fundamental knowledge gained by students and those one which they need during performance of professional duties at high level.

At the Department of Computer Technologies of Control Systems and Automatics (CTCSA) of IFNTUOG the laboratory of modeling and simulation of mechatronic systems is created by joint efforts of students, masters, postgraduates and teachers what now is under implementation in the educational process. Currently laboratory stands what are designed on the basis of social constructivism philosophy using the available materials, hardware and software tools consist of the following operating blocks: three-axis machine with computer numerical control(CNC), dual-axis plotter, thermodynamic object with distributed parameters in the form of air warming room, models of united industrial tank's control systems at lower and upper levels, pressurized receiver's automatic control system. To my mind, only functional defect of laboratory stands is the complexity of organization their control process remotely, that is transferring them into the category of web-oriented laboratory practical works or in other words laboratory practical works of remote access (LPWRA) [5].

From practical viewpoint, the teachers and students use the plotter and machine with computer numerical control to examine the working conditions and control algorithms of the step motors, their drivers and settings of appropriate software.

The only thing what trouble me is that during experimental studies the students who want to set up and test the laboratory stands could get them into not working trim as they don't read the documentation. To prove my words, I want to add the comment about the conditions of computer equipment what is located in the laboratory. Only 4personal computers (PC) out of 10 are in working conditions. The rest of computers are physically and morally outdated one and are not able to gather, process and store experimental data flows which are required for the correct operation of laboratory equipment. Due to this situation, I as postgraduate and research, don't have other alternatives, except the one. The practical and scientific assignment is arisen – organize the distributed control of all laboratory stands via one workstation (PC). We should "mark" such workstation as "central server of laboratory equipment".

You may ask the next: "What will happen? Will the students forced to line up in order to work at this computer?" Yes, you are absolutely right, but there is the logical conclusion of it. This server should open the access to the Internet. It is the solution of all problems. Is it not economically – "One computer – a lot of stands"? Is it not practically?

Thusly, we have the central server, laboratory equipment (i.e. stands), but only those which are guided by the computer, in other words, all experimental data, calculations of characteristics, oscillograms are reflected on the computer monitor. What is the next action? PC can operate in asynchronous mode during remote execution of laboratory works by a group of the students at once. Moreover, group size depends on the central server's configuration.

There are obvious advantages in such educational process organization: the student will not have the direct contact with laboratory equipment what will maintain its appearance, functionality and integrity. You may say: "This is not education. The student should touch the rig and others". I am of the other opinion. Have you ever seen the master touches the executive elements during cruise or the crane operator looks at the engine turns during materials load? This is the whole point of automatic control. The operator sets the input control operation on the technological object or dynamic system after what receives the feedback – the response of such action. In my case, the student connects up the server has the opportunity to select the appropriate laboratory stand, give the control operation on it, receive output responses and analyze them, compose the mathematical models of the object or system, test hypotheses. The skeptics will be indignant again. What about visual contact with the process? We find the solution – stream video that is webcams directly connected to laboratory equipment as well as sensors.

So, we have complete project (LPWRA). On the computer monitor you can watch stream video where control process dynamics, figures of real sensors and control buttons are also represented here. In addition, PC accumulates the experimental research data for further processing and making decision. The range of such LPWRA's potentialities stints of the list of mentioned tasks and reflected services. In such approach, the future engineers can feel like the real operators of real technological equipment, analyzing the sensors indices, changing the control algorithms and performing appropriate actions to ensure the normal operation of the equipment what their training consists of [4].

To carry on the above, we can raise the issue what software we can use to use to ensure the central server's operation. You can see that this issue provoke the wide range of discussions [6]. I would like to bring the solution of this problem. We have selected the software environment developed by famous engineering process automation corporation National Instruments – LabView as the main one. This software belongs to the class of object-oriented one what uses drag-and-drop technology and has the clear user interface, simple settings and wide range of operations. Another important advantage of the LabView environment is the ability to design the virtual laboratory instruments (VI) via maximum adaptation to experimental studies and user needs.

However, in our case the most valuable thing is the possibility of Web service organization. This service allows receiving output data from industrial and bench equipment and transferring them to the internal Web server in any shape. Do not confuse Web service with the Web publishing tool service. The last one transmits the complete picture of the virtual device's window (in this case the picture of the operator's panel) what do not meet the transmission speed requirements and traffic. A lot of information about the technology of

creation and using VI of LabView environment and the basic elements of such software is available on the Internet. There is no need to describe them as we only discuss the service what could help to organize the remote control of the laboratory instruments with the optimal use of resources.

Thus, we can configure Web service when we develop the program of control the variables of laboratory stand's state. These variables need to be monitored and controlled. As the main options, we need specify services name and connection port(it is advisable to choose the one that is not occupied by another process because it can lead to unnecessary conflicts). We should specify in what form the data will be transmitted – the best one will be in the JSON format. To logical opinion, it is better to register the control variables via separate VI what give the potentialities of synchronous specifying different control operations on control object. This program will automatically create the URL-marking map of VI according to the variables what are connected to the connector's icon. URL-marking is an address at which the experimental data variables will be available (http://your_server:port/webservice_name/variable). To pass to the appointed address, you will receive a response in the form of JSON: {"variable", "value"}. We could find not only one variable but also a set of variables at the appointed address. In this case the variables will be displayed in the form of array: {"variable1":"value1"};{"variable2":"value2"}; {"variable3":"value3"}. To initialize the variable we need to insert the next address at browser: http://your_server:port/webservice_name/variable/value). The server will return an error if the query and value's type are incorrect. We could set the range of variable's value at the application of VI organization what propose the user friendliness and safety during the experiments.

Now let have a word about the research process visualization as it is boringly to work with "bare" figures. The Google service have such option on a cost-free basis. It concerns only to the graphs, tables and diagrams (Figure 1). We could set the control buttons of laboratory equipment and its structure at the cascading style sheets (.css) as we only work via the browser and the Internet (in other words remotely) and the user does not need to set up the additional software and modules).

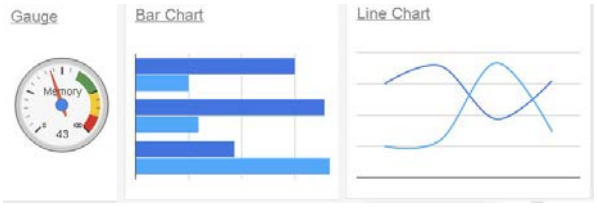

Fig. 1 google chart gallery

Having such free visualization possibilities, at the browser's window we could create the identical operator's panel what includes all windows and bottoms, the analysers and indicators of control process of real laboratory equipment.

The requests to the correspondentinitial variable's values are sentvia browser using javascript. The simple query code is below:

```
function Requestdata(){
  var xmlhttp;

  if (window.XMLHttpRequest){xmlhttp=new XMLHttpRequest()}
  else {xmlhttp=new ActiveXObject("Microsoft.XMLHTTP")}

  xmlhttp.onreadystatechange = function() {
      if (xmlhttp.readyState == 4 && xmlhttp.status == 200) {
          var data = JSON.parse(xmlhttp.responseText);
          Load(data)
      } else {}
  };
  xmlhttp.open('GET','http://192.168.0.1:80/web/abi',true);
  xmlhttp.send(null);
   }
```

After setting up laboratory equipment, developing the software and organizing the queries by means of CSS full value operator-researcher's panel is developed. Using such panel, we could remotely control the laboratory equipment what includes the direct video stream and sensor's indices monitoring. At figure 2the operator's panel for controlling the process of air heating in the pressurized camera with distributed parameters when taking into consideration the external dynamical disturbances is represented.

Herewith the browser download analysis is maximum 40 MB, which indicates about the optimized data collection process, professionally generated queries and after-sales service of task. With these parameters of data transmission and collection we can perform such remote laboratory work using the mobile device like smartphone. Moreover, we can use such technology as during learning process of future engineering personnel's training so during technological objects' controlling at any branch of industry.

Today, the prototype of remote access laboratory what uses the hard- and software developed by themselves and by well-known international companies at the automation field like Siemens Simatic and National Instruments is developed in the form of the training site WebLab (Figure 3). This environment includes the separate LPWRA, educational elements of the disciplines "Theory of automatic", "Recognition and Identification of objects", "Modeling and Simulation of Mechatronic Systems".

During the connection to this laboratory, the environment of learning process control LMS Moodle and the opportunities of WEB 2.0 services, we can design, practically implement and attract to the remote education the students of engineering specialties VLEE what based on the innovative strategies and new approaches to its organization.

Figure 2–The view of the operator's panel at the browser

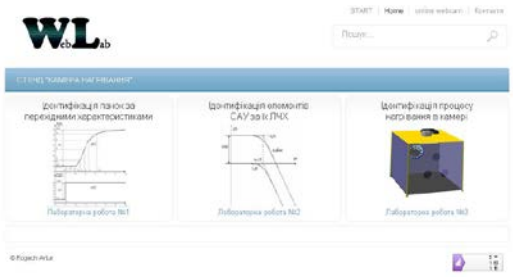

Figure 3–The main page of remote laboratory

II. CONCLUSION

Taking into consideration the complex crisis phenomena at the field of higher engineering education in Ukraine, the proposed approach to the organization of professional education (including the remote form) of the students of engineering specialties should be considered as the forecast way to overcome the qualitative gap between theoretical and practical knowledge of young professionals, the ability of their quickly professional adaptation, to overcome the skepticism and distrust to the DE methods and algorithms at the field of engineering education and possibility of laboratory equipment's modernization at the Ukrainian universities.

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Interactive and online methods of forming civic competence of students

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I.G. Dolinina

Abstract. Formation of civic competence of students is viewed as very urgent phenomena in modern Russia. The research is devoted to the innovation way of solving this problem-using the network of teachers' association «The Commonwealth» (Perm region, Russia) and applying the organizational - pedagogical conditions in order to upgrade the level of the civic competence of students.

Keywords. Association «The Commonwealth» • civic competence • network.

I.INTRODUCTION

In our research we develop the idea about the upgrading the level of civic competence of students using the model of networking. According to our practical activities we have also found that the model will be effective only if we create the specific organizational and pedagogical conditions.

We identify a set of necessary organizational - pedagogical conditions as methods contributing to the formation of civic competence of students. Organizational and pedagogical conditions of formation of civic competence are the practical side of the educational process, i.e. the determined forms and methods of education [1].

These are the pedagogical conditions that are created in networking model of the teachers' Association «The Commonwealth»:

- a system of forms and methods for facilitating the formation of civic competence of students;
- features of the educational institutions' relationship that promote the development of civic position;
- attracting foreign language and language environment for the creation of a more effective understanding and acceptance of another culture;
- Carrying out diagnosis and correction of educational activities.

Let us now consider each method separately.

II.OLYMPIADS

One of the most interesting pedagogical forms is the Olympiads. The purpose of competition «Citizen of the World», «I am a Russian patriot», «Kungur - My Homeland» - to form civic competence as an integrative personality trait, develop students creative ability and interest in research activities , create the necessary conditions to support the abilities of students, ready to engage in oral and written communication in Russian and foreign languages (English, German) , to draw attention to the study of the political, legal and cultural aspects of modern society.

Educational tasks of carried out competition:

- to improve communicative competence with the components (sociocultural, compensatory, educational and cognitive);
- to intensify creative independence of participants and promote interest in research activities;
- to generate interest and motivation to master Russian and foreign languages;
- to contribute to the acquisition of skills to effective use of telecommunications technologies;
- to develop general education horizons of participants;
- to intensify the process of obtaining historical and social scientific knowledge;
- to help to create a comfortable space for future motivational professional choices;
- to promote educational value of orientations of students.

In drawing up the tasks and the evaluation of the work to the Olympiads there are the following criteria:

- expressed active civic position, the ability to see the problem and suggest ways to solve it;
- scientific knowledge in accordance with modern concepts of philosophy, sociology and political science;
- relevance and novelty of the content;
- independence, originality and creativity;
- depth and completeness of the material presented;
- consistency, credibility, conclusiveness of presentation;
- the validity of the theoretical and practical conclusions.

III.INTELLECTUAL GAMES

We use modern form of work which is the intellectual game «What? Where? When?», «Jeopardy», «Scrabble bingo».

Intellectual games are held in the form of collective action to implement the tasks that require the use of

productive thinking in a limited time and competition from other participants. Games are built on verbal stimulation material with the addition of intellectual tasks, aimed at the development of knowledge, analytical thinking and intelligence.
Conceptual point is that we introduce new information that affects the development of the civic position of students and enhancing its moral components contributing to the formation of civic competence.

IV.PROJECT METHOD

Working with projects occupies a special place in terms of networking, allowing students to acquire knowledge that cannot be achieved using traditional teaching methods, it becomes possible because students make their choice themselves, they take up the initiative and civic position.
Requirements for projects are presented as follows:

1. project must have relevant practical use and value;
2. conducting independent research trainees;
3. project should be individualized according to the design-time;
4. project creates a training opportunity to learn according to student's abilities [2];
5. contains elements of design and suggests solutions to problems;
6. promotes establishment of communication and interaction between learners and the surrounding society [3].

Method of projects in the association's work is the way to achieve practical goals through the development of detailed problems (technology), which should be completed with a very real practical result, which must be completed properly. This set of techniques and activities of students should have a particular sequence. The purpose of this activity - to solve the problem and design of the final product.
The main objective of the projection method is to teach students to independently acquire knowledge in the process of joint decision of their tasks, which require the application of knowledge from different domains. This form is a set of problematic, searching and researching methods that are creative in their nature. At the core of this activity there is the ability of students to design independently their knowledge, to navigate in the informational and educational space [4]. All this leads to the development of critical and creative thinking.
Method of projects - is a didactic tool which allows to find solutions to various problems in human life. Participating in the design, the student develops his creative start and mental abilities and necessary qualities of his developed intellect, and becomes a person holding his own active civic position. Project activity - is a joint activity of the teacher and students [5]. Under the guidance of a teacher mastered methods of action are applied, there is a literature review, they propose and test different hypotheses, build a program of action and a time-frame of the expected result. The basis of the project activity is the development of students' cognitive abilities, the ability to build their educational programs, ability to navigate in the information space. During this activity communication skills are improved. Teachers create motivational conditions of project activities that are in accordance with the individual characteristics of students and become student-orientated character.
Association «The Commonwealth» in its activities implemented the project of cooperation with the Autonomous Nonprofit Organization «The Urals» in foreign languages.
The organization «The Urals» works in the field of developing and strengthening relations of local tourism businesses and authorities in order to promote domestic tourism in the area. The result of the project is to publish a multilingual tourist guide-book and to increase the students' interest to their native land. We also can see the dynamics of knowledge in the study of foreign languages and history.
At the final stage we held the reflection, aimed at understanding and awareness of the knowledge and skills of actions and results. An ability of participants of project to reflection was developed, their actions and aloof assessment to understand the level of interaction and matching the result to the task was finally aimed. Project activities are very important for studying the implementation of innovative pedagogical forms involving productive activities participants, cooperation, independent, individual and group work of students, integration of subjects, global thinking and vision of the world as well as their own land [6]. In our study, the project activity helps to achieve positive dynamics in civic competence.
Association «The Commonwealth» organizes creative competitions in schools and colleges. They are the contests of video and- slide presentations of students of 6 - 11 grades of secondary schools. They are devoted to small historic towns of Perm region, merchant dynasties, well-known dynasties of the world as well as the interests of the family, youth organizations and movements, which contributes to the formation of interest to own native land, to increase civic awareness and, ultimately, the formation of an active civic position.
Annual competitions of written essays on themes such as «My home – Russia», «My family - a piece of my Motherland», «I am proud of my country» – are presented in the form of writing a letter to a friend to a foreign country which is also a form of intercultural communication.

Contests are remotely a full-time comprehensive educational program, a form of networking.
The basic idea of the competition is to involve the participants to recognize the current problems requiring practical solutions, define their civic position and their own areas of activity that could affect the solution of common problems.
Contests have didactic orientation, they develop the civic competence, as well informational, researching and communicative competences of participants develop creative abilities.
This form helps students to acquire knowledge in the creative process of planning and independent performance of practical tasks. Work on the project competition allows students to show independence in finding sources of information and method of its presentation. This increases their motivation [7]. Students learn to analyze, compare, to choose the most important facts and the most entertaining details. In addition, such projects contribute an atmosphere of cooperation.
According to Patrick J.J. [8] the foundation for civic competence lies in the development of knowledge, skills, and dispositions related to core concepts. In their four-component model for civic education (knowledge, intellectual skills, participatory skills, and dispositions), they identify a set of concepts that form the basis of successful civic participation.
Working under the contest projects, students demonstrate proficiency in various aspects of civic competence:
1. Educational and cognitive competence: manifested in self- searching and retrieving information from different sources, in the ability to analyze and think critically [9].
2. Valuable and-sense competence related to valuable orientations of student, the ability to see and understand the world, to navigate in it, be aware of his role and purpose, to demonstrate ownership of humanistic and democratic values [10].
3. General cultural competence - knowledge and experience in the field of national and universal culture, spiritual and moral foundations of life, cultural foundations of family and social traditions, social phenomena.
4. Information competence - skills activities in relation to the information in school subjects and learning areas, as well as in the outside world, knowledge of the modern media and information technologies. Search, analysis and selection information, its transformation, preservation and transfer.
5. Communicative competence - knowledge of languages, ways of interacting with surrounding people.
6. Competence of personal cultivation [11], which is aimed at the development of methods of physical, spiritual and intellectual self-regulation.

Projects of video and presentations on the theme of «Hometown tour for foreign friends», «Sky Fair of the Urals», «The Great Tea Road» - evidence of civic pride for the young authors and their land and for their country and it says about the readiness of the communicative act with the representatives of foreign-language cultures.

V.INTERNATIONAL PARTHERSHIP

Association «The Commonwealth» is developing international cooperation with similar associations throughout the world. The aim of such cooperation is intercultural communication. This connection and communication between different cultures involve both - direct contacts between people and their communities, as well as indirect forms of communication (including language, speech, writing, electronic communication).
In intercultural interaction the leading place undoubtedly belongs to electronic communications. Such correspondence promotes the formation of social patriotism, the content of which is the love to Motherland and the willingness to subordinate your own interests to the interests of your country. According to these contests pride for your own country is developed, which is connected with the achievements and culture of your homeland. The desire to preserve this character of affairs is vividly noticed and students identify themselves with other members of the community [12]. They desire to protect the interests of the country and its people. Patriotism becomes a part of the consciousness of students, reflecting national moments in its development and forms the active civic position and civic competence.
Association «The Commonwealth» has partner relationships with a number of similar organizations from Norway, Spain, Germany and Denmark. Colleagues from these countries provide information for the association via communication web-sites and social networks as Facebook, where students can find friends with the same interests. The resulting web-addresses are distributed to all educational institutions of the Association.
Correspondence (mail, on-line communication) is a modern means of intercultural communication. Association «The Commonwealth» cooperates with the international organization Pen-Pals International (Australia). It is an international club in correspondence, which offers hundreds of addresses, both individuals and classes for adults and children. Intercultural electronic communication represents a new type of interaction. Informative communication is a complex combination of discourses with certain functional and pragmatic features. Communication is carried out by means of electronic texts, which have several characteristics: multimedia, accessibility, interactivity, virtuality.

Correspondence moves to a new, more sophisticated level of communication that requires communicating in the mode specified by the simultaneous use of electronic knowledge.

With the help of visual Internet communications (Skype, video chats) there appeared a unique opportunity for direct communication with partners and friends from other countries. Association «The Commonwealth» took an active part in the cultural exchange program between the sister-cities of Perm - Hannover on «Museum Pedagogic» event. The joint conference provided both the partners an opportunity to present and discuss the problems of preservation of historical traditions and cultural and natural heritage of the south-eastern region of Perm region.

VI.CONFERENCES

Every year, the association organizes a scientific and practical conference. It is a form of organization of scientific activities of the association in which researchers discuss their scientific and practical work.

Conference of the association is a great annual event, which welcomes delegations of 20-25 teachers from every city of the region representing the association. Conference sums up the past year, announces the best teachers .The work of sections is organized and a draft resolution is adopted where new projects for the next academic year are sounded.

Principles of the conference organization are:

- purpose of the discussion is to summarize the ideas and opinions regarding the problem of formation of civic competence;
- all participants act as proponents (express an opinion about the issue);
- all participants are equal, no one has the right to dictate their will and decision.

Number of sections increases from year to year and their profile is changing.

The main directions of the conference are:

1. Actual problems of modern education.
2. Fundamental and applied aspects of educational research.
3. Formation of civic competence.
4. Problems of methodological support in teaching.
5. Problems of teachers' training.

Teachers and the winners of the state educational project act on the sections. Each section is headed by an experienced teacher, who at the end of the section holds reflection and at the close of the conference gives a brief analysis of the work.

Association held scientific and practical conference such as «Information and digital technologies in teaching foreign languages» in 2008, «Modern technologies in teaching foreign languages» in 2009, «Competence approach in teaching foreign languages» in 2010, «Introduction of new GEF in teaching foreign languages» in 2011, «Formation of civic position in teaching foreign languages» in 2012.

Elaborated algorithms allow to:

- broadcast technology of formation of civic competence;
- create a single information and methodical educational space;
- provide methodological assistance to younger colleagues;
- increase the activity of teachers in the work of the association;
- improve the quality of teaching in general.

VII.COOPERATING

The efficiency of formation of civic competence depends on the cooperation with the public [13], which is regarded as one of the main principles of its activities.

Civic competence is a consequence of its integral and marginal areas, it focuses on the person and his life and the solutions of his problems. The need for mediation between man and various institutions occurs when a person cannot independently exercise his rights and opportunities. The study revealed three conceptual positions: Firstly, working with the public should be a means of coordination and cooperation of traditional methods, and secondly, it should be considered as a means to meet the interests and needs of education, and thirdly, it should stimulate a change of existing needs, expectations and interests of citizens.

Subjects of networking association «The Commonwealth» are the local public, government and the business community. Interacting with these subjects, the association presents itself as an independent participant of networking and receives additional preferences for its further development.

The association organizes and conducts contests and projects among pupils and students on the history of native land and landmark events like hometown or region. These competitions are held with the help and assistance of travel companies of Kungur and the city sector of promoting tourism which is a part of the city administration. Representatives of these organizations are invited to the jury and give prizes to the winners of contests. This interaction contributes to an increased interest in the local history, brings up patriotism among students that ultimately helps to grow a good citizen of our society.

Cooperating with Autonomous Nonprofit Organization «The Urals», students take part in the competition for the best translation of articles about native land. Translations of the winners are included in the collection of the winners and awarded with

diplomas and prizes. Of course, this interaction promotes civic competence and love to homeland.

Interacting with «Stalagmite», the association holds a contest for the best essay on Kungur Ice Cave in foreign languages, organizes courses for guides and interpreters to represent Kungur to foreign tourists. This cooperation allows practically organizing an intercultural communication between students - guides and foreign guests of the city of Kungur that enhances the city's image.

Purposeful cooperation with local media allows creating public opinion about the work of the association, not allowing information to spread spontaneously. Such cooperation creates a favorable environment for further work and in promotion of different activities.

VIII. EXPERIMENT

Diagnosis is made in the form of an experimental research on the effectiveness of the networking model of the formation of civic competence of students on the basis of municipal autonomous educational institution - secondary school №10 (Kungur, Perm region), a partner of the Association «The Commonwealth».

The study was conducted in the form of ascertaining and forming experiments. As parameters for assessing progress in the implementation model of networking the following quantitative and qualitative criteria were highlighted:

• Quantitative: change in the number of students with low / medium / high level of development of civic competence in the study group.

• Qualitative: the dynamics of changes in personal beliefs of students on the three components of civic competence: knowledgeable , valuable and behavioral.

Knowledgeable component includes knowledge of the principles of state and society: political, legal, social, historical, cultural knowledge; valuable component provides the assimilation of civil values such as patriotism, freedom, tolerance, civic duty, knowledge of law, respect for human rights and freedoms, national traditions and cultures of human values; behavioral component shows the mastery of social action competence, communicative competence, the ability to think critically, to perform civic duties, analyze the political situation, to be able to protect one's rights - to debate, define and explain position.

Diagnostic tools included: a technique for diagnosing the level of formation of civic competence (by V.S. Maslennikova), technique «Incomplete sentence» and a test to determine the level of civic competence (by N.I. Derekleeva), questionnaire «Reflecting on the fate of my country, I think about ...», «I'm ready for civic and political participation», «Am I tolerant?», «Values Scale » and a test to determine the level of knowledge on the basics of democracy and the constitution (by I.G. Dolinina).

The techniques were chosen due to the fact that they are the most effective and can be adapted and used to measure the level of formation the civic competence of students in our study. The analysis was conducted according to a scale of levels of civic competence: low, medium and high.

Low level of civic competence (neutral) manifests indifference to civil convictions, characterized by apathy to events of public life. Students show clear unconcern or negative attitude toward civil and political values. Students struggle to find a common language with others, which shows the absence of tolerance. They show the lack of knowledge about the historical and cultural past of the country, having no interest in it.

The medium level of civic competence (steady) is characterized by the formation of an open, friendly attitude towards others, the desire to be active in school and community life. Students are interested in local history, and the history of their country - begin to develop a certain attitude, affection, pride in their homeland. More consciously perceived and accepted knowledge about the state and its apparatus.

A high level of civic competence (holistic) is manifested in the system formed by the position consisting of a deep sense of love to motherland, performing active life and citizenship, participation in public life and in the development of a society based on knowledge about effective methods of interaction between society and the state, and established body of personal qualities such as friendliness, integrity, honesty and mutual respect.

Ascertaining experiment was conducted during a month at the beginning of the academic year 2012-2013. The study involved sixth-grade students (n=150), eighth grade (n=150) and tenth grade (n=60) of the chosen school. The specific students' grades were taken because at this age students are most active in the academic and extracurricular process. They are not baffled by the finals (as at ninth and eleventh grades) and not too small for participation in the programs of the Association «The Commonwealth» (fifth grades).

The experiment on the ascertaining step yielded the following indicators:

1. The tenth grade students have the most dominated the medium level of the civic competence' development. Low level was detected in 40% of respondents. And only 14% of students demonstrated a high level of civic competence.
2. Respondents showed the lack of knowledge in the field of civic education, low understanding of the role of the state and the ideals of the motherland, the lack of motivation for active civic activity.

3. Only 20% of tenth grade students demonstrated their ability to respect the opinions of others and are willing to reckon with them, which means a low level of tolerance.
4. Pupils of sixth and eighth graders showed higher rates of formation of civic competence. 47% of respondents of sixth graders and 37% of eighth graders possessed the high level of civic competence.
5. 50% of students of sixth and eighth graders do not always find a common language with their peers, which means the inability to build friendly relationships with others.
6. Deep perception of civic values, understanding of citizenship among the respondents was missing. At the household level, students' presented ideas about the necessity of loving and protecting the homeland, but conscious awareness of such beliefs, the reasons and prerequisites have not been identified.
Discovered results of the ascertaining experiment revealed prevalence of low and medium levels of civic competence that helped us to confirm the relevance of the research problem and justify the need for a formative experiment, using specially organized pedagogical methods within the networking model.
During the formative experiment the specific organizational and pedagogical conditions were created to upgrade the civic competence of students.
To comply with the purity of the experiment, after the ascertaining diagnosis two groups were formed: control group (CG) and experimental group (EG). The first studied the regular school program, the second did the same plus participated in the activities of the Association «The Commonwealth».
The Association implemented interactive and online methods of formation the civic competence of students. There were organized: elective courses, competitions and contests on the theme of civic rights, educational projects devoted to local history, scientific-practical conference with the goal to establish intercultural cooperation aimed at building knowledge about civil society and sustainable value of patriotism.
The phase of forming experiment lasted for seven months from September 2012 to April 2013, after which the final diagnosis was carried out.
Results of the formative experiment showed that pedagogical influence, organized within the educational network allowed to increase an individual's level of the civic competence of students, which is confirmed by the following data:
1. Quantitative changes (Table 1): there was an increase in the total number of students with medium and high levels of civic competence and a reduction in the number of students with low level. Sixth grade students group with high level of competence (educational maturity) increased from 47% to 59% and this became the majority of the students. Eighth-grade students also showed a positive trend - the number of students with a high level of competence (personal maturity) increased from 37% to 50%. Tenth grade students with high level of development of civic competence (civic maturity) have gained 18% (previously 14%). The quantity for the medium level increased from 46% to 52%. The number of students showing low level decreased by 10% and amounted to 30%.
2. Qualitative analysis enabled us to discover the dynamics of personal changes:
• sixth grade students demonstrated significant positive dynamics of knowledgeable component of civic competence: after studying experimental work they began to show more interest in the history of their native land, the quality of basic legal knowledge. Positive dynamics was also evident in valuable and behavioral components. Students have become to express a desire to participate in local history quizzes. Many of them showed awareness in understanding the terms of «patriot» and «citizen».
• eighth grade students demonstrated significant positive dynamics in knowledgeable and behavioral components. Students have become more interested in issues of politics, economics and culture. They showed motivation and desire to improve their country, city, life. Positive changes in the value component are characterized by an increase in number of students, associated their homeland not only with their house and the city, but also with the whole country. Positive dynamics is vividly seen in understanding the concept of «citizen» and familiarizing themselves with such notion.
All these data indicate the qualitative changes in the minds of students, and say about the positive results of pedagogical influence to raise the level of civic competence and strengthening of formation of civil values.

Table 1. Dynamics of the civic competence of students

Group	Levels	Ascertaining experiment, %	Formative experiment, %	Margin, %
EG 6-th grade	High	47	59	+12
	Medium	26	22	-4

ISBN: 978-1-61804-238-5

(n = 56)	Low	27	19	-8
CG	High	47	49	+2
6-th grade	Medium	26	27	+1
(n = 94)	Low	27	24	-3
EG2	High	37	50	+13
8-th grade	Medium	31	27	-4
(n = 61)	Low	32	23	-9
CG2	High	37	37	0
8-th grade	Medium	31	34	+3
(n = 89)	Low	32	29	-3
EG3	High	14	18	+4
10-th grade	Medium	46	52	+6
(n = 30)	Low	40	30	-10
CG3	High	14	13	-1
10-th grade	Medium	46	49	+3
(n = 30)	Low	40	38	-2

• As a result of the survey, the tenth grade students became more conscious about understanding the role and importance of the state and the current social problems, which means the transition from understanding themselves as passive local identity to realize themselves as citizens of a state possessing the citizenship. The majority of students acquired Russia's historical past, which confirms the assimilation and acceptance of cultural and historical memory. They try to be active citizens and demonstrate tolerance. The indicators created in the knowledgeable component of civic competence of students revealed a marked improvement in the quality of legal knowledge compared with students in the control group. Students began to assign higher rating values of «justice», «honesty», «freedom», «order», «civic duty» and «patriotism». . Conducting research in the control groups allowed to observe the purity of the experiment and proved that pedagogical influence in terms and conditions of the networking model had a positive impact on the results in the experimental groups. As for the control groups, changes in the level of civic competence showed no significant positive or negative results. The proved positive dynamics of civic competence in experimental groups gives reason to believe that the advanced hypothesis of the research is confirmed.

IX.CONCLUSION

In this research using a system analysis, the author has examined the questions of methodology of formation of civic competence, described its organization, defining the main characteristics of the pedagogical process (peculiarities, principles, conditions), its logical structure (subject, object, result, forms, means, methods) and temporal structure of the implementation process (the hierarchy of educational projects, a reflection of its results).

We hope that further development of science will contribute to the democratic modernization of Russian education.

X. ACKNOWLEDGEMENT

This article was prepared under a grant from the Russian Humanitarian Foundation project “Legal education and the formation of a civil competent youth Perm edge” 14-16-59004.

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ISBN: 978-1-61804-238-5

ICT and eLEARNING2.0

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***Abstract*—** The association LOGOS-FTS (National Vocational Training Accredited in Apulia Region - Code accreditation: 3P - BURP n. 02/14/2013 24 Audit of the Regional final accreditation of 11.13.2013) espressed its user's needs in the "Gender Dimension in the Digital Agenda", as part of uesr's needs in Education and Training domain [Avellis et al., 2014] of the Living Labs SMARTPUGLIA 2020, by underlining a well identified diagnosis and disconfort situation of many young and youngest people in the participation and acquisition to the education and training processes. The tools that we introduced in the Living Lab "ICT and eLEARNING" are oriented to the adoption e-learning based on Web2.0 and techniques of promotion of Role Models, that are models of people who played successful life choices in their career, reaching a full work-life balance, especially women, in mobility situation as well.

.

***Keywords*—**vocational training, elearning2.0, women role models, gender dimension.

I. INTRODUCTION

THIS project aims to bring innovative and effective ways and means of orientation and promotion, positive role models relate to the stories and faces of women successfully engaged in research, technology, the creation of start-up, so as to be able to propose an experimental prototype be submitted the end user, to meet the following objectives:

1. to affect persistent female stereotypes and a traditional educational setting, especially for girls, is less and less adapted to the challenges of the Knowledge Society;
2. to counteract the negative female models offered daily by the media system (the lack of role models is a major problem);
3. to help building a cultural climate that sees women as inventive, innovative, creative users, active protagonists of innovation.

The added value to the traditional technological tools can be represented by an innovative system of E-learning web 2.0 which is based on the following features:

- Analysis of the personal characteristics of the 'user (the way in which they carry the narrative, organization, retrieval and application of content knowledge to solve new problems), their needs and expectations (profiling action);
- Analysis of the behavior during the execution of the learning process, the ability to track the user during collaborative activities and the recognition of the completion of the user who participates in assigned learning groups. (Behavior recording action);
- Structuring, visualization, storytelling and re-design of teaching sequences (action planning);
- Semantic analysis of flow diagrams of the maps of learning (action planning);
- Analysis of cognitive activities, associated with the Social networks (scanning action).

II. ELEARNING2.0 PROTOTYPE

The foresee prototyped tools on elearning2.0 is characterised by four technological classes::

1. Synchronous communication systems (video conferences, etc.) and asynchronous communication systems (forums, blogs, etc.);
2. Systems for synchronous sharing of resources (video sharing, whiteboard, etc..) and asynchronous resource sharing shared database access, file sharing, etc.);
3. Tools for Mapping Knowledge and simulation (concept maps, flow charts, etc.);
4. Systems to support group activities (collaborative writing, collaborative rafting of synthesis documents, etc.)

III. USER'S INVOLVEMENT

The co-design participation of 'end-user at different stages of the process is a "linear" classic research and development - ranging from concept to design, from prototyping to validation and verification, until the final engineering process.

These pathways appear to co-design useful and are therefore recommended at an early stage, in order to obtain immediate benefits in terms of selection and elimination of alternatives more or less relevant.

This stage will co-design the prototyping and customization of solutions related to the implementation of the platform of E-Learning 2.0 and its correlation with the major social networks and their production of technical documentation, will ensure the success of the system to be prototyped, so to eliminate all complications of the man interaction system. The end-user, in this case the project, consisting of the majority of women with discomfort learning in technology, will participate in the co-design, drawing step by step system that will adopt for the use of training.

The end user has to fully participate to the co-design phase in order to obtain better results in the validation and verification phase by putting the prototype for a sufficient long time in the same "real life" condition in which the prototype will be used, once launched in the market.

This allows to evaluate the user feedback, in a development phase where the modification of the product is still feasible and economic and can avoid market failures.

Then, it is not sufficient, following the Living Lab approach that the user is given a limited role in the innovation process. Further, also the so-called "user Centred Design Innovation" and the exploitation of the so called "Driving Users" are insufficient if it lacks the involvement and the contribution of the potential beneficiaries, today consumers and producers at the same time (prosumers).

In the Living Lab approch the main aim is to give space to the end users, at least with the same voice of the other actors of innovation. The co-participation of the end users to the co-design of the solutions is in th edifferent phases of the linera classic process of Reasearch & Development, which encompasses the requirements, design, the prototyping to verification & validation, until the final engineering of the solution.

This process of co-design are useful and are then recommended since the initial phases, to the end of gaining immediate advantages in terms of selection and elimination of the more or less relevant alternatives. The co-design phase on prototyping and personalisation of the solutions concerning the E-LEARNING 2.0 platform and the related correlation with the social network, has guarantee the successful implementation of the prototyped system, so that all the difficulties related to the man-system interaction can be eliminated yet in this phase.

The end users in this project, consisting mainly of women with technological learning discomfort, have participated in this project by designing step by step the system that they will adopt for the fruition of the learning paths.

IV. Activities to Develop the E-Learning System

The activities that characterize this approach, and its interaction between the parties, may be summarized as follows. Given the above, the following shows the steps required to develop a project of E-Learning:

- Design,
- Creation / Implementation
- Provision

in the logic of 'Living Labs approach, in order to create is a system for the use of teaching materials

Design Phase

In this phase the working team will elaborate specific techniques of educational design and didactic strategies, also with an adaptive learning approach based on the knowledge of the learning models and online communication, on the educational needs of the target and the context in which the educational intervention takes place. In this phase, it will be devised a detailed description the structure of the didactic path, the design and planning of the development and implementation and evaluation paths, and take care of the didactic aspects and the usability.

Design the storyboard taking into account the contents. The storyboard is a paper document with three levels of description, namely:

- the specific information that the user has to learn;
- the indication for the graphics, illustrations, animations and audio contributions which can be provided with the textual information;
- the indication for the developer who has to implement the product, including the user-system interaction

In this phase it is important to make research and knowledge organization through the knowledge available in the organization, the research in the network and the development of exchanges and relations with other training experiences.

Here the ICT SME Never Before Italia srl will play a fundamental role such as the design and production of an editorial environment on the web to guarantee the suitability of the project to the needs and characteristics of the user, with activities such as monitoring plans, user test, focus groups.

In the framework of this phase the ICT SME will personalize the chosen platform for the training activities, by taking into account reference targets, didactic methodologies, contents and the offered activities.

Creation/Implementation Phase

In this phase the co-design team elaborate a map for a specific discipline and produces the contents creating and designing a didactic path.

There have been identified the first educational content which will be elaborated by the end user LOGOS-FTS to be included in the initial prototype as follows:

- the competence balance;
- the educational booklet
- the accompaning measures
- orienteering to the study path;
- culture and enterprise motivation
- self-enterpreneurship

In this phase the SME has to elaborate the contents provided by the field experts and prepare the storyboard for the translation of the contents in the didactic multimedia form, in some cases the experts should be supported and co-operates with simulation experts or more in general experts with technical competences in virtual environment implementation.

The Technical Development Team should compare several platforms and services to choose the better technological solution and the set of instruments coherent with the training objectives, teh didactic issues, the characteristics of the target, etc.
The content development team collaborates in this phase with the instructional designer to evaluate the suitability of the foreseen solutions.

Provision Phase
A major role is played by the ICT SME in this phase, which has to manage the platform and all the tools devised for the activities provision, users identification, the management to synchronous and asyncronous activities, to the report production (such as the data of automatic tracing of the users), manage the abilitation procedures in tight relations with the figures responsible of the project management and/or the community.

V. Solutions Protypying and Personalization

Since the prototyping phase, the co-design team should identify a technological platform of e-learning in order to develop a prototype which will satisfy all the characteristics mentioned in the phase of design: in short terms, to define the prototyping and then the progressive adaptation of the system to the user's needs it is important to define the nature of the prototype, of the validation to which it will be submitted and to arrive to personalised solutions and then acceptable by the whole system.
The prototype and the subsequent personalisation will bring into play enormous potentialities which will allow a network learning of *constructive* type, which exploit the *collaborative* and community dimensions.
The steps of the personalization phase are as follows:
I. User access LOGOS-FTS
II. Path identifying the type of user
III. User access to th efruition of the training module;
IV. Personalization of the training content with interaction with the teacher and adoption of strategies suggested by the system;
V. Learning Community
Such an approach will guarantee to pass from an idea of passive and isolated learning, consisting of a unidirectional model teacher-student which learn, to *a collaborative learning* model founded on the shared and dynamic construction of knowledge through "learners communities": knowledge becomes individual and collective of shared meaning and mobile interpretation of experience.
The pedagogic reference model of current e-learning platforms is one Skinner of the teaching machines: a model, then, which is based on a behavioural approach of learning build on the concepts of stimulus, objective measurement of teachers behaviour and design of contents following a sequential pre-ordered logic.
The prototying will be finilised toward a *learner centered* product, based on a *constructive* approach and more effective training.
The prototype and its personalisation have courses with the learner at the center of the learning path, not only from the point of view of a more personalised fruition, but especially through an active participation to the content construction.
The prototype has an e-learning environment with high levels of interactivity between teachers and learners, such as in a traditional classroom, and to actively involve the student during the fruition. The resulting platform lead to models based on specific didactic strategies of constructivist approach and will involve a high degree of self-learning from the students.
The prototype introduces a new learning methodology, so called "learning by doing", which means a learning through experience. Such an approcah based on active participation of the student/end user to the learning path of the knowledge will favour the learning. The end user will be stimulated through problem resolution and the self-evaluation invitation.

VI. DEMOLAB

The public DEMOLAB model represents the presentation/demonstration in public site of the innovative product/service, developed by the research laboratory Dyrecta Lab Srl and by the ICT SME Never Before Italia srl, for dissemination and exploitation of the results, besides the experimentation with the end users.
The dissemination of the results gained to make available by the interest groups represented by the following:

- End users representatives
- Stakeholders
- Didactic content recipients
- Citizens and consumers

The diffusion mode which has been used is based on the organisation of press conference for the presentation and launch of the project.
Consequently, the communication activities development will also be centred on the 2.0 media.
The end user involvement in the context of the project life cycle is assured by the Living Lab method
Different levels of the user interface have been simulated and the completeness and usability will be verified.
A first prototype will be devised by the developers with the support of researchers of Dyrecta Lab, private laboratory trusted by MIUR, through the study of the most updated scientific bibliography.
The simulated system, without the information technology component, will be proposed to the users/citizens both by a specific web site, and by web questionnary, interviews, focus groups, and workshops.
In the website will be available all the produced documentation.
The demo version of the interfaces and the e-learning system will be populated with simulated data and made available via web to the defined class of users.
The issues related to the non structuring of the proposals, derived from the end users, will be addressed and overcome thanks to an area from which they can access once

registred.and by logging in every user, by submitting the different choices/proposals/changes to a panel forum starting from user guidance selected according to the expressed user's needs derived from the demolab of the end users, especially the courses applicants of the LOGOS-FTS association.
Further, through the demolab and the public expressions of interest the project will try to involve the subjects that have expressed similar kindred, and related user's needs, and that do not take part of the project team structure.
To improve this aspect, besides the usual events publicity, there will be addressed specific invitations to participate to extensions of enumerated users needs from the living lab of the project.

VII. Conclusions

The association has expressed LOGOS-FTS, as already indicated, the requirement "Gender Dimension in the Digital Agenda" [4] highlighting an accurate diagnosis of the difficult conditions of the world of women and youth in general in the acquisition and participation in education , the reference domain of the notice, the title of which enhances its synthesis.

The proposed "conceptual" highlights in particular:

- To address the persistent women sterotypes on a traditional educational foundation adequate to the Knowledge Society challenges
- Lacks of women Role Models daily offered by the mediatic system
- to contribute to build a cultural atmosphere exploiting inventive, innovative, creative women, and active players of the innovation different types of end users such as:
  i. Young and youngest end users less attracted by the most engaging studies and encouraging towards technical educational paths toward the ICT culture;
  ii. Women, especially inventive, creative and active women, players of the innovation processes
- Possible types of the methodologies/instruments/means toi be used to implement and personalise elearning2.0, techniques of role models promotion and Social network;
- The need to focus on innovative and efficient methods of orienteering and promotion of positive models of reference (stories and faces of successful women engaged with the research, technology, and start up creation.

The proposal for the subjects and objectives that aims to pursue, however, is quite extensive embracing a very diverse catchment area, putting issues of realization of the prototype will be produced as shown below.

The joint planning and the involvement of the different actors on the pattern of interactions has as its goal to produce a prototype to be submitted to experimental validation of 'end-user, acquiring the appropriate evaluations / recommendations, then to produce a product / service.

The proper interaction between users involved often a prelude to easier acceptance of the ICT system and a longer life of the product (with obvious commercial implications). The road to overcoming the "digital divide" seems to be so tied to the logic of co-design, extended to users and developers that will lead to a co-design thrust.

Acknowledgment

This work has been funded by Apulia Region, Area Politiche per lo Sviluppo, il Lavoro e l'Innovazione, Servizio di Ricerca Industriale e Innovazione, Ufficio servizi die Government e ICT and realized in collaboration with InnovaPuglia, under P.O. FESR PUGLIA 2007-2013 – Asse 1 – Linea di Intervento 1.4 A zione 1.4.2 – Investiamo nel vostro futuro, Supporto alla crescita e allo sviluppo di PMI specializzate nell'offerta di contenuti e servizi digitali Apulian ICT Living Labs – Verso Puglia Digitale 2020.

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A physical model for teaching one-dimensional kinematic gait

C. A. Collazos and R. E. Argothy

***Abstract*—**The aim of this work is to present the one-dimensional gait kinematic principle, in order to identify the kinematic parameters for each type of gait associated with uniform linear motion and uniformly accelerated motion. We use the Smart Tracker software and BTS Bioengineering hardware. The physical modeling developed complements the information of the data acquisition system and can also be used for the biomechanics teaching.

***Keywords*—**Gait, kinematic, modeling, physics.

I. Introduction

THE gait analysis is the measurement and assessment of human locomotion which includes both walking and running [1]. These movements, known as stereotyped reflexes, are characterized by being repetitive in time when the velocity and the acceleration are constant [2]. Therefore, it is possible to obtain reference curves at each movement phase that could help to determine abnormalities or pathologies which are related to the musculoskeletal system and modify normal behavior [3].

The motion analysis techniques used to measure accurately kinematic curves are obtained through skin markers, which record the position, velocity and acceleration of a body segment. These measurements provide quantitative information about the movement [4].

The different tissues involved during walking namely: muscles, tendons, cartilage, ligaments, connective tissue (fascia) and the bone component, perform different functions such as motion generation, power transmission, buffer loading, joint stabilization of segments, among others. These functions are the basis of motion and therefore are constantly analyzed and evaluated to determine alterations that modify their performance [5], [6].

The gait biomechanics can be understood from two perspectives: analyzing the behavior of the tissue during motion or, measuring the kinematic behavior of the body segments. The latter allows the quantification through phases of gait, of the changes and compensations, made by the human body when they are modified like for example when the gait has a constant velocity but is slightly accelerated. Such alterations in the normal patterns indicate that the reference curves should be focused according to gait velocity, weight, and height, and step width, strides length among other characteristics that according to the morphology of the studied population might change and determine normal patterns.

This paper describes the behavior of the gait at a constant velocity and acceleration. We identify the kinematic parameters for each type of gait and compare the kinematics curves presented in each of the cases.

The article is structured as follows: In Section II it shows the physical fundamentals of the one-dimensional kinematic. Section III shows the instrumentation used and the associated markers for gait evaluation. Section IV presents the identification of the kinematic parameters related to the gait and the mathematical tools. Finally Section V is dedicated to the discussions and conclusions.

II. Fundaments of the One-Dimensional Kinematics

A. One-Dimensional Motion with Constant Velocity

When a body has a motion with constant velocity, the kinematic equations are refer to (1), (2) and (3).

$$x = x_0 + v_0 t \tag{1}$$

$$\frac{dx}{dt} = v = v_0 \tag{2}$$

$$\frac{d^2x}{dt^2} = a = 0 \tag{3}$$

where x_0 and v_0 correspond to the initial position and velocity respectively. Note that the velocity v corresponds to the first derivative of the position x respect to time t and the acceleration a corresponds to the second derivative of position x respect to time t. The slope of the position-time graph is the velocity, which is constant during the motion [7]. The kinematic curves for a constant velocity motion can be seen in Fig 1.

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ISBN: 978-1-61804-238-5

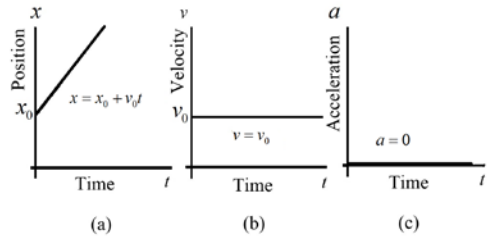

Fig. 1 Kinematic curves for a move with constant velocity (a) The Position-Time Graph, (b) The Velocity-Time Graph, and (c) The Acceleration-Time Graph

B. One-dimensional motion with constant acceleration

The equations of one-dimensional motion with constant acceleration are refer to (4), (5) and (6).

$$x = x_0 + v_0 t + \frac{1}{2} a t^2 \tag{4}$$

$$v = \frac{dx}{dt} = v_0 + at \tag{5}$$

$$a = \frac{d^2 x}{dt^2} = cte \tag{6}$$

where x_0 and v_0 correspond to the initial position and velocity respectively. It is important to note now that the velocity is the slope of the position-time graph. The slope of the velocity-time graph is the acceleration, which is constant during the motion [7]. The kinematic curves for a constant acceleration motion can be seen in Fig. 2.

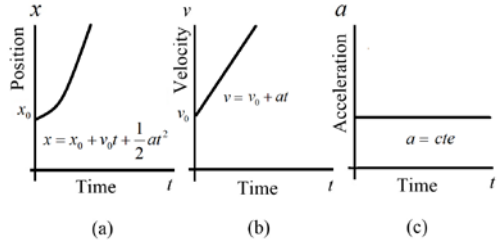

Fig. 2 Kinematic curves for a move with constant acceleration (a) The position-time Graph, (b) The velocity-time Graph, and (c) The acceleration-time Graph

III. INSTRUMENTATION

Manuela Beltrán University Biomechanics Laboratory was used for data logging. We use BTS GAITLAB [8]. This acquisition system of high precision for motion analysis has six optoelectronic cameras that measures the displacement ($10^{-7} m$) of body segments in time ($10^{-2} s$).

The device has 3 markers placed strategically as Fig. 3 indicates. The markers involved in the gait were the sacrum (marker 6), the right greater trochanter (marker 7) and the left greater trochanter (marker 8). The study of movement in this work is restricted to the X axis only. The Fig. 4 illustrates the dimensional axis employed for the gait.

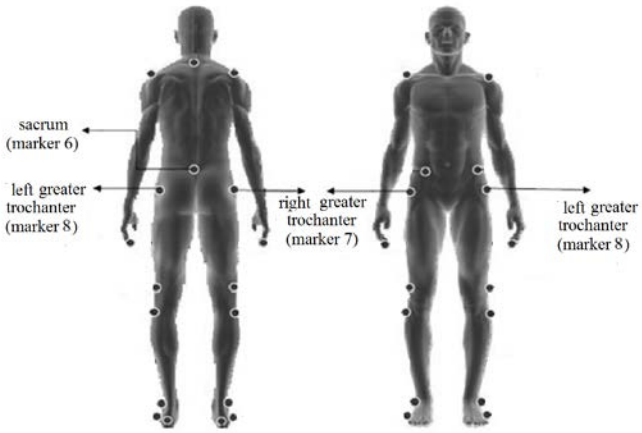

Fig. 3 Disposition of the cutaneous markers in the human body [8]

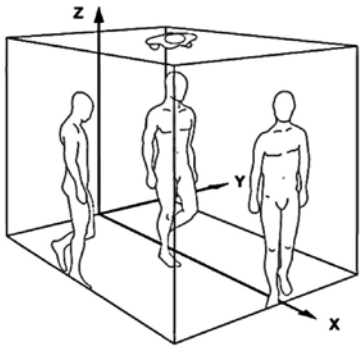

Fig. 4 Dimensional walking on the X axis [9].

IV. RESULTS AND ANALYSIS

The test was applied a 19 year old female, height 1.54 m and mass of 54Kg. For the data analysis the least squares and correlation coefficient methods were used [10]. The figures 5 to 10 show experimental data in dotted line and the models in continuous black line. The units for all variables and parameters are represented in the International Units System. Hence, for a data set, the best curve that fits is one for which the sum of the squares of the deviations is a minimum, Accordingly: $J^2 = \sum (y_i - \hat{y}_i)^2 = \text{minimun}$, where y_i is the experimental value and $\hat{y}_i$ is the theoretical value.

For a linear model the first-degree polynomial is given namely: ($\hat{y} = a + bx$). For N pairs of data, the regression parameters a and b are refer to (7) and (8) respectively as :

$$a = \frac{\sum_{i=1}^{N} x_i^2 \sum_{i=1}^{N} y_i - \sum_{i=1}^{N} x_i \sum_{i=1}^{N} (x_i y_i)}{N \sum_{i=1}^{N} x_i^2 - \left(\sum_{i=1}^{N} x_i \right)^2} \tag{7}$$

$$b = \frac{N\sum_{i=1}^{N}(x_i y_i) - \sum_{i=1}^{N} x_i \sum_{i=1}^{N} y_i}{N\sum_{i=1}^{N} x_i^2 - \left(\sum_{i=1}^{N} x_i\right)^2} \quad (8)$$

For a parabolic model, the second-degree polynomial is given: ($\hat{y} = a + bx + cx^2$). For N pairs of data, the regression parameters a, b and c are refer to (9), (10), (11), (12), (13), (14), (15) and (16) as follow:

$$a = \frac{\left[S(x^2y)S(xx)\right] - \left[S(xy)S(xx^2)\right]}{\left[S(xx)S(x^2x^2)\right] - \left[S(xx^2)\right]^2} \quad (9)$$

$$b = \frac{\left[S(xy)S(x^2x^2)\right] - \left[S(x^2y)S(xx^2)\right]}{\left[S(xx)S(x^2x^2)\right] - \left[S(xx^2)\right]^2} \quad (10)$$

$$c = \left[\frac{\sum_{i=1}^{N} y_i - b\sum_{i=1}^{N} x_i - a\sum_{i=1}^{N} x_i^2}{N}\right] \quad (11)$$

where:

$$S(xx) = \sum_{i=1}^{N} x_i^2 - \frac{\left(\sum_{i=1}^{N} x_i\right)^2}{N} \quad (12)$$

$$S(xy) = \sum_{i=1}^{N} x_i y_i - \frac{\sum_{i=1}^{N} x_i \sum_{i=1}^{N} y_i}{N} \quad (13)$$

$$S(xx^2) = \sum_{i=1}^{N} x_i^3 - \frac{\sum_{i=1}^{N} x_i \sum_{i=1}^{N} x_i^2}{N} \quad (14)$$

$$S(x^2y) = \sum_{i=1}^{N} x_i^2 y_i - \frac{\sum_{i=1}^{N} x_i^2 \sum_{i=1}^{N} y_i}{N} \quad (15)$$

$$S(x^2x^2) = \sum_{i=1}^{N} x_i^4 - \frac{\left(\sum_{i=1}^{N} x_i^2\right)^2}{N} \quad (16)$$

There is a quantitative measure of the data x that follows the physical model y obtained by the least squares fit. It is given by the value of the so-called correlation coefficient r given by (17).

$$r = \frac{N\sum_{i=1}^{N} x_i y_i - \sum_{i=1}^{N} x_i \sum_{i=1}^{N} y_i}{\sqrt{\left[N\sum_{i=1}^{N} x_i^2 - \left(\sum_{i=1}^{N} x_i\right)^2\right]\left[N\sum_{i=1}^{N} y_i^2 - \left(\sum_{i=1}^{N} y_i\right)^2\right]}} \quad (17)$$

A. Gait with constant velocity

Fig. 5 indicates the position register towards the sacrum (marker 6) and the linear interpolation. Here, it is observed that there is a high correlation between the model and the experimental data. This correlation is significantly statistical ($r = 0.997$). The identification of the model allows determining the initial position (x_0 =-1.91m) and the average velocity on the walk (v_0 =0.76m/s). The model of the position in function of time is therefore $x(t) = -1.91 + 0.76t$.

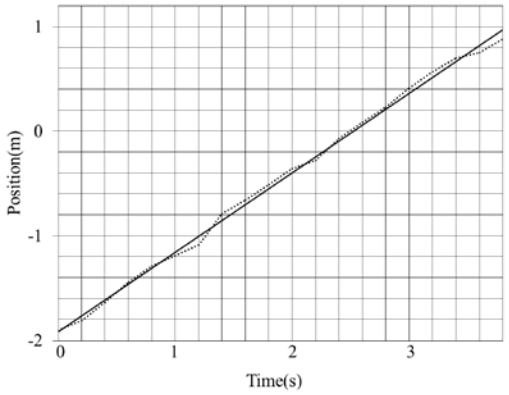

Fig. 5 The position–time graph on the X axis for the sacrum with constant velocity

Fig. 6 shows the position registered towards the right greater trochanter (marker 7) and the linear interpolation. The identification of the model determines the initial position (x_0 =-1.97m) and the average velocity in the gait (v_0 = 0.78 m/s). Here can be seen that there is a high correlation between the position and the experimental measurements with $r = 0.996$. The model of the position in function of time is therefore $x(t) = -1.97 + 0.78t$.

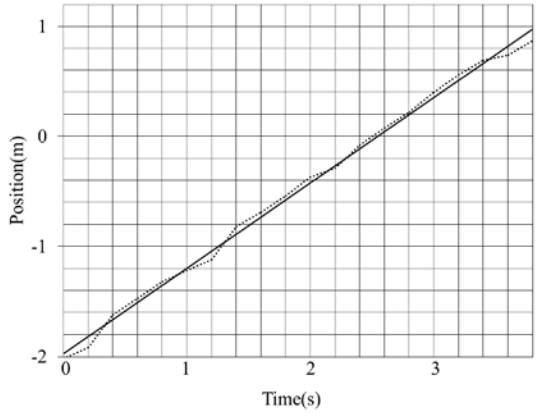

Fig. 6 The position–time graph on the X axis to the right greater trochanter with constant velocity

Fig. 7 indicates the position register to the left greater trochanter (marker 8) and the linear interpolation. The identification of the model determines the initial position

(x_0 =-1.91m) and the average velocity on the gait (v_0 =0.76 m/s). In this case the correlation coefficient is $r = 0.996$.The model of the position in function of time is consequently $x(t) = -1.91 + 0.76t$.

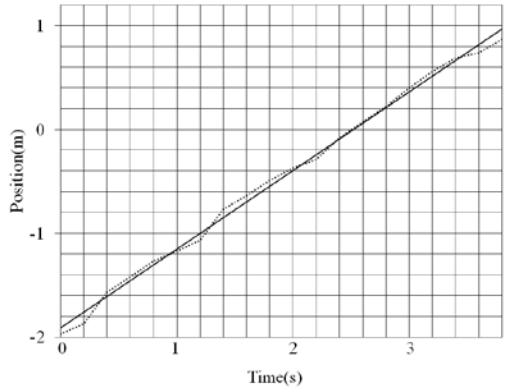

Fig. 7 The position–time graph on the X axis to the left greater trochanter with constant velocity

Based on physical models found for the sacrum, for the right and left greater trochanter, notice that our experimental data support the model reasonably well. We observed a 0.99 higher correlation between the kinematic models for position and the measurements, which meets the characteristics of a uniform linear motion according to [5], [11].

B. Gait with constant acceleration

Fig. 8 indicates the position registered towards the sacrum (marker 6) and quadratic interpolation. The identification of the model allows determining the initial position (x_0 =-2.57 m), initial velocity (v_0 =-0.80 m/s) and half of the average acceleration (0.39 m/s^2). There is a high correlation between the model and the experimental data ($r = 0.997$). The model of the position in function of time consequently is $x(t) = -2.57 - 0.80t + 0.39t^2$.

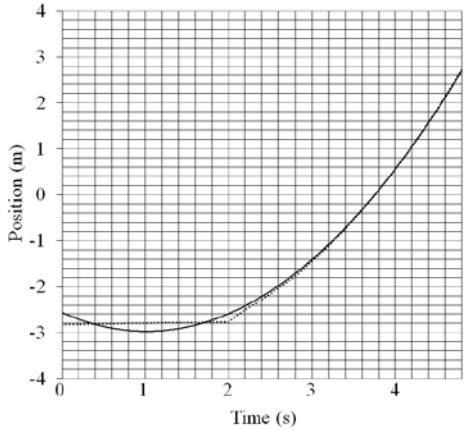

Fig. 8 The position-time graph on the X axis to the sacrum with constant acceleration

Fig. 9 indicates the position registered towards the right greater trochanter (marker 7) and the quadratic interpolation. The identification of the model allows determining the initial position (x_0 =-2.58m), initial velocity (v_0 =0.82 m/s) and half of the average acceleration (0.40 m/s^2). Like we can see there is a high correlation between the position and the experimental measurements ($r = 0.996$). Hence, the model of the position in function of time is $x(t) = -2.58 - 0.82t + 0.40t^2$.

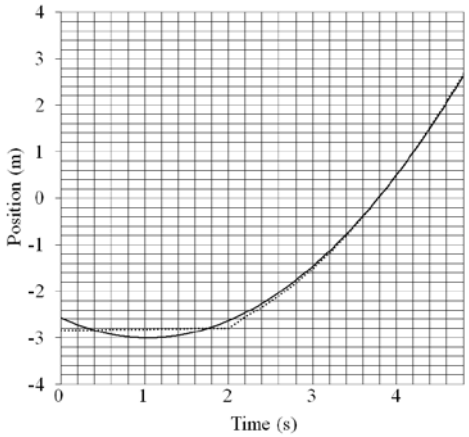

Fig. 9 The position-time graph on the X axis to the right greater trochanter with constant acceleration

Fig. 10 indicates the position register to the left greater trochanter (marker 8) and the quadratic interpolation. The identification of the model allows determining the initial position (x_0 =-2.60m), initial velocity (v_0 =0.83 m/s) and half of the average acceleration (0.34 m/s^2). Here can be seen that there is a high correlation between the model and the experimental data ($r = 0.997$).The model of the position in function of time is $x(t) = -2.60 - 0.83t + 0.34t^2$.

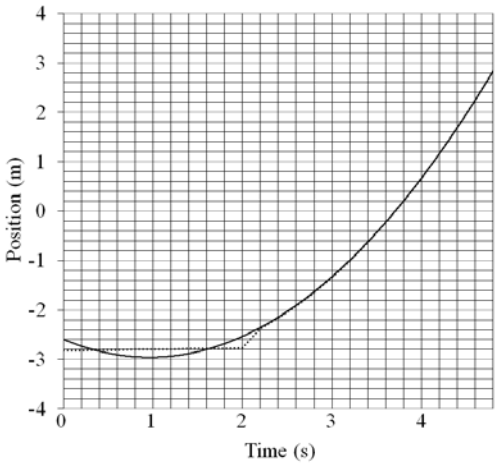

Fig. 10 The position-time graph on the X axis to the left greater trochanter with constant acceleration

According to kinematics curves and mathematical models found for the sacrum, for the right and left greater trochanter, we observed a 0.99 higher correlation between the kinematic models for position and the experimental measurements, which meets the characteristics of a movement with constant acceleration regard to [5],[11].

V. CONCLUSION

We show a simple gait physical modeling for kinematics. Experimental results were theoretically validated for the physical models and parameters found. The technique used involves three reference markers (sacrum, right and left greater trochanter,) related to the center of mass of the human body. The identified models predict in time quantities such as position, velocity and acceleration at the different types of motion with constant velocity and acceleration. Orders of magnitude found for the physical models of position are within the range of magnitudes reported by authors like Winter in [6].

This work is introductory and aims at opening the possibility to compare physical models between normal and abnormal gait. It is known that the normal gait may be affected by conditions of different origin at the structural level, osteoarticular, myopathic and neuropathic leading to an alteration of any part of the cycle or the gait entire cycle. In this sense our purpose in future is to establish a three-dimensional kinematic modeling involvement other markers such as hip, knee and ankle.

It is important to note that the normal gait pattern modeling can be affected by many causes, such as size, age, footwear, terrain, load, activity of the subject, which are not necessarily pathological but are related to the alteration or adaptation of musculoskeletal structures for movement. In this sense we can generate in future works to do comparisons of the gait in some people with physical characteristics different.

Finally, the models can be used to reinforce concepts of kinematics in the field of biomechanics. The method used in this work is part of the current curriculum of Manuela Beltran University. We state that students: they worked actively and collaboratively in the implementation of projects, they could establish a process for testing (prediction, observation, and validation) with the kinematics curves and physical models of the human gait.

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Undergraduate L2 Learners' Perception and Preferences towards Error Correction Type on Pronunciation Errors: An Exploratory Study

Zulqarnain Abu Bakar and Muhammad Ridhuan Tony Lim Abdullah

Abstract— The present study is an exploratory survey to investigate learners' perceptions and preferences to some proposed error correction methods, in response to mispronounced English words. A set of 36 error-correcting act video clips was developed to accompany a corresponding questionnaire survey in exploring respondents' preferences for the different error correction types. Comparisons by their learning experience (year) and environment (institution) were carried out to study any effect on their preferences. The survey questionnaire was conducted on 88 undergraduate students. The analyses showed that the respondents seem to share the same pattern of preferences disregard their learning experience and types of higher institutions. Their evaluations were positive with greater appreciation for *Explicit Correction*, *Visual Cues*, *Elicitation* and *Verbal Metalinguistic Feedback* which may be viewed as being intrusive in nature as opposed to *Repetition* and *Clarification Requests* which are more communicative in their approach.

***Keywords*—**Pronunciation, corrective feedback, correction types, preferences

I. Introduction

Most studies of error correction are driven by the interest to investigate the effectiveness of error correction on L2 interlanguage development. Studies have also been carried out to identify the circumstances in which it may function effectively. Such studies have mostly dealt with spoken errors in relation to a range of language problems including grammar, vocabulary and syntax in classroom settings. The current study, however, focuses on one aspect in language learning that has been largely neglected for quite some time, that is, pronunciation.

Pronunciation has a key role in successful communication both productively and receptively. It has been a common concern among L2 learners with regard to their confidence in oral communication (Bang,1999). Operating at a sub-conscious level, it is often not easily amendable, though it is not impossible for an L2 learner to achieve an impressive performance (Munro & Derwing, 2008). Native listeners often use contextual cues to resolve ambiguity when a pronunciation feature impedes the intelligibility of a word. Non-native listeners, who might rely more on the acoustic signal, are prone to communication breakdown eventually (Jenkins, 2000). Nevertheless, considering the fact that L2 learners use English more often among non-native speakers than among native speakers (Jenkins, 2005), L2 learners may still need to master the basic segmental sounds of English for mutual intelligibility instead of the more complex suprasegmental qualities. Such limitations among L2 speakers can be frustrating and may need addressing. More soundly, the teaching of pronunciation is vital for L2 learners in the context of interaction between both non-native speakers and native speakers in general. Unfortunatel, the topic of the teaching of pronunciation has been underdeveloped within the area of applied linguistics. As such, L2 teachers and instructors are frequently left to depend on their own intuition with minimal sense of direction. Hence, more research is needed to inform teachers of findings relevant to helping L2 learners to improve their pronunciation skills (Derwing & Munro, 2005). In order to address the issues involved in helping L2 learners improve their pronunciation skills, several areas of study are relevant. These include the theory of Speech production, the history and practice of teaching pronunciation, and the nature and effectiveness of different types of error correction. This study focused on the application of different types of error correction strategies in L2 language learning.

In the scope of error correction, Bang (1999) conducted a study investigating EFL learners' reactions towards oral error correction. A questionnaire was administered to 100 EFL students in Spoken English classes at a university. In response to methods of error correction, respondents showed a preference for specific types of oral feedback. The study indicated that the learners had a positive perception towards error correction but were principally sensitive to the manner in which feedback was given. Relevant to the purpose of this study is the fact that only a very small number of the respondents felt that phonological error correction of pronunciation was a great concern. In contrast, Rajadurai

This work was sponsored and financed by Universiti Teknologi PETRONAS.

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(2001) surveyed a group of students in a TESL programme in Malaysia, investigating the effectiveness of teaching pronunciation. Findings showed that more than 85% of the subjects agreed that pronunciation training was essential, particularly on the segmental aspect of pronunciation. Derwing & Rossiter (2002) also used a survey approach in their study on learners' perception of their pronunciation needs and strategies. The results disclosed segmental superiority over suprasegmental importance as perceived by their respondents. Considering the mixed results in these studies of which the survey approach was adopted to investigate learners' concern for improvement in English pronunciation, the present aim is to explore learners' preferences for different types of phonological feedback. To date very limited study on the perception and preference of error correction on pronunciation errors for Malaysian English learners has been conducted, although this aspect of the language has been quite a concern among the learners. Another interest in relation to the error corrective feedback is to find out if learners' learning experience and learning environment have any impact on their perceptions and preferences for the proposed error-correction types. According to Rivers (2001), experienced learners tend to have their own autonomic decision as to how they would like to manage their learning process and activities. It is postulated that experienced learners exhibit good metacognitive behaviours that could assist them making assessment and decide what work best for them (Wendon, 1999). The same goes to the influence of environment in which it is postulated that a target-language rich environment would be much conducive for a leaner to internalize the target input (Celce-Murcia, Brinton & Goodwind, 1996; Ellis, 2009) as opposed to the ones that are of L1-L2 mix or in L1 only.
Thus, it is important to find out how learners perceive possible error correction methods from these perspectives.

There are numerous pronunciation training software packages on the market, many with attractive interactive activities. Nonetheless, few if any have a robust capacity to attend to individual pronunciation problems or offer meaningful constructive error correction (Neri, Cucchiari, & Strick, 2008). It is hoped that the present study may illuminate ways of correcting pronunciation errors that are appealing to L2 learners for use in future software packages for pronunciation training.

II. Aim/Objective

This study is aimed at conducting exploratory survey to investigate learners' perceptions and preferences to some proposed error correction methods, in the event of correcting a mispronounced English word. Thus, learners' perceptions and preferences for the respective corrective feedback types may be analysed and understood how they interpret teachers' corrections and the reasons for their preferences. The study is also extended to explore if learners' learning experience (year) and environment (institution) affect their preferences.

A. Research Questions

Hence, in response to the earlier studies and the concerns on learners' perception and preferences for the different corrective feedback types as well as the potential impact of learners' learning experience and environment on their perceptions and preferences, the following research questions were constructed.

i. What are the learners' perceptions and preferences with regard to the different error correction types, overall?

ii. What are the learners' perceptions and preferences with regard to the different error correction types in relation to their learning experience (first year vs final students)?

iii. What are the learners' perceptions and preferences with regard to the different error correction types in relation to their learning environment (Institution A vs Institution B)?

III. Method

Data collected will be analyzed to investigate the respondents' evaluation of the different error correction types. The study adopted the survey technique to elicit the respondents' perception and preferences. As formal pronunciation classes are not available in Malaysian colleges and universities, observation of phonological feedback classes is almost impossible. Pronunciation is integrated into the syllabus of most English classes at tertiary level. Videotaping those classes to capture phonological feedback would have been time consuming because feedback on pronunciation may be rare and unpredictable. An alternative approach of observing and studying learners' reactions towards feedback in the context of commercially available packages was also dismissed, due to the inconsistency in the features of the feedback found in the available pronunciation software. Some do not provide feedback at all. The ones that do, consist of various intensities and approaches from responding to differences in discrete minimal pairs to providing spectrograms and waveforms. In other words, although there are a few programmes that provide quite technical support, on the whole, pronunciation feedback is not accorded much systematic attention. This has resulted in difficulties to set hard-and-fast rules that can be applied universally across different settings for categorization.

Hence, one of the workable, if not the best, alternative means for data gathering is to adopt a set of categories based on a database of classroom interaction between teachers and learners with regard to error correction. The researchers have therefore chosen to focus on five of the seven correction types identified by Lyster and Ranta (1997) namely, *Explicit Correction*, *Clarification Requests*, *Verbal Metalinguistic*

Feedback, Elicitation and *Repetition*. It was found that these error correction types to be most relevant to the provision of pronunciation feedback than the other two error correction types i.e., recast and multiple feedbacks. Another correction type that is common in pronunciation training is *Visual Cues.* It is an error feedback type adopted from most common approach adopted by pronunciation training workbooks and software. Based on the six error correction types, a set of 36 error-correcting act video clips was developed to accompany a set of corresponding questionnaire survey.

A. Participants

The survey questionnaire was conducted on 88 undergraduate students. The participants were first and final year students in private Institution A and public Institution B. In institution A, all subjects are taught in English and the language is commonly used by the lecturers and students for both academic and social purposes. While in institution B, the communication is of a mix between L1 and L2 for both academic and social purposes. Table 3.1 provides the breakdown of the participants in terms of institution, year and gender.

Table 1
Distribution of Respondents

Institution	Year	Male	Female	Total
A	First	11	10	21
A	Final	9	14	23
B	First	14	8	22
B	Final	4	18	22
Total Respondents				88

These students were all native speakers of Malay who had studied English for at least 10 years by the year they sat the national examination in high school. They had also met the entry requirements stipulated by the respective institutions.

The questionnaire had a 5-point Likert scale in a Likert format i.e., Strongly Agree, Agree, Don't know, Disagree and Strongly Disagree. The respondents were asked to mark their perceptions by ticking one of the five boxes in response to a statement pertaining to an evaluation criterion in connection with the different error correction types. Thus the emerging data from the 5-point scales was numerical and analyzed quantitatively. The feedback questionnaire consists of two parts: Parts A and B. The participants were first asked to respond to Part A, which elicited their personal information and their general attitude towards pronunciation. Each of the statements in the questionnaire was translated in Malay, and although it was expected that the students would understand most of the statements in English, the translation was read to avoid uncertainties among the students. The students took between 25-30 minutes to complete the questionnaire.

IV. Findings and Discussion

The analyses in this section are reported descriptively and the result of inferential statistical tests is included wherever applicable. The report will proceed in the following order. Firstly, a report on the overall results of the participants' responses, followed by the analysis of their perceptions by different academic level (year of study), by institution and eventually by group. The basis of the analysis is their judgment expressed as a score on a continuum of 1-5; where '1' denotes strong agreement and '5' denotes strong disagreement. To report these results; means of 1.00 - 1.79 are considered positive, means of 1.80 - 2.59 are taken to reflect fairly positive, means of 2.60 – 3.39 are assumed to represent a neutral attitude, means of 3.40 – 4.19 signify a fairly negative perception and means of 4.20 – 5.00 are interpreted as a negative perception. The score is given in response to an item statement corresponding to the relevant evaluation criteria whilst viewing a video clip of an error correction type. The mean for each of the error correction types is the average mean across the three evaluation criteria.

A. Overview of the analysis of assessment to the error correction type

This subsection reports the overview of the analysis in relation to all the 88 participants.

Table 2
Means for All Correction Types

Correction Type	Mean	Std. Deviation	K
Explicit Correction	1.90	0.915	528
Visual Cues	1.96	0.902	528
Elicitation	2.10	0.921	528
Verbal Metalinguistic Feedback	2.37	0.954	528
Repetition	2.65	1.063	528
Clarification Request	2.86	1.044	528
Total	**2.31**	**1.031**	**3168**

Note: 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree
A high mean score indicates a less positive attitude and a low mean score indicates a more positive attitude

ISBN: 978-1-61804-238-5

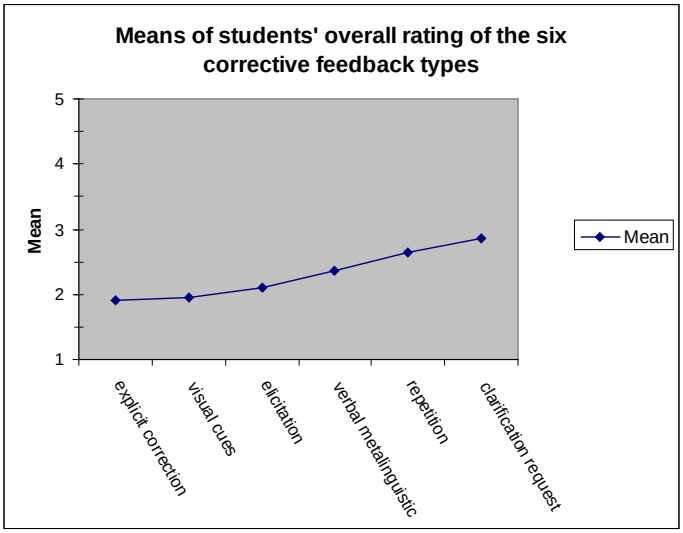

Fig. 1.Means of students' overall ratings of six types of error correction

Table 2 and Fig. 1 show the means for all error correction types in relation to the evaluation from the 88 respondents. Since each respondent evaluated a set of 36 clips, the total number of clips (K) evaluated by all the respondents is 3168 or (88 x 36 clips). Thus there were 528 or (3168 / 6) clips evaluated for each error correction type. The same approach in dividing the clips by the six error correction types is applied for the assessment by year and institution. It should be noted that item statements in relation to some clips were reverse coded to maintain consistency of interpretation.

As a reminder, the value of a mean closer to 1.00 indicates a positive mean while a mean closer to 5.00 denotes a negative mean. The analysis shows that the means for the correction types range between 1.90 and 2.86 with the total mean of 2.31, which reflects a fairly positive rating throughout the population. It also shows that the means for *Explicit Correction*, *Visual Cues* and *Elicitation* are closer to 2.00, while the means for *Repetition* and *Clarification Requests* are closer to 3.00. The mean for *Verbal Metalinguistic Feedback*, however, seems to be midway between 2.00 and 3.00.

The overview reveals that the participants seemed to have a greater preference for *Explicit Correction*, *Visual Cues*, *Elicitation* and *Verbal Metalinguistic Feedback* which are more direct in nature as opposed to *Repetition* and *Clarification Requests* which are more indirect in nature.

B. Analysis of the assessment to the error correction type by year

This subsection analyses the results by year. The purpose of this analysis is to find out the similarities and differences between the responses of the different year groups. The aim is to find out if number of years of learning experience affects the respondents' perceptions and preferences for the different types of error correction. The similarities and differences between the two year-groups are presented in Table 3 and illustrated in Fig. 2. The numbers of respondents for the first and final year are 43 and 45, respectively. Each student assessed a set of 36 clips that yielded a total number of 1548 clips or (43 x 36 clips) for the first year, and 1620 clips or (45 x 36 clips) for the final year. Since there are 6 error correction types in focus, each type has 258 clips or (1548 / 6) evaluated by the first year students and 270 clips or (1620 / 6) evaluated by the final year students. The following results were observed.

Table 3
Means for All Correction Types in Relation to The First and Final Year Respondents

First Year				Final Year			
Corr. Type	**Mean**	**Std. Dev.**	**K**	**Corr. Type**	**Mean**	**Std. Dev.**	**K**
EPT	1.99	0.948	258	EPT	1.82	0.875	270
VCS	1.97	0.931	258	VCS	1.96	0.876	270
ELT	2.14	0.948	258	ELT	2.06	0.894	270
VMF	2.27	0.948	258	VMF	2.47	0.951	270
RPT	2.73	1.034	258	RPT	2.57	1.087	270
CLR	2.92	1.007	258	CLR	2.80	1.078	270
Total	**2.34**	**1.035**	**1548**	**Total**	**2.28**	**1.027**	**1620**

Note: 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree
A high mean indicates a less positive attitude and a low mean indicates a more positive attitude
Abbreviations: EPT stands for *Explicit Correction*, VCS for *Visual Cues*, ELT for *Elicitation*, VMF for *Verbal Metalinguistic Feedback*, RPT for *Repetition* and CLR for *Clarification Requests*

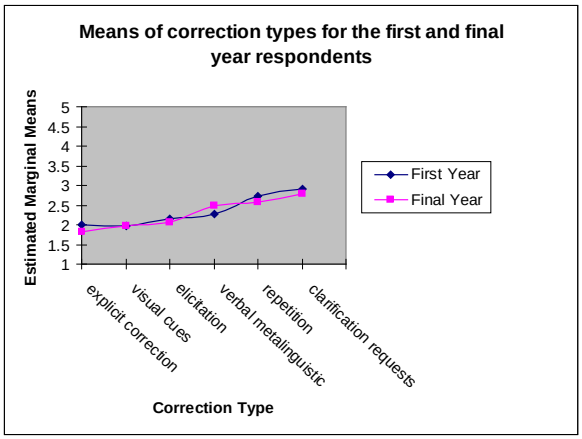

Fig. 1 . Means of the first year and final year students' rating of six types of error correction

Table 4
Independent Samples Test for Year With Regard to Error Correction Type

Corr. Type	t	df	p-value	95% Confidence Interval of the Diff.	
				Lower	Upper
EPT	2.140	526	0.033*	0.014	0.326
VCS	0.383	526	0.941	-0.149	0.160
ELT	1.000	520.379	0.318	-0.077	0.238
VMF	-2.408	526	0.016*	-0.361	-0.037
RPT	1.715	526	0.087	-0.023	0.340
CLR	1.309	525.73	0.191	-0.059	0.297

* Significant at the 0.05 level
Abbreviations: EPT stands for *Explicit Correction*, VCS for *Visual Cues*, ELT for *Elicitation*, VMF for *Verbal Metalinguistic Feedback*, RPT for *Repetition* and CLR for *Clarification Requests*

Table 3 and Fig. 2 generally reveal that both the First and Final Year respondents seem to show quite similar patterns of evaluation. Both groups of respondents have evaluated *Explicit Correction, Visual Cues, Elicitation* and *Verbal Metalinguistic Feedback* fairly positively with the means ranging between 1.82 and 2.47. The Final Year respondents seemed to have evaluated *Repetition* fairly positively with a mean of 2.57 as compared to those of the First Year respondents with the mean of 2.73. On the other hand, the First Year respondents evaluated *Verbal Metalinguistic Feedback* with a mean of 2.27, better than those of the Final Year's evaluation with a mean of 2.47. Both groups seemed to have a neutral attitude for *Clarification Requests.* In other words, the results showed the somewhat similar pattern of preference at the year level as it was for the general overview.

To assess whether differences between the year groups reached statistical significance, a t-test was conducted. The t-test was performed to compare the means between the First and Final Year students as a whole. On running the t-test (Table 4) the result shows that there is a significant difference in their evaluation for *Explicit Correction* and *Verbal Metalinguistic Feedback* in which t = 2.140 (p–value = 0.033) and t = -2.408 (p-value = 0.016), respectively. Notice that the significant result for *Verbal Metalinguistic Feedback* also reveals that the First Year respondents were slightly more positive than the Final Year respondents.

The First Year respondents seemed to appreciate *Verbal Metalinguistic Feedback* more, as compared to those of the Final Year respondents. But the Final Year respondents seemed to appreciate *Explicit Correction* more than those of the First Year respondents. Like the result in the general overview, the means for *Verbal Metalinguistic Feedback* remain somewhere midway between 2.00 and 3.00, which are fairly positive.

Overall, the results suggest that both the First and Final Year respondents seem to prefer what are perhaps the more direct types of correction: *Explicit Correction, Visual Cues* and *Elicitation*. Their experience in learning does not seem to affect significantly the patterns and preferences for the different error correction types. In other words, the results seems to suggest that the metacognitive capabilities may not be much affected by the learners' experience, perhaps in a difference of just about 4 years. Having looked at the means for the different error correction types and the patterns of preferences with regard to the different years, we next continue to investigate the means and patterns of preferences for the error correction types by institution.

C. Analysis of the assessment to the error correction type by institution

This subsection will present the results of analysis by institution; i.e. the respondents in English-medium, Institution A and the respondents in Institution B, where English and Malay are used. The language environment in the context of the present study refers to the language, the respondents are exposed to as a medium of instruction in learning and in other academically and socially related activities. Thus, the aim is to find out if the learning environment affects the respondents' perceptions and preferences for the different error correction types. The result tabulated in Table 5 represents the mean scores for the six different error correction types as evaluated by 44 respondents from each institution. Thus the total number of clips evaluated for each correction type in each institution is 264. The following results were observed.

Table 5
Means for all correction types in relation to respondents from Institution A and B

Note: 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree. A high mean indicates a less positive attitude and a low mean indicates a more positive attitude
Abbreviations: EPT stands for *Explicit Correction*, VCS for *Visual Cuess*, ELT for *Elicitation*, VMF for *Verbal Metalinguistic Feedback*, RPT for *Repetition* and CLR for *Clarification Requests*

Institution A				Institution B			
Corr. Type	**Mean**	**Std. Dev.**	**K**	**Corr. Type**	**Mean**	**Std. Dev.**	**K**
EPT	1.92	0.923	264	EPT	1.89	0.907	264
VCS	1.89	0.811	264	VCS	2.03	0.982	264
ELT	2.19	0.952	264	ELT	2.01	0.881	264
VMF	2.43	0.929	264	VMF	2.31	0.977	264
RPT	2.83	1.063	264	RPT	2.47	1.035	264
CLR	3.01	1.019	264	CLR	2.71	1.050	264
Total	**2.38**	**1.043**	**1584**	**Total**	**2.24**	**1.015**	**1584**

ISBN: 978-1-61804-238-5

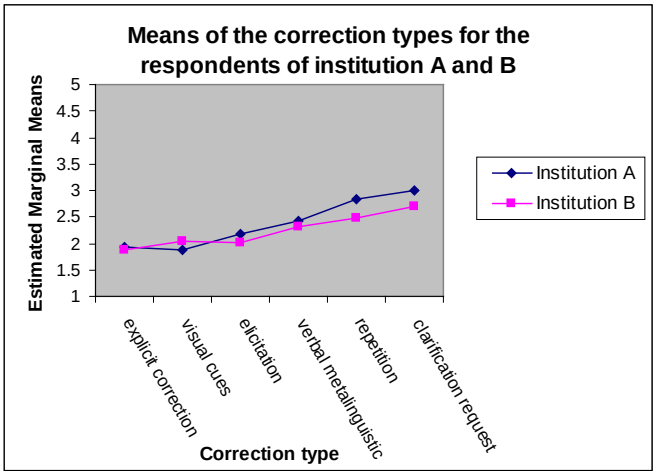

Fig. 2 Means of students' rating of six types of error correction for Institution A and B

Commenting on Table 5 as illustrated in Fig. 3, the results generally show that both groups of respondents tend to share some similarities in terms of the types of error correction they favour and the ones they like the least. Three types of error correction that seem to show differences in the students' perceptions are *Elicitation*, *Repetition* and *Clarification Requests*. *Elicitation* was evaluated fairly positively by respondents of Institution B with a slightly more positive mean of 2.03 in comparison to 2.19 as evaluated by those of Institution A. Respondents of Institution B have also evaluated *Repetition* and *Clarification Requests* more positively than those of Institution A with means of 2.47 and 2.71 as opposed to 2.83 and 3.01, respectively. The means for *Explicit Correction*, *Visual Cues* and *Verbal Metalinguistic Feedback* do not reveal any significant difference for both of the institutions. This is reaffirmed by the t-test result of Table 6.

Table 6
Results of T-Test Comparing Means Between Institutions

Corr. Type	t	df	p-value	95% Confidence Interval of the Diff.	
				Lower	Upper
EPT	0.380	526	0.704	-0.126	0.187
VCS	-1.739	526	0.083	-0.290	0.018
ELT	2.277	522.814	0.023*	0.025	0.339
VMF	1.416	526	0.157	-0.046	0.280
RPT	3.899	525.623	0.000*	0.177	0.535
CLR	3.323	526	0.001*	0.122	0.476

* Significant at the 0.05 level
Abbreviations: EPT stands for *Explicit Correction*, VCS for *Visual Cues*, ELT for *Elicitation*, VMF for *Verbal Metalinguistic Feedback*, RPT for *Repetition* and CLR for *Clarification Requests*

The t-test was performed to compare the means between Institutions A and B for the combined group total. The t-test (Table 4.6) shows there is a significant difference in the respondents' evaluation with regard to *Elicitation*, *Repetition* and *Clarification Requests*, in which t = 2.277 (p–value = 0.023), t = 3.899 (p-value < 0.001) and t = 3.323 (p-value < 0.001), respectively. The total t-test also reveals a significant difference between the two institutions in which the p-value < 0.001. However the difference does not represent an obvious contrast of positive-negative attitude toward the different error correction types, only the degree of preferences within the positive perceptions, depicting a favorable attitude from respondents of Institution B.

The analyses conducted in connection with the respondents of the different institutions show that both groups of respondents in Institution A and B retain similar patterns of preferences as depicted in the general overview and by year. Respondents of both institutions prefer *Explicit Correction*, *Visual Cues* and *Elicitation* which are relatively overt with minimal difference between them. However, respondents of Institution A have less preference for the relatively indirect feedback of *Repetition* and *Clarification Requests* as opposed to those of Institution B who appear to be more receptive to both direct and indirect feedback types, except for *Clarification Requests* with a mean closer to neutral. The result seems to suggest that learning environment does not have a significant effect on the respondents' preferences for the different error correction types.

V. Conclusion

The analyses have shown that the respondents seem to share the same pattern of preferences. Their evaluations were positive with greater appreciation for *Explicit Correction*, *Visual Cues*, *Elicitation* and *Verbal Metalinguistic Feedback* which may be viewed as being intrusive in nature as opposed to *Repetition* and *Clarification Requests* which are more communicative in their approach. Regardless of the generally positive perceptions for all error correction types, the participants preferred the direct type as in *Explicit Correction* and *Visual Cues* more than the semi-direct type of *Elicitation* and *Verbal Metalinguistic Feedback*, followed by the indirect type of *Repetition* and *Clarification Requests*. The participants were pretty similar in their perceptions and preferences when compared by institution and by year. The present study has raised several stimulating questions, which could be explored further.

The present study focuses on perceptions of and preferences for different error correction types. A follow-up longitudinal study might be conducted to study how the different error correction types or the preferred types help the learners acquire the target sound or phoneme permanently.

A thorough piece of research using an observation approach can be carried out to study the actual real-life, in-class corrective exchanges between teachers and students in relation

to pronunciation errors. Such a study may well take into consideration various factors i.e., intrinsic factors, which refers to learners' interests, attitudes and preferences; and extrinsic ones, which relates to external influences, e.g. settings, teachers and approaches. Videotaping the exchanges in the correction moves for later viewing in a stimulated recall procedure could promise much richer data to understand learners' perceptions and preferences in relation to the qualities of each error correction type.

Prototype pronunciation software may be developed taking into consideration the learners' preferences for error correction types in the present study. A synergy of expertise from the pedagogical point of view, IT representation in terms of layout and the technical expertise in the signal reading for ASR technology should be fostered to study the feasibility and appropriateness of developing pronunciation software. Such prototype pronunciation software can be provided to learners to practice their pronunciation and to gather feedback from them with regard to the relevant aspects which require further improvement of the software.

ACKNOWLEDGMENT

We would like to acknowledge Universiti Teknologi Petronas for the financial support to conduct this study as well as the presentation of the outcome of the study in the conference.

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Apulia Future Learning 3.0: cluster of Education and Learning in Apulia Living Labs

Italo Mattia Spada, Giovanna Avellis, Gaetano Grasso

***Abstract*—** Apulia Future Learning 3.0 is a cluster and a Thematic table of Education & Training projects in Apulia Living Labs, based on a regional aggregation of SMEs, public organisations, schools and universities located in Apulia region, linked by the desire for necessary change in learning methodologies for the European society of the future. Referring to the European Plan *"Opening up Education"*, oriented to the increase of digital culture between different learning contexts, with the obvious value of sharing knowledge for a new standard for teaching and the transfer of innovative expertise.

Thus the need for creating useful cooperation in order to define new lines of action, which, through research and innovation can develop new services for citizens, students and workers.

***Keywords*—** Interactive Learning Environment, New Educational Technologies, Cooperative/Collaborative Learning, E-Learning and Society.

INTRODUCTION

In Italy we need to solve many problems in the Education and Training sector in terms of infrastructures, technologies and methodologies. ENOLL represents an opportunity of networking with advanced experiences in Europe to share a collaborative approach in finding demand-based innovative solutions.

Apulia Future Learning 3.0 arises to transform the threats of the digital divide into opportunities of developing new knowledge paradigms for the transformation of the processes of learning, coherent with the European standard of all levels of education.

New technologies could have an extraordinary effect on efficiency, access and equity of education. Teaching and learning could be optimised by supplying individual pathways of learning, improving the cooperation online and the mix between formal and informal learning. Thanks to Web 3.0 and new multimedia tools as well as virtual reality and augmented reality, the informal way of learning has become dominant, conditioning the evolution of Education. Innovation leads to an upgrade of the *"old" virtual learning environment*, based only on the use of LMS/LCMS platforms, with the more flexible *personal learning environment*, i.e. the education environment is oriented to the individual user, supplying both informal learning, based mainly on web resources, and formal learning based on conventional designed e-learning platforms. It is then aimed at the *analysis and experimentation of new learning methodologies starting from the demand for innovation of the regional context.*

In fact, with reference to the activities of the local Living Labs funded through the Apulian ICT Living Labs programme, Apulia Future Learning 3.0 represents a true unique experience of thematic aggregation of stakeholders in which technologies are the tools of connection between single projects and the LL protocol is the mechanism that allows the growth of the network, looking at three lines of development:

- ***Innovative learning, with particular focus on social learning;***
- ***New Media and Robotics, with particular focus on friendly interfaces;***
- ***Adaptive Learning, with particular focus on inclusion processes.***

The organisation model of Apulia Future Learning 3.0 is characterised by the cooperation between SMEs, Education Institutions, Public Schools, Universities. AFL 3.0 is coordinated by CETMA Consortium(Host Institution) with the participation of *Universities, University Departments, Research Centers, Schools, Associations, Training Institutions, SMEs.* The governance model will involve each member in the following strategic activities:

- Benchmarking of educational systems in the world;
- Monitoring of the State of the Art of Open Educational Resources (OER);

This work was supported in part by the U.S. Department of Commerce under Grant BS123456 (sponsor and financial support acknowledgment goes here). Paper titles should be written in uppercase and lowercase letters, not all uppercase. Avoid writing long formulas with subscripts in the title; short formulas that identify the elements are fine (e.g., "Nd–Fe–B"). Do not write "(Invited)" in the title. Full names of authors are preferred in the author field, but are not required. Put a space between authors' initials.

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- Defining pilot actions and development programme;
- Implementing Communication Plan by multimedia channels.

Conscious that "Knowledge is OPEN when it is available through accessible tools for all citizens and for all social levels" , AFL 3.0 would stimulate both offer and demand in producing advanced contents in the European context, by using new technologies. The Open Educational Resources are fundamental for spreading learning environment contexts where the contents could be adaptable to the user needs.

Apulia Future Learning 3.0 is aligned with the approach "Open Access" and stimulates the use of "Open Source" tools with the aim of:

- Efficiently sharing research results by open access to scientific productions;
- Defining new standards of learning contents and sharing them;
- Helping educational institutions to improve their digital performance;
- Connecting classrooms;
- Improving multilingual thesaurus for better availability of content translation.

Referring to the involved structures of AFL 3.0, it is clear that the available technological resources cover a wide range of application. This kind of technological potential could be available through an Open Lab approach offering:

- Technical-educational Laboratories with advanced instruments;
- Spaces for conferences or public meeting/focus group with communication instruments (videoconference, web streaming);
- Interactive spaces based on virtual reality and augmented reality;
- Co-working locations;

Thanks to the wide range of services offered and in respect of a global market focused on continuous evolution, Apulia Future Learning 3.0 places itself in different learning sectors:

- Public Education;
- Professional training;
- Commerce;
- Communication and marketing;
- Industry;
- Agriculture;
- ICT e new media;
- Special education needs
-

This paper is organised as follows.

Section 2, describes user involvemente.

Section 3, …

Conclusions …

I. USER'S INVOLVEMENT

Taking in account that the structure of our Living Lab could be defined as a "Services Oriented Community", the users' role in AFL3.0 is strategic in terms of:

- Co-design of services/products to be realized as solution for user needs
- Test and validation of services/products to be realized as solution for user needs
- Market design for business model developments
- Methods and tools adopted for the active involvement of users are:
- Operative focus group for sharing problems and difficulties, designing solution perspectives,
- suggesting strategies for the development of results, further stakeholder involvement,
- networking actions.
- Workshop for dissemination
- Communication plans

In terms of concrete practice of the Living Lab, the DemoLab, located at users' headquarters plays a fundamental role, where the deployed technological solutions could be applied every day by a number of users: teachers, students, families, professionals etc. The DemoLab becomes the core of the Living Lab, the connection between knowledge, real life and concrete experience, and technology.

II. VALUE

Based on the expertise of each partner and in particular on the experience of each Local Living Lab Project, the Apulia Future Learning 3.0 supports the three lines of activity previously mentioned, emphasizing the *features* and the *performances* of each related project as the following scheme:

- **Innovative Learning:**

This line of technological specialization includes the following local Living Lab project:

- **S.P.L.A.S.H -** Social Learning Platform dedicated to schools: teachers, students, families are the users able to use the flexible and open source platform through all communication devices (tablets, smartphone, notebooks). The platform is also : e-library of self designed contents; e-portfolio of student skills, with the deployment of::
  - services aimed at expertise certification and the collection of credits;
  - Services for students with Learning Disabilities;
  - Services for MultiLanguage learning;
  - Market place Services for content socialization.

- **Edil Learning** - Social Learning Platform for the professional building sector. The technological solution offers integrated learning modules aimed at the new training needs of the sector, evolving with new materials, new building techniques and the environment sustainability. The platform has been realized by a co-design strategy between professional schools of the building entrepreneurs association, the University of Salento and the companies offering state of the art technologies.

- **Scuola Aperta** – Digital Administration Platform for Schools. Open Source based, the platform offers services for a more efficient management of the administrative processes and

the complete

education infrastructure

- **New Media and Robotics**

This line of technological specialization includes the following local Living Lab project:

- **ASTRO** – Humanoid Robot for autism spectrum disorders (ASD). Advanced Tool for education and rehabilitation, it is useful in terms of socialization of children, reducing stress due to emotional inference. Fundamental role of end users in the co-design of the learning module through computer interaction between children and robot.

- **Easy Perception Lab** – By using augmented reality techniques, a new approach has been tested using cultural heritage for learning. It is possible to transform historical heritage into an interactive object in order to increase the access to museums for learning. This technique allows the use of museums also in terms of remote access.

- **Robin** – Platform of learning management system, based on use of Tablet, PC, Smartphone e robotic multimedia systems for individual learning and for the contents production aimed at students with Learning Disabilities, in particular students with dyslexia. Fundamental role of users in co-designing the learning module through computer interaction between children and robotic systems.

- **CLIOedu 2.0** – Based on a virtual environment, the system offers solutions for new management models of knowledge processes at schools, by using a mix of NGA and cloud computing for a collaborative space of knowledge building.

- **INRL** – Based on an approach of learning by interacting and collaborative remote learning, a new methodology of on-line learning has been tested, capable of promoting a more suitable interaction between end users and contents. In particular, 3D augmented reality has been applied to professional on-line training modules in order to create the conditions for a more attractive learning environment, also in terms of business success.

- **Adaptive Learning**

This line of technological specialization includes the following local Living Lab project:

- **Agripointer** Technological supply for agrifood workers' training aimed at the implementation of ICT tools for certification processes in the value chain of agrifood productions. The system allows the adaptation of training procedures to the firm's dimension and to the SMEs business model, in order to promote the local products.

- **ALL** – An adaptive system of web-based learning, aimed at offering learning tools to cross cultural gaps and gender gaps.

III. Directions and Future Plans

The know-how and the experience developed will allow the Living Lab Apulia Future Learning 3.0, with the use of a CMS Open Source platform, to implement the following integrated actions:

- Promotion and diffusion of methodologies and innovative tools for Education, through the organization of events, meetings, conferences and international focus group;

- Learning innovative programme "Open";

- Participation in national and international projects;

- Development of smart business model for different economical contexts;

- Innovative Start-up creation;

- Participation in international research groups and industrial development.

IV. Conclusions

The idea of aggregating entities (SMEs and Research Laboratories) WHICH operate in the same FIELD OF research AND development and, in the same AREA allowed an easy aggregation of ideas and areas of interest on which working in an integrated form. The result of such kind of action led to include in one project several objectives on which learning Apulia environment intends to invest with the main aim to create new componential transferring models able to be affordable and technologically advanced.

Acknowledgment

Authors thanks all the partners of the E&T projects in Apulian ICT Living Labs and LivingLabs SMART PUGLIA 2020. This work has been funded by Apulia Region, Area Politiche per lo Sviluppo, il Lavoro e l'Innovazione, Servizio di Ricerca Industriale e Innovazione, Ufficio servizi die Government e ICT and realized in collaboration with InnovaPuglia, under P.O. FESR PUGLIA 2007-2013 – Asse 1 – Linea di Intervento 1.4 A zione 1.4.2 – Investiamo nel vostro futuro, Supporto alla crescita e allo sviluppo di PMI specializzate nell'offerta di contenuti e servizi digitali Apulian ICT Living Labs – Verso Puglia Digitale 2020.

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The use systems for measurement using a computer in the school laboratory to explanation for temperatures during the water heating

Radek Nemec, Stepan Hubalovsky

***Abstract*—** In science subject during the learning of the temperature is important to justify the differences in dependency of the temperature during the heating. To facilitate understanding of the dependency we suggest using of a graphical representation. Therefore, to express the best graphic demonstration, the system for measurement using a computer in the school science lab can be used. The system allows showing the dependency in real time.

***Keywords*—**Experiments supported by ICT, temperature sensor, the system SMPSL.

I. Introduction

FOR the real display of temperature dependency during heating the systems for measurement using a computer are used. These systems are usually very expensive. As an alternative system was created SMPSL (http://smpsl.radeknemec.cz). The SMPSL (Measurement System Using a Computer in School Lab) enables using sensors connected to the hardware of the system via a USB connection to a PC evaluation program. The evaluation is created using a graphical representation of values from the computer. It enables control and measure - see Figure 1. By constructing the hardware part from programmed microcontroller and using of a few components (Figure 2), USB connection (Figure 3) a free program available SMPSL such a system can take just a few euros. The system can be connected to commercial sensors or the sensors can be developed in the same ideology as the system itself, i.e. the most acceptable options - both financial and material.

One of the presented sensors is sensor for temperature measurement.

Fig. 1 System SMPSL

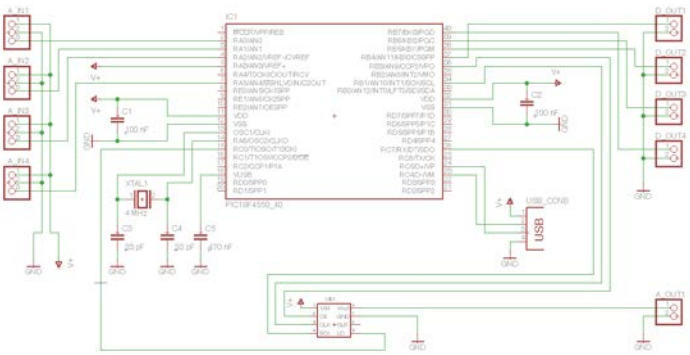

Fig. 2 System SMPSL – connection diagram

This research has been supported by: Specific research project of University of Hradec Kralove, Faculty of Education in 2014.

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ISBN: 978-1-61804-238-5

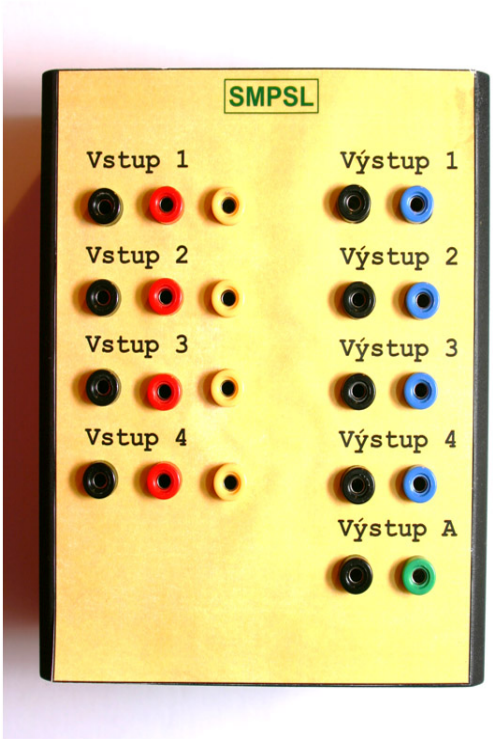

Fig. 3 System SMPSL

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II. Science Experiment

Science experiment offers a way to observe, document, set hypotheses, draw conclusions and finally gain knowledge about a phenomenon. It is a way how to actively acquire knowledge.

When carrying out science experiments the observations and experiments themselves are conducted. This will enrich all science learning and work of pupils and students in the classroom is activated. They will get practical skills for understanding the natural aspects of the world. At the same time scientific observation and experiment is strong motivator of teaching and it strongly contributes to the development of science pupils' interests.

Natural-science experiment unlike mere demonstration experiment is not only demonstration of already known phenomena, but pupils and students based on their hypotheses verified phenomenon itself [1].

III. Natural Science Experiments Using ICT

Thanks systems for measurement using the computer, the above described observations and experiments can be carried out with the use of ICT, which is a major advantage in the rapid collection of large amounts of data and real processing in the form of graphs. Graphical representation helps for easier understanding of a phenomenon, which is our purpose. [2], [3], [4], [5].

IV. Experiment Explaining the Course of Temperature in Heating Water

In science subjects (e.g. physycs) during the teaching of the temperatures it is needed to justify the difference in heating of water with free surface and covered surface.

The graphic representation is used to help to understand this phenomenon. Let's present demonstration of this phenomenon using for computer measurement in the school science laboratory. The experiment requires a computer system for measuring a temperature sensor.

In addition to heating the water with free and covered cover surface the experiment with heated ice will be presented too.

A. Temperature Sensor

Temperature sensor is simple sensor consisting of a sensor adapted directly to the low voltage output with a suitable voltage (power and output) for system SMPSL with linear characteristic 10mV/°C. The range of temperature is from –40°C to +125°C. The sensor should be placed to a suitable case (e.g. steel tube with thermally conductive paste for better transmission of the heating from the surrounding) and provide appropriate cables with connectors for connection to the system SMPSL (Fig. 5). The total price of self-produced sensor is tenths of price of commercial sensor.

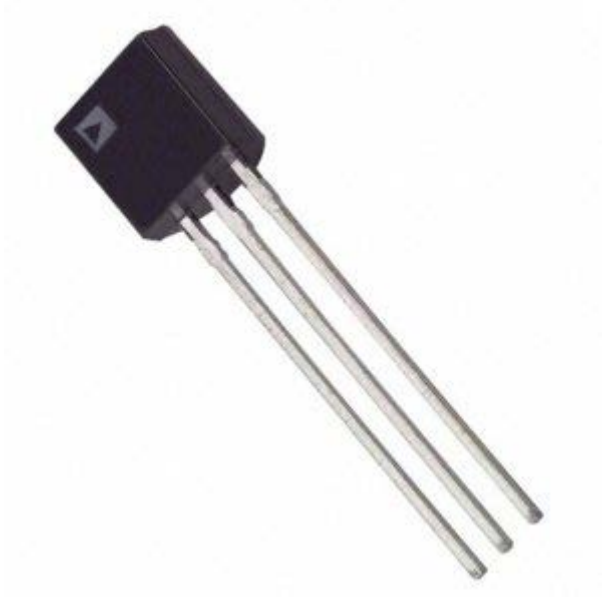

Fig. 4 Temperature sensor

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Fig. 5 Self-produces sensor with cables and case

In addition to monitoring and clarification of process of heating water, the temperature sensor can be used, for example in the following experiments:

• spontaneous cooling of sensor (dry / wet, with / without flapping)

• Dissolution of ice cubes in fresh and saltwater

• Water cooling rate of water

• How to change the temperature in the freezer or refrigerator during the day

• How the temperature changes at a particular point during the day and night.

B. Experiment realization

For experiment realization, in addition to already mentioned computer system for measurement and temperature sensor is need a container with a lid and heating source. For comparison between temperature curve with free surface and covered surface covered would be ideal to have two containers (one with a lid, second without), two sources of heating and two temperature sensors. The current realization of the experiment would guarantee the same conditions under which the experiment will be carried out (ambient air temperature, pressure). For demonstration experiment is carried out first one and then the other measurements – see Figure 6.

Fig. 6 Sestava pro měření

Before performing the experiment, it is first necessary calibrate the temperature sensor (Fig. 7). It is advisable to calibrate it before the lessons.

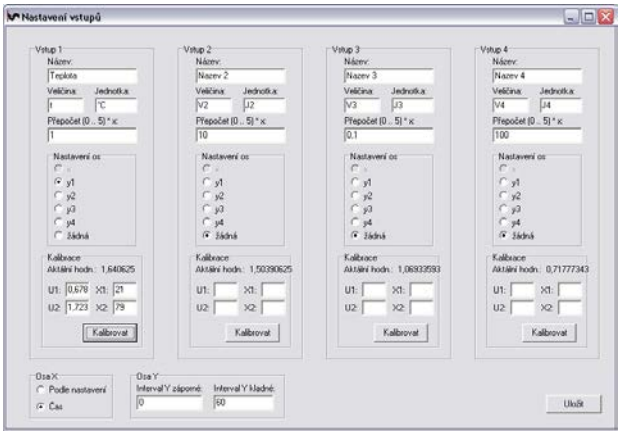

Fig. 7 Calibration

The resulting temperature dependence of heating of water with free surface is shown in Figure 8.

The resulting temperature dependence of heating of water with covered surface is shown in Figure 8.

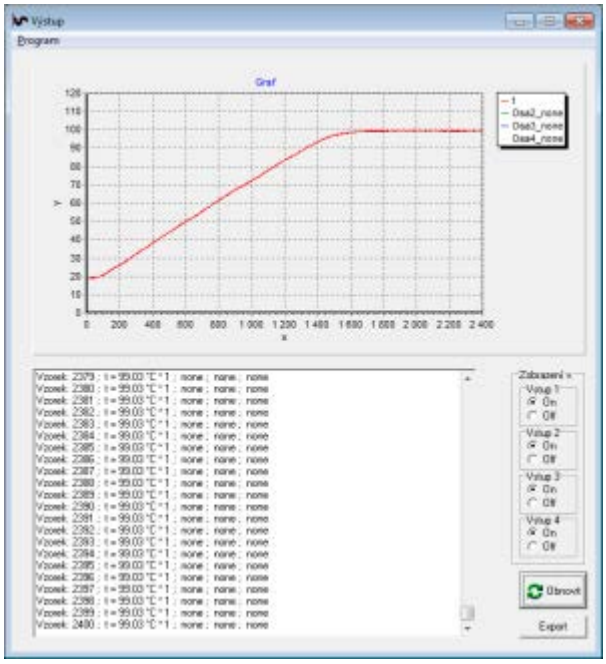

Fig. 8 Heating of water with free surface

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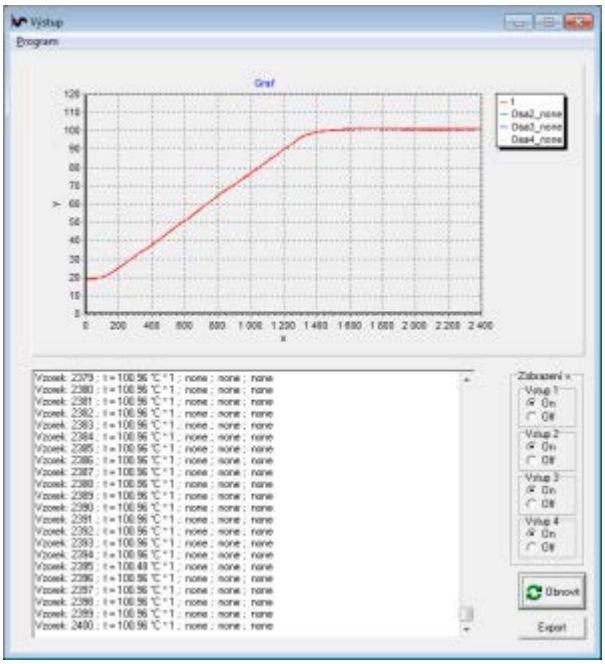

Fig. 9 Heating of water with covered surface

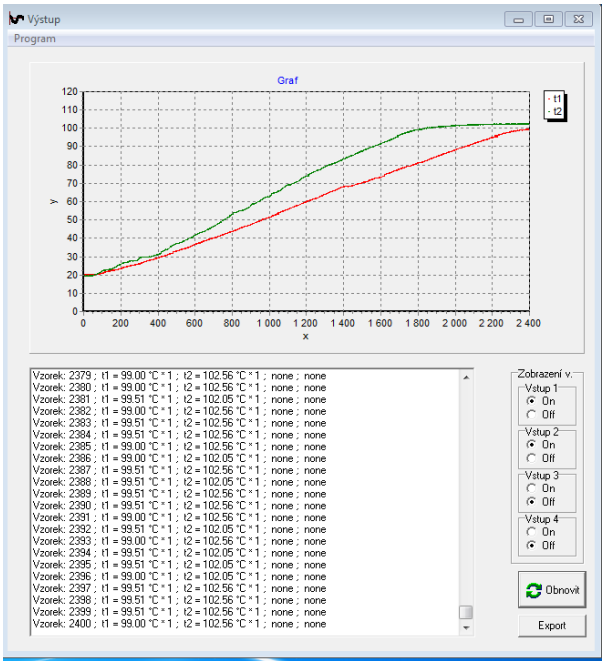

Fig. 10 Heating of water with free and covered surface

Heating of ice is shown on the Figure 11. In this case the solid state (ice) we get to the boiling point. For this measurement to SMPSL the temperature sensor is connected to thermometer and two beakers with hot and cold water to calibrate and set the input.

The measurement is carried out by immersing the calibrated sensor into ice, by setting the measurement time, and initiating a measurement.

Fig. 11 Measurement of heating of ice

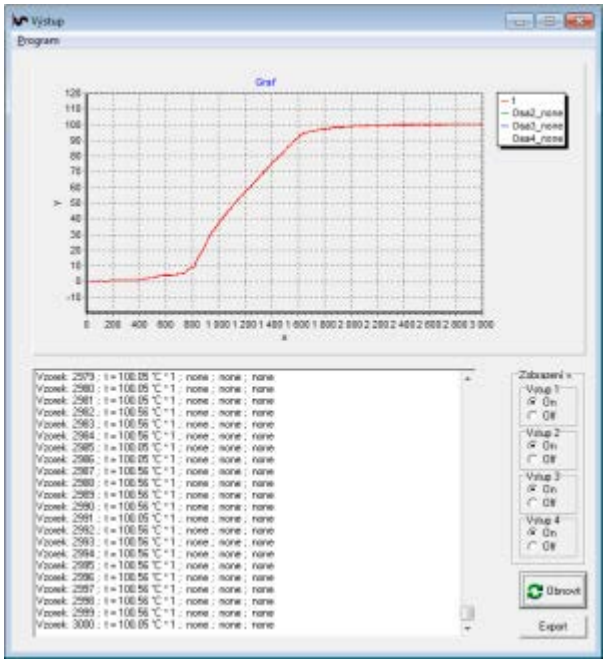

Fig. 12 Heating of ice

When this measurement demonstrates known phenomenon in which the first heat the entire volume of the container and then starts to increase until the temperature. The same thing happens then is shown on the Figure 12

C. Bonus experiment

In the case that we have sufficient time the experiment can be proceed spontaneously. It can be demonstrated cooling liquid of the water with free surface and covered surface. This

ISBN: 978-1-61804-238-5

experiment is, however, very time consuming, so it is appropriate to include heating in the beginning. In the time the student will evaluate the heating dependencies it can in the background provided this bonus experiment [6].

V. CONCLUSION

The important rule, as described above, is that natural science experiment has to fulfill its sense, therefore, test hypotheses and conclude it. Without this they are only mere experiments in which the pupils and students only saw a demonstration of various phenomena. They should enrichment their knowledge by visual demonstration, establishing and verifying hypotheses, and by better understand the science principles. [7].

ACKNOWLEDGMENT

This research has been supported by: Specific research project of University of Hradec Kralove, Faculty of Education in 2014.

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Easy Perception Lab: Perceptive Ergonomy through Virtual and Augmented Reality in MAUS Museum

Invitto S., Spada I., Turco D., Belmonte G.

Abstract: The project Easy Perception Lab (Apulian ICT Living Labs. Puglia Region Area Development Policies, Labor and Innovation Services - Industrial Research and Innovation - Office Services e-Government and ICT) stems from the focus on experimentation and the creation of new tools that enable interaction museum conceptualization of new learning objects (museum digital content) as part of learning process - educational and testing of new technological prototypes aimed at increasing the experiential user interaction (all internal contexts of educational, cultural and museum). The innovative prototype Ep_LAB allows a large pool of users (students, professors and museum members) to test a new approach to historical and scientific use, both physical and virtual use. The partnership Ep_LAB, consisting of MAUS-Environment Museum of the University of Salento, Agilex Srl and CETMA Consortium, produced the required deliverables from the project by interacting heterogeneous technologies and scientific models. Also, the innovativeness of the project, as well as the use of ICT, is related to its validation techniques related to ergonomics perceptual and cognitive neuroscience too.

Keywords: Museum Learning, Virtual Reality, Augmented Reality, Perceptive Ergonomy.

Introduction:

In recent years, many researches have focused on how technologies can be linked to the cognitive neuroscience of support structures within the educational museum. In this paper we will briefly present the Living Lab Easy Perception Lab, and the theoretical basis, that explain how, in contexts related to the environment perceptive museum and cultural heritage, studies of neuroaesthetic and the use of new technologies interconnected with new discoveries neuropsychological, can become building blocks to support the places where the subject experiences an educational context, art and culture.

This work was supported in part by the Apulian ICT Living Labs Apulian ICT Living Labs. Puglia Region Area Development Policies, Labor and Innovation Services - Industrial Research and Innovation - Office Services e-Government and ICT
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The Neuroaesthetic, is a new trend that emerges from the premises of psychophysiology and cognitive neuroscience, founded twenty years ago by some studies of Semir Zeki[i,ii], one of the greatest contemporary neurobiologists. Research in this area are concerned with how our system can analyze neurocognitive visual stimuli and synaesthetic related to art or aesthetics in a broader sense. Example of how this new movement has had great resonance in the cultural field is the recent Conference on Art and Perception (Brussels 2010), where they examined various aspects of the cognitive sciences, perception, art and aesthetic phenomena in a scope and methodologically heterogeneous based on different theoretical approaches[iii]. It emerged as users can perceive art and aesthetics from a psychological point of view and neuropsychological and how this vision can change the very concept of art. The purpose of this interaction is heterogeneous to develop critical skills, new and cross-cutting, and self-management education, including levels of virtual communication modulated by simple activation and attentional brain activity of the subject, also enhancing the user's level of motivation. This construct is based on the theories of Embodied Cognition[iv], tied to recent research in the field of cognitive science, dynamical systems, artificial intelligence, robotics and neurobiology. For the embodied cognition learning multi-perceptive allows you to evaluate how the system affects the motor and perceptual skills and knowledge and enhances brain connectivity: the body modulates the learning process and increases the capacity attentional and motivational. In a classical context of museum education body is partially inactive because the user needs to 'see' without having the chance to see him physically stimulus. The levels that are activated in a museum visitor, in situations of high 'competence' of the object perceived, are symbolic and affective levels [v,vi]. The interaction of the subject with the object to be observed and / or learning interaction is extremely complex cognitive process that requires both top-down (driven by the knowledge, experience and empirical representations of semantic / cognitive subject), both of bottom-up (essentially guided by the characteristics of the object, in a state of 'perceptual neutrality'). The study by Massaro et al.[vii] took in account the influence of bottom-up processes and top-down processing on the

visual artistic paintings observed while naïve. The subjects were asked to look at paintings in color or black and white paintings categorized as either static or dynamic; accounted for half of the images painted with natural settings and half with human subjects: the results on the behavior of eye movements (saccades) and fixations (both measured with an eye tracker) have shown that in artistic representations with human subjects (with faces painted or with affordances of movement[viii]) the top-down processes outweighed the bottom-up levels. In contrast, bottom-up processes prevailed in the analysis of images in environmental content (pictures with naturalistic representations). These results can be discussed in terms of a reshaping of the 'embodied perception'. As illustrated by Freedberg and Gallese[ix], the hypothesis of 'embodied simulation' favor an analysis of the motor, via a 'pre-rational' to make sense of the actions, the visual affordances and emotions expressed in the image.

Museums, Cultural Heritage, Virtual Reality and the Customers Accessibility: Ep_Lab

Now, starting from these results, we can imagine how it is 'cognitively' useful for the user who participates in a vision of educational / museum, can act directly with the subject, both in the real sense that in a virtual sense. It may strengthen studies of perceptual facilitation, such as analysis of colors, positions, and shapes of objects in the museum facilities, to facilitate the understanding and learning, and to avoid the decrease in attentional states during the observation museum. I quote here a recent study (M. De Tommaso [x]) related to ergonomics visual architectural and artistic work that has sought the help of virtual reality to assess how brain activity can be activated as a function of different types of environments and as environments, in turn, can become assisted-living in ergonomics perceptual function. Based on these theoretical assumptions, the project Easy Perception (Ep_Lab) is designed according to the request of the MAUS - Museum (DiSTeBA - University of Salento, Prof. Genuario Belmonte Director), the end user, member of Apulian ICT Living Labs, for a presentation on the facilitation in the communication of scientific content to the general public, with particular attention to individuals with disabilities. The project, winner of 11 winning projects of the first call of the call Apulian ICT Living Labs, was presented May 22, 2013 at the Innovation Festival in Bari, by Sara Invitto (DiSTeBA - design, testing and validation of Ep_Lab), Italo Spada (CETMA, - design and production Augmented Reality and Virtual Reality) and Dario Turco (Agilex, - digitization and web platform and Augmented Reality). Living Labs provide a partnership between Research Laboratories, Public Bodies, Universities and Companies that operate in the field of Information and Communication Technologies (ICT). In this sense the project has best expressed this concept by promoting the interaction between the company (Agilex), research laboratories (CETMA and Laboratory Human Anatomy and Neurosciences) and end user (MAUS museum). Through the exchange of ideas, knowledge and aggregation between researchers, enterprises and end-users, have defined the new prototype testing related to the possibility of intervention. The Museum Environment (MAUS), in cooperation with the Laboratory of Human Anatomy and Neurosciences of the same DiSTeBA, CETMA of Mesagne- Research's city and ICT company Agilex of Lecce, has developed prototypes of experimentation related to a new type of teaching. The project Ep_Lab (Easy Perception Lab), it was proposed to build a prototype linked to digital applications that take advantage of partly augmented reality and virtual reality, to define new paradigms of education and teaching laboratory, but at the same time that are versatile and scalable. The prototype is expected, as well as the digitization of objects located in the museum MAUS, the possibility that they are easily accessible in their content, even for users with disabilities, and which give the possibility to the museums to enter the network and to create an environment interactive teaching. The idea has been to define new functional educational content to science and to define new models of experiential enjoyment, the scientific heritage present in MAUS, with a working prototype validation and testing of the same that has been carried out thanks to the participation Laboratory of Human Anatomy and Neurosciences (through analysis on the customer satisfaction about the level of attention and learning assessed through psychophysiological techniques and usability of the website built). With this type of intervention, various types of users can have an 'easy' heritage present in the structure MAUS Museum. During the year, we are planning several meetings took place in order to define local objects of enjoyment, an intermediate workshop presentation of the results, and a final workshop. During the year the MAUS carried out the following activities: involvement in design Easy Perception Lab for Research and identification of scientific material sample (images, objects, printed matter, etc.). Digitally acquired with the object Plankton and Tarbosaurus Bataar; Design component of the prototype dedicated to the enrichment and archive functionality Museum; Design component of the prototype dedicated to the use of data, not only through the app, but also through the integration with other platforms; Design the format

of multimedia content and use scientific sample. In particular, the definition of facilitation for users linked to teaching, 3D interaction, and augmented reality. The museum is' State Involved in the following development activities Perception Easy LAB: Digitization of archival samples, which employs the MAUS in the trial; integration of the app / front-end integration of the prototype dedicated app / front-end prototype dedicated to the enjoyment and interactive 3D AR for cultural content. Front-end component of the prototype on the data-entry museum archive data; front-end component of the prototype relative to navigation and consultation of the digital archive of the app and linked to the network of museums; the format of interactive use. Inside the building we then carried out a Psychophysiological trial (fig.1, fig.2) through ergonomic techniques EEG effects created by the prototypes of Virtual and Augmented Reality products for the network laboratory and museum as well as the validation and testing of accessibility, interface front end web site museum. There have also been various activities of involvement in training activities for the use of the prototype. Specifically:

- Creation of the contents of the interactive calendar printed on evolutionary represented through images of objects present in the MAUS. The calendar shows digital interaction, through QR code with 3D movies and sounds.
- Preparation of the tabs systematic paleontological site MAUS
- Usability Questionnaire based on User Centered Design and Usability Analysis of website.
- Psychophysiological analysis of the contents presented in 3D and 2D[xi, xii, xiii, xiv, xv, xvi, xvii].

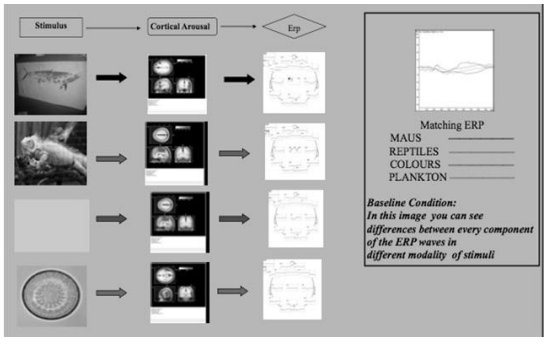

Fig.1 Task with Event Related Potentials Recording

Fig.2 Subject during a task with EEG Cap ans Anaglyph Glasses

Fig. 3 Students during Plankton (i.e., globigerina) 3d active glasses projection

The final products of the project were the video in Virtual Reality of Plankton (fig.3) on move with interactive services, or through a screen with 3D projection and interaction with a playstation, through including a kinect installed on a 3D TV, and an interactive video with Augmented Reality, with a subject a Tarbosaurus Bataar. At last a website with cards systematic paleontological finds inside the MAUS and geo-referencing of the same for the location of the discovery of fossils. Concurrently with the completion of the proposed solutions, an experiment was carried out aimed at the validation of the interfaces AR (augmented reality) and VR (Virtual Reality), through the registration of psychophysiological variables (Event Related Potentials and Galvanic Skin Responce) based on theoretical assumptions to 'perceptual ergonomics. The web interface has been validated through usability testing UCD. All tests of perception and usability were tested in students of Educational Sciences, Mathematical, Physical and Natural and Cultural Heritage, University of Salento. For the realization of the project were actually involved several researchers both nationally and internationally (respect the paleontological images we involved Rinchen Barsbold, respect the part related to the plankton, marine biologists like Tod O'Brien and Russell Hopcroft of NOAA for copepod images, Stefano Piraino for a

image of a recent discovered jellyfish, Maurizio Pinna, Alberto Basset for images of phytoplankton and Genuario Belmonte for the supervision of the size, proportions and movement of the images). At the moment, the results of the validation and the ergonomic study of the finds of the MAUS were objects of publications in peer review journals and presentations at national and international conferences.

Conclusion: Psychophysiological Results with EEG show that the 3D images with Virtual Reality and Augmented Reality activated ampler arousal in frontal and frontoparietal lobes with respect to the 2D images which activated ampler arousal in occipital lobes. These results indicate that there is a greater arousal when the environment is immersive and even more so the stimulus is 3D and multi-dimensional. Behavioral results show that users are more involved during an interactive museum learning, immersive and multisensory learning rather than in a 2D static and non-immersive learning (outside the museum context.) In our experience, the Living Lab network helped us to build a museum technological learning linked to just an experimental learning session based on embodied cognition.

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ISBN: 978-1-61804-238-5

Knowledge Sharing Management in Political Organization: ICT Roadmap model

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Abstract— The multi-ethnic nature of the Malaysian society has made it necessary for the politicians, representing the varied groups to share knowledge pertaining to nation building through the political machineries available. Building new knowledge-based systems today usually entails constructing new knowledge bases from scratch. It could instead be done by assembling reusable components. System developers would then only need to worry about creating the specialized knowledge to the specific task of their system addressing the information needs of the politicians. This new system would interoperate with existing systems, and the Internet, using them to perform some of its functions. In this way, declarative knowledge, problem-solving techniques, and reasoning services could all be shared among systems. This approach would facilitate building bigger and better systems cheaply. The ICT infrastructure to support such sharing and reuse would lead to greater ubiquity of these applications, potentially transforming the knowledge industry. This study attempts to present a vision of the future in which knowledge-based system development and operation is facilitated by infrastructure and technology for knowledge sharing as stipulated by the ICT infra-structure and ICT policy of Malaysia. Based on ROADCON model, the study describes an initiative currently under way to develop these ideas and suggests steps that must be taken in the future to try to realize this vision through development of a roadmap model for knowledge sharing within the political party organization.

***Keywords*—**Knowledge management, ROADCON model, Information System, politics

I. Introduction

Knowledge can be more effectively shared within an organization via technology, more so in large organizations which are geographically dispersed. Knowledge sharing and collaborating has become a reality among co-workers around the globe. Enabling technology plays an important transformational role and has become a key part of changing the corporate culture to a knowledge sharing culture. Information and knowledge can be retrieved quickly, and effectively posted on the system for access by others within and beyond the organization.

This work was sponsored and financed by Universiti Teknologi PETRONAS.

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In the new era of globalization, accelerated developments in information technology and the widespread availability of communications have had significant implications for the generation, integration and transfer of knowledge. Knowledge has become a precious global resource – the embodiment of human intellectual capital and technological know-how. The general consensus in the business environment is that organizations need to seek fundamental insights into how to become sustainable and to stay ahead in the competition. Knowledge management is a newly emerging discipline involving the identification and leveraging of organizational knowledge. It has become the key strategic resource for organizations aiming to improve effectiveness and efficiency.

In the information age, the only way an individual or his country can thrive is by being knowledge empowered. However, for people in the developing world, coming to grips with this new era requires an endemic mental 'reconstruction of reality' (Low, 2000). An important factor for consideration is the knowledge which arise synergistically out of this cybernetic fusion of information communication technologies (ICT) and humanity (Low, 2000). Generally ICT is considered as a force for social changes in several areas such as invigorating the economic systems (Gates, 2000), empowering citizens (Gore, 1994) and also encouraging social and psychological well being (Cole et al., 2001). According to Selwyn and Gorard (2002), ICT has the power to provide a 'technical fix', which means the ability of technology to solve complex social problems. Leaning (2004) claims this idea has arisen primarily because ICT has been learnt in societies where such beliefs are common currency. Technology interacts with society in various ways, and it is suggested that ICT be understood as being 'modal'– something that may be used in a particular way in one society but not in others. For instance, according to Thomson (1990), media are socially contingent means of communicating information, and according to Kress and Van Leeuwen (2001), the internet is a mode of communication or according to Slevin (2000), ICT is a moderating form of cultural transmission. Public sector organizations now realize that many benefits can be achieved by using internet technology to improve electronic government applications in both internal processes and interactions with external constituencies (Chircu and Hae Dong Lee, 2003; Lenk and Traunmueller, 2000). Slevin (2000) believes that new ICT is a motivation for effective change in the organization of companies through working processes. In other words, advanced use of modern ICT and fundamental changes in an organization in the direction of the new organizational logistics has some inherent social risks.

Today, technological and organizational development has become increasingly intertwined, as organizational changes need new ICT and at the same time ICT enables new organizational forms, such as the Virtual Organisation (VO) (Riemer and Klein, 2003). VO refers to distributed, ICT-based work arrangements that keep people from meeting regularly. However, insufficient duration of projects leads to an unpredictable work setting that allows the formations of sustainable social structures for challenging tasks. This collaboration is based on trust, shared understanding of the joint task and the ability to create knowledge as a group (Riemer and Klein, 2003). Shared understanding is something which is harder to achieve than initial trust, so a lack of shared understanding might prevent the effective establishment of trust (Riemer and Klein, 2003).

The success of VOs depends on superior individual excellence in human and intellectual capital as well as social capital. Without any of them, collaboration in the VO is unlikely to succeed (Riemer and Klein, 2003). The concept of knowledge in organizational and strategic theory is essentially regarded as a function, or a managerial tool for performing a task in relation to the environment. Organizational knowledge is a sum of individual knowledge and knowledge already existing in organizational systems, processes, products, rules and culture (Apshvalka and Grunspenkis, 2004). The three types of knowledge within every organization that should be shared are individual, group, and enterprise knowledge.

In Malaysia, various parties have shown their interest in knowledge management as part of their preparations for the new millennium, technology and the knowledge economy (Saidin, 2001). Actually the effort started in the 1990's when innovative organizations began to explore knowledge, experience (tacit) and expertise (Saidin, 2001). Since then these three components have been recognized as the foundation of an organization with academic knowledge as an alternative asset. Growing awareness of the importance of management, quality assurance, security, management and the technological revolution is reflected in the increasing popularity of ISO-9000, TQM and mind mapping concepts (Saidin, 2001).

However, in Malaysia, there is evidence which suggests a lack of IT utilization by the political organizations with regards to the dissemination of knowledge to their members. As such, many implementation policies and procedures have not reached the lower levels of party management. In addition, the use of certain dissemination tools has been found to contribute to problem issues in knowledge management, such as distortion of meaning. Appropriate knowledge management ontology has been viewed as the main medium that best facilitates the dissemination of political knowledge in the political organizations. This study takes into such task by proposing a knowledge management model based on the use of ICT in political organization.

II. Aim of the Study

The overall aim of the study was to facilitate the creation of knowledge society within Malaysia in the context of political parties. Based on this aim, the objectives of the study are as the following:

- To investigate knowledge sharing within Malaysian political parties.
- To undertake a case study of knowledge sharing within a given political party.
- To apply the theory of innovation to develop a roadmap for knowledge sharing.

III. Limitation of the Study

As is typical with any research study, this study has inherent limitations that need to be addressed in order for the results to be appropriately interpreted. A potential limitation usually found in most survey research is information access. In this study, this was seen when individuals were completing the survey about their party management, strategy and strength, which involved respondents' perceptions of the research questions and their work environment. Sometimes, this results in individuals misreporting their information in order to protect their party management strategy and method. However, the researcher's background and experience in the party allowed the data collection through interviews and questionnaire to run smoothly. As this study was limited to a specific political organisation, the results cannot be generalised until similar findings are found in other situations. Further research should be undertaken to validate the present study. Future studies may replicate the present study to include other political organisations within the same dimensions of study.

The responses in this research could have been improved by using other data collecting methods and designs. The result of the study may also have some similarity to other non-political organisations, in both the public and corporate sectors. The results may provide additional evidence of information that may not be found in this study. The findings may also uncover the differences in the attitudes of members of the organization from other perspectives.

IV. Method

The main data for this research came from three sources: structured interviews, survey questionnaires, and documentation.

A. Participants of the Study

The individuals who were most relevant to this study ranged from Central Administration Officer to members of the State Youth Secretary Management. The reason for choosing this group was that they have some experience in using ICT for communication in a Malaysian political party context. The context was chosen because the first author was familiar with the social and cultural background of the respondents; hence it was possible to understand facial as well as verbal

expressions. The shared social and cultural background ensured that the respondents were more open and willing to give their views, and this enabled a rapport of trust to be established more easily.

The main resources for the study were the Secretary of Youth Wing and the Head Staff Secretariat of the Wing. Both of them are front liners of the Party's Wing movement. All instructions from the Head Office are directed through them. Additional respondents were the State Youth Secretaries for the states of Perak, Federal Territory and Selangor, together with three respondents from the Information Technology Development Bureaus of Selangor, Terengganu and Federal Territory. One further respondent was the Special Officer to the National Secretary General of the party.

B. Survey Questionnaire

A questionnaire was constructed and used as a secondary tool for this study. Questionnaires are among the most efficient data collection mechanisms, particularly it is to the knowledge of the researchers exactly what is required to measure the variables (Sekaran, 2003). The purpose of this questionnaire was to access the perceptions and expectations of the office bearers in order to find ways for the party to improve their ICT infrastructure and management.

The questionnaire was designed as an easy-to-read five-page document. It was distributed personally to the same officers who had recently been interviewed. On completion, the questionnaires were returned to us either through mail or by collection. A total of 20 questions were included, divided into 4 parts, and using the Likert scale for responses. We chose the Likert scale (Likert, 1932) since it is simple and easy to develop and is widely used. It was suitable in this case to examine how strongly respondents understood or agreed with the questions (Sekaran, 2003). All questions used a 3-part scale, with 1: lowest, 2: fair and 3: highest.

- Part 1: Trends and expected changes in the political party (political party and models; political culture, social and organizational issues; ICT awareness of the organization and skills and job satisfaction) [contained six questions]
- Part 2: Requirement for ICT support (ICT context and future opportunities for ICT Application and Integration) [four question]
- Part 3: Anticipated impact (what are the most important impacts of the more advanced uses of ICT?) [five questions]
- Part 4: Barriers (main barriers that prevent more advanced use of ICT and categories of ICT tools) [five questions]

The personal demographic variables in this study related to individual name (optional), position in the party, academic background, length of service in the party, unit (location of duty, to determine whether respondents were serving at Headquarters, N-in a national position, or states position), contact number (optional), present appointment, and e-mail (optional).

C. Structured Interview

We used structured interviews, as by using closed-ended questions, we were more likely to obtain clear, specific and explicit answers (Salkind, 2000). During the interviews, the primary data source in the study, we hoped to access the interpretations of participants with regards to their opinions, views, values and feelings towards ICT as a party management tool.

Each interview was audio-taped openly, at the interviewee's convenience and with their full consent. The questions asked covered such delicate issues as the quality of party management, and not surprisingly the interviewees were not really comfortable about sharing some of their invaluable views and experience of handling the party using ICT. However, since they were interested in the issues discussed – important issues which will affect the party in the future – they overcame their misgivings and communicated openly with us. Furthermore, the interviews were conducted in an environment on which the party is really focusing, 'information knowledge', so those who were interviewed felt that it was a welcome opportunity to express and share their experiences sincerely and truthfully.

The interview is the best method of collecting data when conducting interpretive research (Myer, 1997). Ten individuals were chosen for interview from the party organization (see table 4.1). Most of the respondents represent the main management board at the party level, which comprises the Secretary General, Information Chief, Executive Secretary, Head of ICT Bureau and Head of Organization and Leadership Bureau.

D. Documentation

In order to complement the data that was given by the respondents, some documentation was obtained as an additional source for research. We managed to obtain some documents from the party itself, besides other related documentation from sources such as annual reports, working papers and project papers which were considered useful and relevant. The reason for using documentation was that not all the information is open for public access (Meriam, 1998; Bogdan and Biklen, 1992; Creswell, 2002). Documentation was used in support of the interviews. Miles and Huberman (1994) state that relying on interviews alone can lead to the research being interpreted as biased. Using documentation as a secondary research tool can help refute allegations of bias.

E. Validity

As already mentioned, the interviews were taped and recorded, and the transcription process was achieved without problems. To ensure the transcription was properly done, we played each tape a couple of times. If some of the points seemed to have been missed, we validated the comment through a phone call or via e-mail.

ISBN: 978-1-61804-238-5

F. Site Location

The site location of the study was the political system in Malaysia, into which it fit comfortably culturally and socially, focusing on the Islamic Party of Malaysia (PAS). This was chosen because of the first author's previous connections with the party and the wish of his sponsors to investigate how the party uses their IT infrastructure in disseminating knowledge to members, and how knowledge management can improve this.

G.Development of the Political Party ICT Knowledge Management Model

In order to capture the requirements and assess the current ICT implementation in this case study, we adopted a slightly modified version of a road map called ROADCON (Hannus, 2003) as shown in Fig. 1.

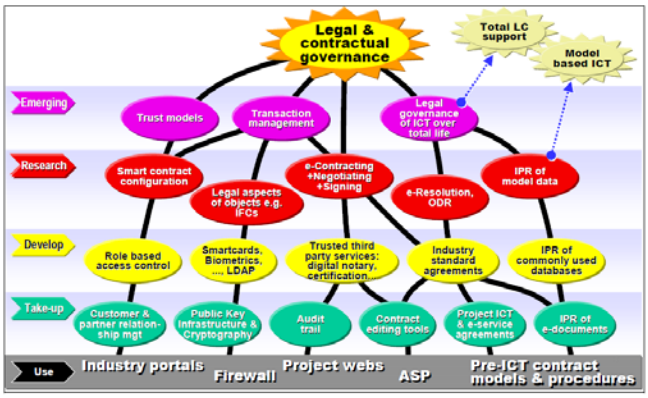

Fig. 1 Road map for legal and contractual governance
Source: ROADCON (Hannus, 2003)

The roadmap of the ICT development of political parties proposed by this study was based and adopted on the model developed in the ROADCON project. Even though the model was developed specifically for the ICT construction for construction industry, the model was appropriate to be applied in this study as it bears similar and essential characteristics needed for the roadmap of ICT development for political parties. The ROADCON initiative was motivated by issues plaguing the construction industry in terms of digital divide among industry personnel and workers, information distortion between community levels in the industry, inefficient management of expertise and resources, and inappropriate handling of transaction and resource records. Hence ROADCON was initiated not only to propose settling down these issues through use of ICT but further providing a model to develop ICT. Similar to construction industry, political parties do have their share of issues which may be similar or different such as lack of proper information dissemination, ICT experience, improper management of information, ICT awareness and literacy among members of parties at all levels. In ICT development of construction industry, ROADCON model outlines a linear flow of stages in management of knowledge, information and resource for ICT construction: use, take up, develop, research, emerging and vision (as shown in Fig. 2).

Though the issues faced by construction industry and political parties are different but the model is relevant to develop ICT for the latter as ICT current issues in political parties can be managed using the stages as proposed in the model. In order to appropriate the model for ICT development for political parties, adaptation to the model is proposed as illustrated in Table 1. The application of a development model designed for a specific field or context in other field or context has been a practice. For instance, the SECI model of knowledge management developed by Nonaka and Takeuchi(1995) which was initially developed to illustrate the processes involved in transfering of tacit knowledge to explicit knowledge in the workplace and industries (Nonaka and Takeuchi, 1995; De Geytere, 2005), has been applied in informing knowledge acquisition in education settings such as in virtual learning (Hosseini, S.M., 2010); in cultural context (Andreeva, T. and Ikhilchik, I., 2011), and in the design of tourism products **(**Zhang, Li 2008**).**

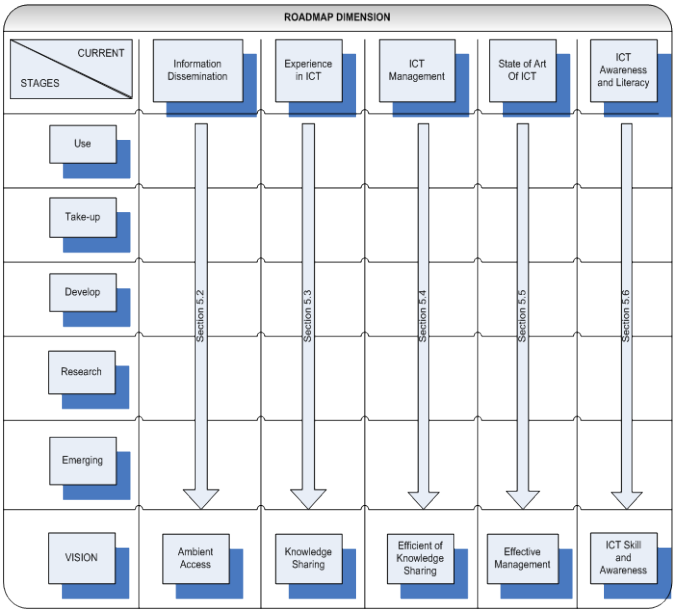

Fig. 2 Road map dimension

Table 1

Diffusion: Current to Vision

Current	DOI	Vision
INFORMATION DISSEMINATION to party members and the public via Internet	relative advantage	AMBIENT ACCESS anytime, anywhere is provided by wide communication technology and infrastructure in term of broadband, 3G, WiFi
ICT MANAGEMENT between ICT Bureau and Information Bureau in coordinating information and knowledge	complexity	EFFICIENT KNOWLEDGE SHARING towards increasing collaboration between relevant party entities
ICT AWARENESS AND LITERACY within the organization at all levels	complexity	ICT SKILLS AND AWARENESS promoted by campaigns, training, built in learning support using ICT tools (e.g. SPOKAS)
EXPERIENCE IN USING ICT in different states/provinces	testability and observability	KNOWLEDGE SHARING amongst personnel or within party organization to utilize ICT within their own capacity
STATE OF THE ART ICT towards efficient management. (e.g. for election campaign, technology-WiFi, PDA)	complexity	EFFECTIVE MANAGEMENT to increase efficiency and quick decision-making such as EIS, support systems

V. Findings and Discussion

After finalizing the interview and questionnaire response, the report found that the political party of the subject of this study faced several challenges that can be categorized into several challenges based on the road map dimension (Fig.2) : i) Ambient access, ii) Efficient Knowledge Sharing, iii) ICT Skills and Awareness, iv) Knowledge Sharing, and v) Effective management. The report of the findings according to these challenges are as the following.

A. Findings Based on Roadmap Model

1. *Ambient Access*

Referring to Fig. 3,

Current dissemination of information in the office is handled by a Local Area Network (LAN), a useful tool for inter-office communication between staff, departments and wings (I: 2, 6, 8). Most of the staff at the state level offices have access to broadband facilities (T^1: 1), and consequently life is much easier for the party management in terms of communication and information dissemination (I: 2). Most of the state offices have been provided with a secure virtual network, via software created for communication between the headquarters and the state offices, named the Virtual Private Network (VPN). By virtue of having the system, all documentation between the headquarters and state offices can be standardised online and will inevitably streamline party management procedures, via for instance, the creation of a membership database.

However, internet access is limited to the office environment, and consequently information is not always retrievable when required. Hence the party's vision is for ICT support to be available anytime, anywhere regardless of physical location (Q^2: 8, 13). Also, the ICT system should be fully integrated with the working environment and supporting people. The intention behind these efforts is to improve information delivery and communication to ensure the best service possible within the limits of existing technology. Through the use of advanced ICT support, it may also be possible to reduce the time constraints on management: for instance, the use of diskettes and CDs can be rendered obsolete by the e-mail system (I: 8). Consequently, the party management can become more streamlined and efficient in its communications. It is hoped that involving ICT elsewhere in the management system will improve productivity as well as the dissemination of information not just between members but also between the party organization and the public. Using the party website as a medium to reach the general public is considered essential.

Ongoing research should have two points of focus: the members and public; and the development of the system by improving applications. For instance, in relation to the party membership database system, SPOKAS, research needs to be done to find out how the office management in various states can access the membership database directly through the internet. Equally, research is needed to establish what ICT tools are available for disseminating information and news.

One aim is to develop in-house an online membership database system and to generate details of all members (Q: 2). By developing the database, the information could be easily disseminated to all members via an internet connection. In relation to the party website, developers can give groups automatic access when they register with the website. The system will automatically send the latest information by text when the moderator logs in to the system at party headquarters.

In addition, the party can utilise multimedia and internet technology to devise a programme to disseminate information to the public. One way of achieving this is through the use of WebTV and Web Radio (I: 14, 23). Through such media, party leaders can update the public almost instantaneously. For example, the party president can make a statement or speech from any location using his Notebook and ICT tools, courtesy of ambient internet access. It should also be possible to acquire a mobile TV station to ensure that any current issue can be addressed quickly, from any location. Hence the public will be constantly updated with the latest information from the party website. Video On Demand (VOD) is another service that could well be provided.

Take-up involves developing the website through new applications such as WebTV, either live or recorded, and Video On Demand (I: 23).

As a basic preparation for implementing the vision and mission, the party management must ensure secure internet access and also the capacity of a broadband service. In order to have all of these applications available at both headquarters and state level offices, an internet service of significant capacity is required (I: 16).

Use relies on the use of internet technologies, computers using LAN, PDAs and mobile phones. Some advanced but specific applications are available, such as digital identification on PDA or voice command for dialing on mobile phones (Hannus, 2003).

DOI's advantages include benefit from innovations such as web development involving websites, WebTV, Web Radio and in-house database systems. Such innovations will help the organization to disseminate party information efficiently to all its members specifically, and to the public generally. All leaders will benefit from the task of leading the party and instructing members will be made significantly easier. Hence leaders will be more readily accepted and they will receive co-operation from their staff (Roger, 1995).

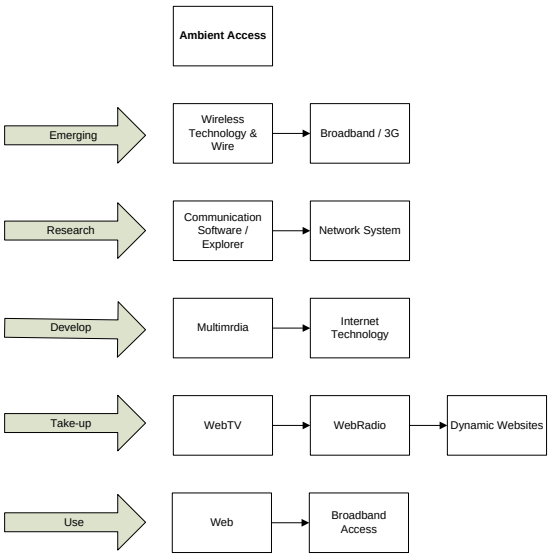

Fig. 3. Challenges Input on Ambient Access

2. ***Efficient Knowledge Sharing*:**

Based on Fig. 4, for **Current**, ICT MANAGEMENT between the ICT Bureau and Information Bureau in coordinating information and knowledge.

Poor coordination leads to inefficiency in delivering information to members and the public, which in turn leads to an unfavorable perception of the party (I:22). At the moment the party's website management has been delegated to the ICT and Information Bureaus and coordination is the responsibility of both over the development of the website.

The Information Bureau has been designed as a tool for use by the party leadership and its members as well as by the public generally. The bureau's chief concern is to explain the policies as well as the vision and mission of the party besides covering all the current issues nationwide. One of the steps taken by the bureau is to make use of the party's official websites and newspaper websites (T: 2).

As for the ICT Bureau, its role is to manage and review the party's ICT policy, besides ensuring the implementation of the ICT policy by the party's IT Department and the State ICT Bureau.(D1, T2, 2007) (I: 11). The running of the official party's website, at www.parti-pas.org, has been entrusted to the bureau.

Unfortunately, the bureaus have not managed the coordination of the website particularly well; as a result both the party's official website and its newspaper websites have the same content and information, which is clearly not an effective use of resources. The repetition of information is wasteful and does not create a favorable impression of the party.

Vision. EFFICIENCY OF KNOWLEDGE SHARING will result in greater collaboration between the relevant party entities. Efficiency in the dissemination of information is a critical factor in success; consequently the uses of ICT as a medium must be coordinated. Both parties should sit together to devise planning strategies which detail how to disseminate the information using their dual expertise within the job specification (T3, T4, 2007). The party also has to draw up the job designation together with both bureaus to ensure that any contradictions and anomalies in the job specification are ironed out and are thus not jeopardizing the bureau's management plans.

Research. It is important to have some form of ICT-theory management or a Management Information System (MIS). An ICT policy needs to be established and the job scope coordinated between the bureaus. Equally important is the organizational structure. ICT needs to be built on a reporting-to-whom structure. It is essential for the management to adopt a management theory to ensure that all party bureaus and committees carry out their tasks appropriately, and to reduce the risk of redundancy.

Development of such an application can help clarify matters between bureaus or individuals to avoid redundancy and waste, e.g. by having party e-mails or by using open-source mail such as Yahoo groups or MSN specifically or websites generally. The party can also develop e-learning and content tools for both entities (such as Blackboard) which can be shared and used for coordinating information and knowledge. When all the applications are recognized and adopted the management of information dissemination will be a more efficient process.

Take-up by specific audiences. By having group e-mail, there can be coordination between bureaus in terms of knowledge sharing from all levels and fields, such as from the headquarters to the state offices, from the state offices to the divisional offices, from the divisional offices to the branches and lastly down to the members. Additionally, open source e-learning applications can be utilized and the party can set about acquiring its own tools for sharing and disseminating knowledge in the future.

Use of websites to reach a wider audience.
DOI-compatible
The intention is to coordinate those elements of the bureaus' job specifications that have the same task, such as handling the party's website. Employing such innovations across bureaus should solve the redundancy problem. Its impact will be to help the bureaus to focus on their areas of expertise. Hence, such measures should be readily accepted (Roger, 1995).

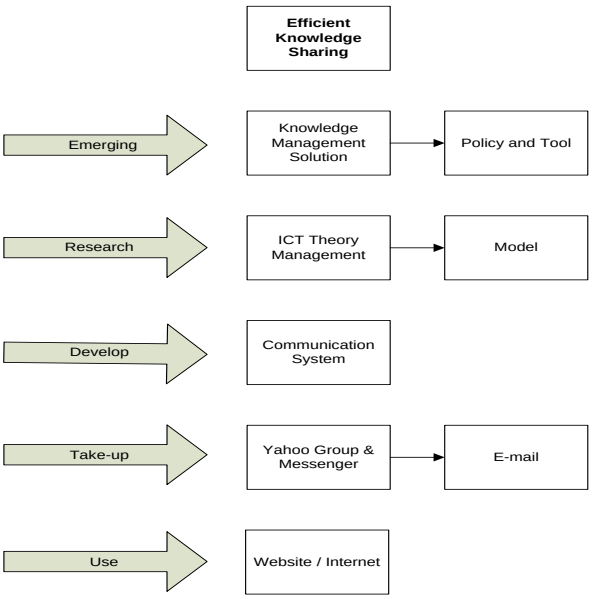

Fig. 4. Challenges Input on Efficient Knowledge Sharing

3. *ICT Skills and Awareness*

For this stage, referring to Fig. 5,
Current within the organization at all levels. There is currently a shortage of ICT skills and awareness in the organization (I: 20, 21) (Q: 4). The leadership seems to be ignoring the importance of ICT for their management (I: 22) (Q: 2, 16). The staff only possess basic ICT skills used for their daily duties in managing the party (I: 14, 21, 22) (Q: 14).

Basic ICT skills are a prerequisite for using office computer programs such as Microsoft Office, the telephone, fax machine and internet, so it comes as no surprise to learn that most of the staff have basic skills which are related to the organization's regular daily needs (I: 20).

Lack of awareness of the importance of ICT among the leadership has resulted in the use of ICT among the party management in the state offices and at divisional level not being as extensive as might have been expected. This state of affairs has arisen largely because of the attitude, prevalent amongst the older generation, that learning IT is an unnecessary burden (T, 2007) (I: 22) (Q: 16).

Vision. Upgrading ICT skills and awareness can be achieved via campaigns, training, built-in learning support for ICT tools (i.e. the SPOKAS party membership system) (I: 18) (Q: 5,9). It is also important to create user-friendly smart tools which reduce the need for learning and provide built-in learning support when needed. E-learning is used widely for transferring technology and providing lessons from good practice.

The party management together with the ICT Bureau and IT Department should launch a campaign highlighting the importance of ICT for the party leadership and members. Such a campaign would be set up initially by the senior management and would reinforce the need to use e-mails, blogs, personal computers, Notebooks, and even PDAs (T, 2007) (I: 19) (Q: 5).

The IT Department should offer training for staff in order to expose them to the new skills and applications that are available courtesy of the party's IT system. Training should also be offered to all office bearers at all levels to ensure that the general management system in the party is well organized and coordinated (I: 18).

Research into methods for communicating and presenting ICT tools to the user. Another area to be looked into is the long-term ICT needs of the party: what type of ICT will be required? In other words, it is essential to conduct a survey and to look at good practices and systems and choose the best practice for adoption by the party (Q: 9, 13).

Develop a template of e-learning tools, make it on-line, and build effective e-learning tools and concepts for the management (Q: 6). By establishing a template, anybody within the party who wants to share their knowledge will be able to fill in the template and upload it into the system. Subsequently the information can be shared by everybody in the system.

A good strategy is to run a series of campaigns among the members and leadership emphasizing the importance of ICT (Q: 9). Such campaigns should stress, for instance, how ICT can help the party in an election, and how this will inevitably help the party to gain votes. When the relevance of ICT is clearly realized by the members and leadership then they will tend to be more supportive and motivated.

Organizing training programs to fill the skill gap in the office will help the management to reduce time constraints. Giving rewards to staff or states that practise good ICT management will create healthy competition and encourage staff to upgrade their ICT skills and awareness.

Take-up. E-learning support tools and guidelines can assist the staff and leadership to learn and understand ICT issues more quickly and comprehensively (Q: 6). For instance, when using MSN Messenger, files can be shared with other users. Hence such a service can help anybody wanting to learn while using applications. Promotion by awareness should be aggressively practised internally through workshops and demonstrations, either monthly or yearly. Open forums on ICT awareness should be held at every level from the national to the divisional.

Use. ICT skills (e-learning, varied use of the internet, basic skills). Having basic ICT skills means having a basic knowledge of how to use common ICT tools.

DOI complexity. Since the office bearer changes every two years after the Annual General Meeting (PAS, 2001), it is conceivable that the perception of technology might change according to the person, and this may jeopardize all the planning especially if the new bearer has different views on ICT. This factor obviously interferes with predictions on the time-frame for successful implementation.

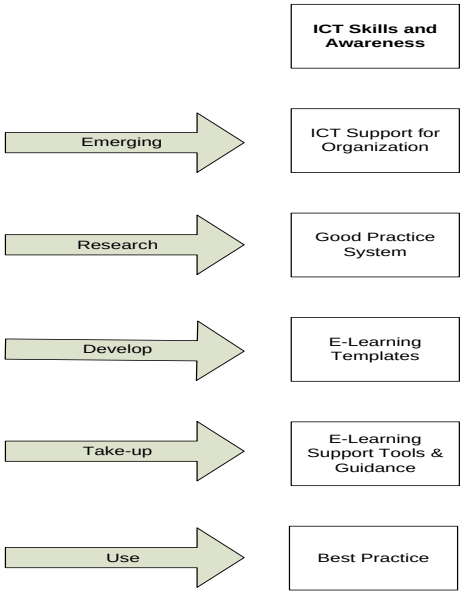

Fig. 5. Challenges Input on ICT Skills and Awareness

4. ***Knowledge Sharing***

Based on Fig. 6,

Current experience in using ICT in different states and divisional levels. Evidence of this exists in the form of personal and office archives. It is said that the party has 174 divisions across 14 states in Malaysia (Shukri, 2001). Each division has at least three organizational structures namely the Division, Youth Wing and Women's Wing. At least 68 individuals are required to fill the posts at each divisional level (PAS, 2001). So from these figures, across all the divisions nationwide, we can see that it would be beneficial to gain from the collective expertise and experience in using ICT in the respective positions. This experience constitutes an important knowledge base that could be shared to support good management practice throughout the party.

Vision from personal or party organizations that utilize ICT within their own capacity. Sharing previous experience in using ICT will ensure best practice and high knowledge attainment within the party (Q: 6). By utilizing such experience, it is hoped to grant immediate access to the right information and practices using the right formats, derived from internal sources within the party.

Research into having our own Knowledge Management System (KMS) designed according to, and suited to, party needs (Q: 12). KMS is needed since knowledge sharing is part of the knowledge management toolkit. By looking at different tools available in KM systems, the party can develop its own KM system (Q: 6).

Develop the system and acquire software related to managing knowledge, customized according to party needs; or develop standard templates for all leadership and members.

Take-up is beneficial in building up a portal for the party management's review. The portal can be described as a ONE STOP MANAGEMENT CENTRE and should be created internally for the members and office management team.

Use of ICT (personal and departmental archives). Most of the experience and expertise is not retained efficiently and much of it resides in the minds of the individuals involved in an event. However, efforts to sort out the information held in the archives may help resolve such problems.

DOI observables: practices observed by others before being implemented by the individual. Since this innovation on the portal will include experience from all management and divisional levels, it should be possible to compare experience and to determine the best practice from all the knowledge shared. This innovation will also help the office management to classify the expertise of the individual or groups.

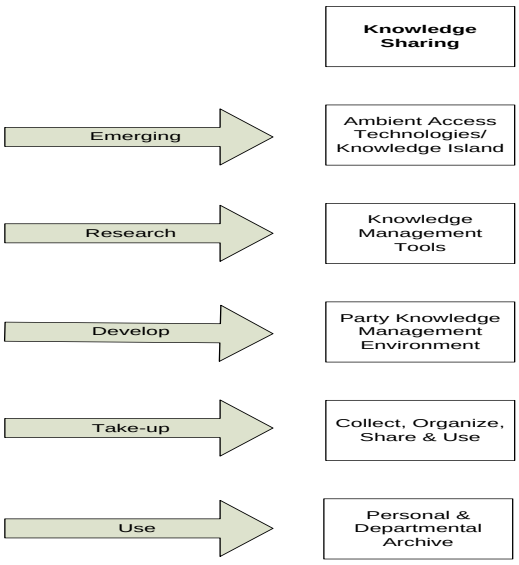

Fig. 6. Challenges Input on Knowledge Sharing

5. ***Effective management***

Based on Fig. 7,
Current. Not fully utilized, not enough, nor fully explored. Evidently there is a lack of effort and commitment towards fully utilizing ICT within the party management (I: 5, 11, 17, 22).

Vision, or STATE OF THE ART ICT dedicated to efficient management. This is to be encouraged through campaigns to increase efficiency which would result in reduced use of resources and higher productivity through the application of the latest technology. The management must be pro-active. Current technological trends should be regularly investigated.

Research. Conduct on-going surveys and research into the latest and most suitable IT tools for effective party management, such as EIS (Executive Information System) or DSS (Decision Support System) (Q: 13).

Develop. Select relevant model systems that can help regulate information flows (Q: 7, 13).
Take-up. Identify and adapt an appropriate management model.

DOI Complexity: our perception of technology might be changing. Technological innovation will continue; new inventions will have an impact on older systems.

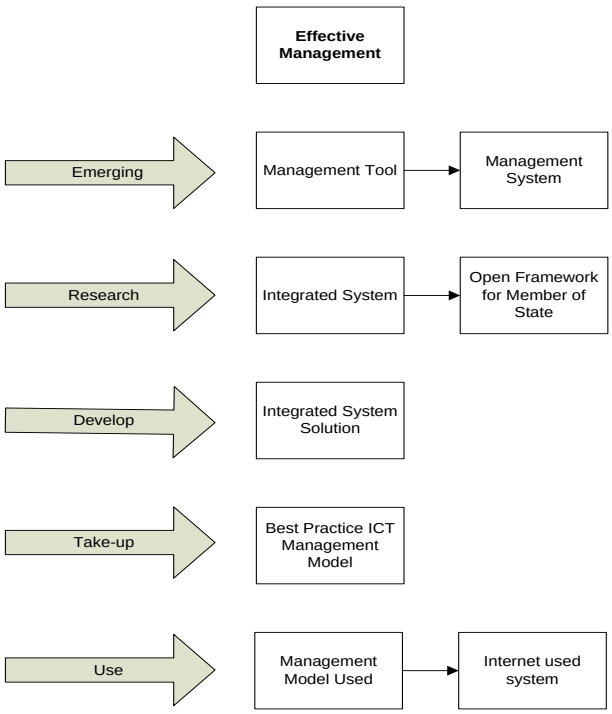

Fig. 7. Challenges Input on Effective Management

B. Recommendations

1 *Ambient Access to Disseminated Information*
The party should explore and provide the latest ICT gadgets to its leadership in order to improve the means of dissemination of information and communication. Newly accessible wireless gadgets are important to gather or to generate information for its members. Besides that, the party also needs to develop its own WebTV and Web Radio, which will help the party's leaders to update any information within seconds at any places at any time. This will ensure that party's information is always up-to-date, efficient and accurate, so it will help its members to understand any current situations and events. The party also must make sure that the security of information will always be given a priority and everybody must understand why it is very important.

2 *Efficient Knowledge Sharing in ICT Management.*
The party needs to build-up their ICT policy and coordinates job requirements amongst both the bureau and its members by adopting a specific ICT management theory, as a 'good practice' method in coordinating information. For instance, by using 'yahoogroups' or 'blackboard', where the coordination between the bureau and its members in term of knowledge sharing from all levels and fields is critical.

3 *ICT Skills and Awareness to ICT Awareness and Literacy*
The party should conduct training for its staff to develop their skills and experience by introducing user-friendly clever tools which can reduce the time constraints for

staff and other E-learning tools which are used widely for transferring technology and lesson from the good practice. Besides that, more campaigns and seminars should be done especially for the party's leadership regarding the importance of ICT in management.

4 *Knowledge Sharing to Experience in ICT*
The creation of record management and departmental archives by a having specific portal just for registered or designated members. Through this, all experience and knowledge can be shared by all divisions and branches, which may make the organisation more effective and efficient.

5 *Effective management to State of Art of ICT*
Select a relevant system model that helps the efficiency of information flows by having on going survey and research on the latest and suitable gadget for the effective management for the party such as EIS (executive information system) or DSS (decision support system)

The five steps suggested above form the foundation for of the implementing process for a roadmap. These steps will also enable smooth and continuous practices into disseminate into knowledge sharing between the party members and the people.

VI. Conclusion

This research will be contributing to the IS domain since it focuses on how political parties might make better use of ICT and information systems. Other developing countries similar to Malaysia can use the suggested framework rather than trying to resolve their problems from scratch. Political parties, both inside and outside Malaysia, face research problems and changing organizational requirements, so this study has extended work in the IS field generally, by creating a framework that has implications for the methodology. Although this study is limited to Malaysian political parties it can still be used for further research by other political parties similar in nature to the ones cited here. The present study was confined to a narrowly defined segment of political organization, where little literature exists in this area; it could be replicated in other areas and types of variables, such as:

(1) The relationship between the political organization's attitudes toward KS solutions and KS implementation.
(2) The relationship between the learning organization and KM innovation in political organizations.
(3) The relationship between KM innovation and political strategy during election campaigns.

In summary, it is possible to conclude from the findings of this study that the attitudes of political parties are related to knowledge sharing which thereafter leads to the existence of a knowledge society. Beyond the immediate findings of this study, numerous other questions have been raised.

Acknowledgment

We would like to acknowledge Universiti Teknologi Petronas for the financial support to conduct this study as well as the presentation of the outcome of the study in the conference.

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Data Processing for Turkish e-learning platform

Sultan Turhan[1], Charlotte Labat-Camy[2]

***Abstract*—** Turkish is a language which belongs to the family of the Turkic language, which is considered a subclass of the Altaic languages. Turkish is an agglutinative language and frequently uses affixes, in particular suffixes. The construction of the sentence is completely different from the Indo-European languages and these differences make Turkish language harder to learn especially for the European people. The main difficulty that faced Erasmus students who come to Turkey is to establish a communication with "the people in the street". In order to facilitate this learning, an online platform is considered to be built according to the needs and desires of the students. In order to determine their needs and desires, a survey is conducted over 250 students. This paper describes part of the research project conducted in the Computer Engineering Department of Galatasaray University. The research project is for building an online Turkish learning platform for Erasmus students according to their needs and the paper is about the collecting, cleaning and modeling of their data in order to prepare them to be used for a data mining application.

***Keywords* —** Survey evaluation, data cleaning, data modeling, data classification, ETL processes

I. Introduction

Turkish is a language spoken mainly in Turkey and Northern Cyprus. It belongs to the family of the Turkish language, which is considered a subclass of the Altaic languages. Turkish is an agglutinative language and frequently uses affixes, in particular suffixes [1]. One word can have many affixes and they can also be used to create new words. Relations between words are created using the suffixes added to the end of words. It is possible to create a verb for a name, or a name from a verbal base. Most affixes indicate the grammatical function of the word. The construction of the sentence is completely different from the Indo-European languages [2]. These differences make it harder Turkish language to learn and master especially for the European population [3].

The Erasmus Programme which is started in 1987 is an exchange program which offers to European undergrad and graduate students the opportunity of studying in a different European country. In 2004 Turkey became a member of this program and since then many undergrad and graduate European student attended to the courses in several different universities of Turkey. Although they don't need to learn Turkish to be able to pursue the courses or communicate with the university' people, they faced the difficulty to establish a communication with "street people". This forces them to learn a minimum Turkish. Learning a foreign language which has completely different structure from their native tongue is very hard for them. Besides, they don't actually need to bother themselves with complex grammatical rules. To facilitate this learning, a project is started in order to build an online platform which is slight different from the conventional e-learning language teaching platform. The platform's design and the teaching techniques which will be used on the platform are shaped according to the needs and desires of Erasmus students coming to Turkey. In order to determine these needs and desire a survey is conducted over 250 students. The data collected from this survey will be passed through three different steps concerning the satisfaction of the project's objectives. The first steps consists of ETL processes, i.e. the data collected will be cleaned, organized, modeled and ready to use on a data mart. The second step involves the data mining algorithms which are responsible from the extracting the most important information from organized data. In the third step, a linguistic will interpret the results of second step and determine the points that the linguists must take into consideration in addition to the basic theories during the system analysis period of Turkish e-learning platform.

This study focuses on the first part of the project, i.e. Extract – Transform - Load (ETL) processes, the data cleaning and modeling part. We believe that this step is the most important step of the project because without any well processed data, the best information would not be extracted. ETL processes are responsible of providing the regular and uninterrupted data flow from the data sources towards to a data warehouse. Data cleaning is the major part of ETL processes and deals with detecting and removing error and inconsistencies from data in order to improve data quality [5]. In order to follow this approach we will first retrieve the results of the survey as raw data, then analyze the data to detect which kinds of errors and inconsistencies are to be removed, then uniform the data and finally normalize the data [5].

The paper is structured as follows. Section 2 describes

This research has been financially supported by Galatasaray University Research Fund with the project number 12.401.005.

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related literature. The methodologies and tools used in the framework are given in Section 3, while Section 4 presents detailed explanation of the proposed model. Section 6 reveals the results and the discussion is made in Section 7. Concluding remarks and future works are given in Section 8.limits.

II. RELATED WORK

A data cleaning approach should satisfy several requirements. First of all, it should detect and remove all major errors and inconsistencies both in individual data sources and when integrating multiple sources. The approach should be supported by tools to limit manual inspection and programming effort and be extensible to easily cover additional sources. Furthermore, data cleaning should not be performed in isolation but together with schema-related data transformations based on comprehensive metadata. Mapping functions for data cleaning and other data transformations should be specified in a declarative way and be reusable for other data sources as well as for query processing. Especially for data warehouses, a workflow infrastructure should be supported to execute all data transformation steps for multiple sources and large data sets in a reliable and efficient way.

While a huge body of research deals with schema translation and schema integration, data cleaning has received only little attention in the research community. A number of authors focused on the problem of duplicate identification and elimination, e.g., [6, 7, 8, 9, 15, 16]. Some research groups concentrate on general problems not limited but relevant to data cleaning, such as special data mining approaches [20, 21], and data transformations based on schema matching [18, 19]. More recently, several research efforts propose and investigate a more comprehensive and uniform treatment of data cleaning covering several transformation phases, specific operators and their implementation [6, 9, 17].

III. METHODOLOGIES AND TOOLS

A. Data Cleaning

In general, data cleaning involves several phases:

1. Data analysis: In order to detect which kinds of errors and inconsistencies are to be removed, a detailed data analysis is required. In addition to a manual inspection of the data or data samples, analysis programs should be used to gain metadata about the data properties and detect data quality problems.
2. Definition of transformation workflow and mapping rules: Depending on the number of data sources, their degree of heterogeneity and the ”dirtyness” of the data, a large number of data transformation and cleaning steps may have to be executed. Sometime, a schema translation is used to map sources to a common data model; for data warehouses, typically a relational representation is used. Early data cleaning steps can correct single-source instance problems and prepare the data for integration. Later steps deal with schema/data integration and cleaning multi-source instance problems, e.g., duplicates. For data warehousing, the control and data flow for these transformation and cleaning steps should be specified within a workflow that defines the ETL process. The schema-related data transformations as well as the cleaning steps should be specified by a declarative query and mapping language as far as possible, to enable automatic generation of the transformation code. In addition, it should be possible to invoke user-written cleaning code and special-purpose tools during a data transformation workflow. The transformation steps may request user feedback on data instances for which they have no built-in cleaning logic.
3. Verification: The correctness and effectiveness of a transformation workflow and the transformation definitions should be tested and evaluated, e.g., on a sample or copy of the source data, to improve the definitions if necessary. Multiple iterations of the analysis, design and verification steps may be needed, e.g., since some errors only become apparent after applying some transformations.
4. Transformation: Execution of the transformation steps either by running the ETL workflow for loading and refreshing a data warehouse or during answering queries on multiple sources.
5. Backflow of cleaned data: After (single-source) errors are removed, the cleaned data should also replace the dirty data in the original sources in order to give legacy applications the improved data too and to avoid redoing the cleaning work for future data extractions. For data warehousing, the cleaned data is available from the data staging area. The transformation process obviously requires a large amount of metadata, such as schemas, instance-level data characteristics, transformation mappings, workflow definitions, etc. For consistency, flexibility and ease of reuse, this metadata should be maintained in a DBMS-based repository [22]. To support data quality, detailed information about the transformation process is to be recorded, both in the repository and in the transformed instances, in particular information about the completeness and freshness of source data and lineage information about the origin of transformed objects and the changes applied to them.

For approaches to schema translation and schema integration, we refer to the literature as these problems have extensively been studied and described [23, 24, 25]. Name conflicts are typically resolved by renaming; structural conflicts require a partial restructuring and merging of the input schemas

B. Tools

Tools that will allow us to develop this project are the following: SQL Server 2008 to create a database, SQL Server Integration Services to supply warehouse, and Excel to retrieve the data in their original format input to using the survey conducted online. Visual Studio 2008 has enabled us to write a script to transfer data to the warehouse. Data mining will be entered through algorithms Data Tools SQL Server Integration Services.

IV. MODEL

In this project we aim to develop a training methodology for determining the training needs of people who learns Turkish as a foreign language.

After a deep research literature, in order to achieve efficient analysis and get relevant results, we decided to apply three basic steps to the data collected from the survey during four semesters. So we have three phases from the ETL process: data extraction, their transformations and finally loading the warehouse with the transformed data.

The first step is to bring all the data obtained using online questionnaires on an Excel file. Each line in the file contains data belonging to one person who answered the questionnaire. It is obvious that the received data from the survey is noisy. The first operation made on these data is the cleaning. This cleaning period forms the compliance verification of the data and it brings naturally several problems with it. Actually 273 lines are recovered from the survey. Unfortunately 23 of these records contains only empty fields (null values) which are useless for a data mining algorithm. We have removed all these lines to provide good data for the analysis. Another problem arises because of some questions. These questions are relevant semantically to each other. When one of them is left blank, the other answers also lose their significance. For example a person stating that the level of study and does not respond to any other issue about his/her education, won't have any contribution to the research so these records also were excluded from the cleaned data.

In order to sustain our results at the end of our analysis we had to remove 33 records from the total number of surveys. These data would have falsified the results that we would use in data mining algorithms. Ultimately we obtained a spreadsheet where the first column corresponds to the identifier of the questionnaire, the second column represents the age of the student, the third column represents the level of education of the latter and the fourth column corresponding to the duration of stay of the student number of the semester. The following seven columns of the file contain the answers' values to seven different questions of the questionnaire. These columns have a wide variety of values. The values of these columns reveal the transformation step after the cleaning step. For example, a response to the same question sometimes appears in a single letter that represents the choice of the selected answer, but it also appears in a complete sentence because it is possible that the student was not satisfied with the choices offered and have wanted to specify its own answer to this question. In the same way the investigation was submitted in three different languages: Turkish, English and French; and it requires a data cleansing to standardize and put them in the same format.

After completing the data cleaning, we model a fairly simple database which will host the cleaned and transformed data. As the data will be used in a data mining algorithm, we prefer to model a data mart according to data warehousing principles instead of a relational database. The schema of the data mart is represented in Figure 1.

The Data Mart consists of two fact tables and seven dimension tables. The first fact table contains the data about the students who respond to the questionnaire. The second one contains their responses to seven questions. The dimensions tables contain all the possible answers' choices for each different question belonging to a specific questionnaire. This situation provokes a transformation process. Among these seven questions, there is multiple choice questions to which the students may choose several options. We decided to process each answer separately and each answer for this kind of questions is recorded as a new line in the dimensions tables.

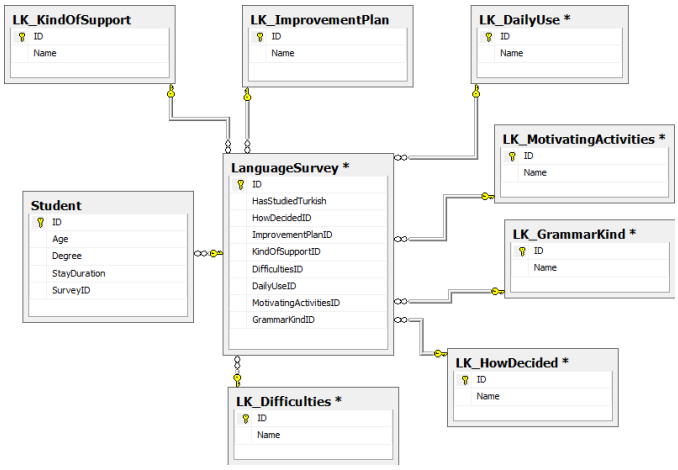

Figure 1 Data Mart Model

Thereafter we load data from the spreadsheet to our Data Mart. Given the small amount of data available it was not necessary to use special means of ETL process, only use a few scripts were sufficient to transfer our data. Therefore we preferred to use the MVC model that allowed us to write a script (a part of it is presented in the appendix) establishing the link between the database and the spreadsheet

V. DISCUSSION

We realized a customized ETL process to a group of non-structured data collected via a survey. The major problem in this process is the data cleaning. We clean the data both

manually. Data are first stored on a spreadsheet. This helps us to model the data mart which will host the data. To transform the data according to the data mart model, we developed another scripts. Therefore we are able to load the data correctly and produce a well structured high quality data which can be used in the following part of this research.

VI. Conclusion

The major role in the success of a survey belongs to the accurate analysis of the collected data. In order to ensure the correct analysis of the data, the data must be processed according to the analysis chosen. Data cleaning and modeling are the phases of this process. This study represents a data cleaning and modeling technique which can be appropriate for any other analysis.

Appendix

The Load Script Part

```
namespace ConsoleApplication1
{
  class Program
  {
    static void Main(string[] args)
    {
      var ctx = new denemeEntities();
      string filePath = "erasmusAnket.xlsx";
      FileStream stream = File.Open(filePath, FileMode.Open, FileAccess.Read);
      IExcelDataReader excelReader = ExcelReaderFactory.CreateOpenXmlReader(stream);
      DataSet result = excelReader.AsDataSet();
      foreach (DataTable table in result.Tables)
      {
        for (int i = 0; i < table.Rows.Count; i++)
        {
          survey temp = new survey() { };
          try
          {
            int number = 0;
            string numberTxt = System.Convert.ToString(table.Rows[i].ItemArray[0]);
            if (Int32.TryParse(numberTxt, out number))
            {
              temp.Id = number;
            }
            string numberTxt2 = System.Convert.ToString(table.Rows[i].ItemArray[1]);
            if (Int32.TryParse(numberTxt2, out number))
            {
              temp.Age = number;
            }
            else
            {
              temp.Age = null;
            }
            string level = (string)table.Rows[i].ItemArray[2];
            switch (level)
            {
              case "lisans": temp.Level = Level.Lisans; break;
              case "yuksek_lisans": temp.Level = Level.YuksekLisans; break;
              default: temp.Level = Level.Default; break;
            }
            string semestretype = System.Convert.ToString(table.Rows[i].ItemArray[3]);
            switch (semestretype)
            {
              case "2s": temp.Semestre_type = Semestre_type.TwoSemester; break;
              case "1s": temp.Semestre_type = Semestre_type.OneSemester; break;
              case "1 semestre + 6 mois de stage": temp.Semestre_type =
Semestre_type.OneSemesterMoisStage; break;
              case "3 months": temp.Semestre_type = Semestre_type.ThreeMonths; break;
              case "1 and 2 Semester": temp.Semestre_type =
Semestre_type.TwoSemester; break;
              case "1 year": temp.Semestre_type = Semestre_type.OneYear; break;
              default: temp.Semestre_type = Semestre_type.Other; break }
            string question = System.Convert.ToString(table.Rows[i].ItemArray[4]);
            switch (question)
            {
              case "a": temp.Q1 = Question.a; break;
              case "b": temp.Q1 = Question.b; break;
              case "c": temp.Q1 = Question.c; break;
              case "d": temp.Q1 = Question.d; break;
              case "e": temp.Q1 = Question.e; break;
              case "f": temp.Q1 = Question.f; break;
              case "g": temp.Q1 = Question.g; break;
              case "h": temp.Q1 = Question.h; break;
              case "": temp.Q1 = Question.Default; break;
              default: temp.Q1 = Question.other; temp.TextQ1 = question; break;
            }
.....
```

Acknowledgment

This research has been financially supported by Galatasaray University Research Fund with the project number 12.401.005.

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‘edil-learning’ Living Lab

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***Abstract*—**This paper presents a user-centered, open source and social learning web platform specifically designed for the building sector. The proposed web-based platform integrates the most up-to-date technological components in terms of Content Management System (Joomla!), Learning Management System (Moodle), and Web Conferencing System (BigBlueButton). The web platform was implemented by customizing a general-purpose framework for the construction sector. Functional specifications was defined considering specific needs of training schools from the construction area. The validation of the web platform was endorsed by feedbacks from both learners and content managers because it facilitates knowledge aggregation and social cooperation.

Keywords—Building sector, Content Management System, Learning Management System, Social learning, Training school.

I. Introduction

PEOPLE interaction was facilitated by the Web but the Social Web is increasing and reinforcing connections among people having similar interests and preferences. Emerging technologies will have a great positive impact on remote education by supporting interaction and knowledge exchange: all actors involved in the learning process may have huge advantages. Students may collaborate to improve their cognitive and social skills. Teachers may consolidate their experience by sharing opinions and feedbacks on education themes. New initiatives and learning needs may spread easily by innovative interaction, thus paving the way to focused on-demand education proposals. These opportunities are common to the different learning sectors, but specific learning areas regarding other benefits and peculiar needs. This is the reason why the very recent trend towards social e-learning deserves the design of flexible frameworks, which cover both specific and general needs, by exploring “vertical requirements” coming from specific sectors, and extrapolating “horizontal services” common to different areas.

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Training area of Building sector is a useful example to piloting this kind of experimentation because is characterized by a great variety of teaching, coaching, mentoring activities and student profiles, with specific learning needs and interaction patterns. In this context, the proposed on-line collaborative e-learning platform, named *edil-learning*, is a rewarding answer to educational needs in the construction area and provides a wide variety of transversal reusable services at the same time.

The platform is supported by “Living Labs - Apulia Innovation in Progress” [1], a project promoted by the Apulia Region (Italy) to increase technological advancements and innovation wich involved educational institutes, ICT Small and Medium Enterprises (SMEs) and research laboratories.

The project partners adopted a co-modeling strategy to work together in an efficient way. Design and development of the platform were achieved by a requirement elicitation phase. The validity of our approach is demonstrated by preliminary deployment results.

The rest of the paper is organized in three sections. The next section presents the proposed platform. In Section III user feedbacks are reported. Finally, Section IV presents some conclusions and further works.

II. The “EDIL-LEARNING” Platform

Edil-learning platform, (EL, from now on), was developed in the Living Lab framework composed of two training schools, *Formedil Bari* [2] and *Formedil Foggia* [3], as Final users, the *Electromagnetic Lab Lecce*, at University of Salento, as Research laboratory [5], that provided the knowhow about enabling technologies, and *Alba Project* [4], as IT enterprise, that is in charge of the overall development stage.

A. Requirement elicitation and design methodology

The partners worked together in an efficient way to gather functional specifications adopting *co-modeling strategy*.

First, we design business processes of the training schools. Then, we find stakeholders and different end-user typologies. Finally, we map stakeholders with both end-users and platform modules.

More in detail, we identified the following stakeholders:

- *Director* – identifies, approves, defines course high level features (themes, budget, location, etc.)
- *Education manager* – guides and controls course organization (identifies criteria for teacher recruitment

and student selection, defines constraints to the course calendar, etc.)

- *Technical assistant* – carries out all the required activities to organize the course according to education manager directives (e.g.; didactic material gathering, student admission test organization.)
- *Administrative assistant* – works on economic and administrative aspects (e.g. cost accounting and reporting.)
- *Teacher* – is involved in delivering and in monitoring training course
- *Student* – takes course lessons

This kind of organization is specific of the application environment considered for our project. Therefore, in order to design a system as replicable as possible, we identified the list of needed functionalities, which correspond to implemented functional modules (Table I), and then defined a mapping between stakeholders, their business goals and functional modules (Table II).

TABLE I. EDIL-LEARNING MAIN FUNCTIONAL MODULES

Module	Description
E-learning	Remote learning activities, even requiring course credit distribution
E-commerce	Courses can be attended freely or bought as in a market-place
Calendar	Both remote and local events can be programmed and shared across users
Web Conferencing	Real-time interaction amongst users thanks to synchronous communication tools (e.g. text/audio/video chats, whiteboards, desktop sharing, etc.)
Video sharing	Video publishing and sharing in a YouTube-like approach
News	Content providers can manage learning materials as in website content publishing
Social Blog	Participants post comments about published contents
Social Network	Tracking of peer's activities; socialization experiences
Forum	Collaborative questioning and answering
Reporting	Statistical reporting tools offered by the adopted CMS, LMS and WCS

TABLE II. MAPPING BETWEEN STAKEHOLDERS, GOALS, FUNCTIONAL MODULES

Stakeholder	Goals	Functional Modules
Director	- To apply the strategic guidelines defined by the Governing Board	- Reporting
Education Manager	- To design educational contents - To manage tests about course monitoring and evaluation - Student high-level management	- E-learning - E-commerce - Calendar - Web Conferencing - Video sharing - News - Social blog - Social network - Forum - Reporting
Technical assistant	- To define the educational plan: to participate in the provision of educational contents - To manage students: to gather contacts, to tutor, to manage notices	- E-learning - Calendar - Web Conferencing - Video sharing - News - Social blog - Social network - Forum
Administrative assistant	- To manage administrative and economic aspects	- E-commerce - Reporting
Teacher	- To supply learning contents - To participate in the management of learning courses - To supply learning courses - To control learning activities: to manage examinations, to register participations, to test students' satisfaction	- E-learning - Calendar - Web Conferencing - Video sharing - News - Social blog - Social network - Forum
Student	- To subscribe to learning courses - To participate to courses - To write up assessment questionnaires - To pay fee of learning subscription - To obtain certifications	- E-learning - E-commerce - Calendar - Web Conferencing - Video sharing - News - Social blog - Social network - Forum

B. *Enabling Technologies*

The *EL* platform is built upon a CMS, chosen amongst Wordpress [6], Drupal [7] and Joomla [8]. The latter was selected as best compromise between the former ones and since it offers the easiest way to implement both social networks and e-commerce components. As for LMS, Moodle [9] was selected since it is open source (if compared to other solutions such as Docebo [10]) and offers a plethora of functionalities for administration, course development, participant interaction and content personalization. In the same way, during the WCS selection many candidates were compared (e.g., GoToMeeting [*11*], Adobe Connect [12], BigBlueButton [*13*], Blackboard Collaborate [14]). BigBlueButton was selected due to its relevant features: ease of usage and configuration, high quality video/audio support, enhanced user experience, desktop and presentation sharing, recording facilities, integrability with third-party systems, resizable components, etc.

Figure I shows how the supporting tools were integrated in the system framework.

ISBN: 978-1-61804-238-5

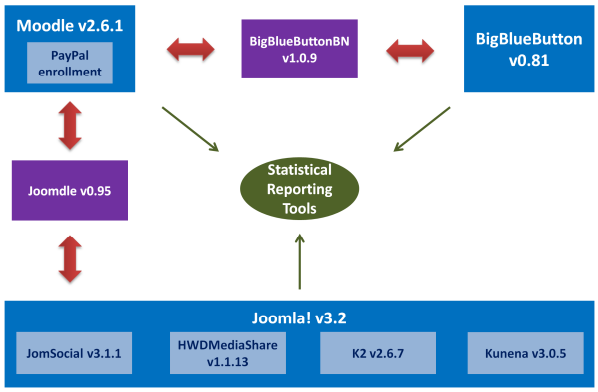

Figure 1. Enabling technology integration

C. *High-level Architecture*

EL is user-centered, web-based and open source. Moreover, *EL* is distributed as a Software as a Service (SaaS).These aspects widen the prospected user audience and make it possible to embed *EL* within other open-source, shared environments.

The system covers all phases concerning the learning process, including "pre-course" activities, such as planning, student selection, inscription and payment, "in-course activities", such as lesson delivery by synchronous and a-synchronous communication, and "post-course" activities, such as credit distribution, feedback reporting and statistical analysis. This required the definition of a modular framework where the different modules work and cooperate to provide the appropriate flux of events and data. A rigorous definition of end-user profiles and roles was performed as well.

Figure 2 shows EL architecture.

We defined a mapping between functional modules and software components, as shown in Table III. Consequently, a mapping among stakeholders, functional modules and end-user profiles of software components was defined, which is shown in Table IV.

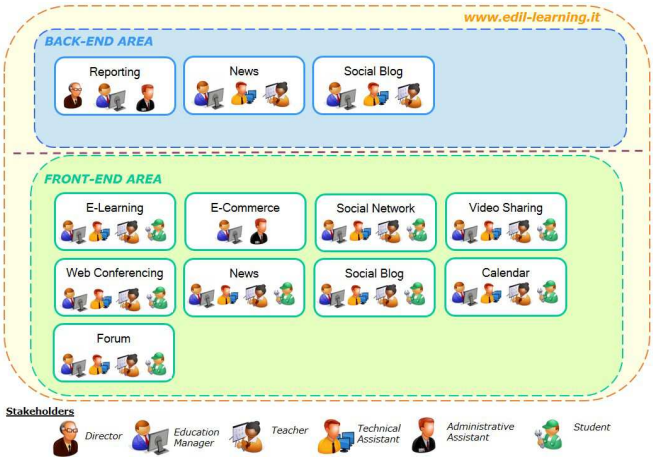

Figure 2. System high-level architecture

TABLE III. MAPPING BETWEEN FUNCTIONAL MODULES AND SOFTWARE COMPONENTS

Functional modules	Software components
E-learning	Moodle
E-commerce	PayPal enrollment- Moodle Component
Calendar	Moodle Calendar
Web Conferencing	BigBlueButton
Video Sharing	HwdMediaShare - Joomla! Component
News	Joomla!
Social Blog	K2 – Joomla! Component
Social Network	JomSocial – Joomla! Component
Forum	Forum Kunena – Joomla! Component
Reporting	Moodle, Joomla!, BigBlueButton

TABLE IV. MAPPING AMONG STAKEHOLDERS, FUNCTIONAL MODULES AND END-USER PROFILES

Stakeholder	Functional Modules	End User Profiles
Director	Reporting	Manager of Moodle, Joomla!, BigBlueButton
Education manager	E-learning	Courses administrator of Moodle
	E-commerce	Administrator of Paypal and Moodle
	Calendar	Courses administrator of Moodle
	Web Conferencing	Moderator of BigBlueButton
	Video sharing	Publisher of Joomla!
	News	Publisher of Joomla!
	Social blog	Publisher and Moderator of Joomla!
	Social Network	Publisher of Joomla!
	Forum	Moderator of Joomla!
	Reporting	Manager of Moodle, Joomla!, BigBlueButton
Technical assistant	E-learning	Teacher of Moodle
	Calendar	Teacher of Moodle
	Web Conferencing	Moderator of BigBlueButton
	Video sharing	Author of Joomla!
	News	Author of Joomla!
	Social blog	Author of Joomla!
	Social Network	Author of Joomla!
	Forum	Author of Joomla!
Administrative assistant	E-commerce	Administrator of Paypal and Moodle
	Reporting	Manager of Moodle, Joomla!, BigBlueButton
Teacher	E-learning	Teacher of Moodle
	Calendar	Author of Joomla!
	Web Conferencing	Moderator of BigBlueButton

ISBN: 978-1-61804-238-5

Stakeholder	Functional Modules	End User Profiles
	Video sharing	Author of Joomla!
	News	Author of Joomla!
	Social blog	Author of Joomla!
	Social Network	Author of Joomla!
	Forum	Author of Joomla!
Student	E-learning	Student of Moodle
	E-commerce	Registered of Joomla!
	Calendar	Registered of Joomla!
	Web Conferencing	Viewer of BigBlueButton
	Video sharing	Registered of Joomla!
	News	Registered of Joomla!
	Social blog	Registered of Joomla!
	Social Network	Registered of Joomla!
	Forum	Registered of Joomla!

III. Results and Feedbacks from Users

The platform is online (http://www.edil-learning.it/jmcms/). Figure 3 shows a snapshot of the user interface.

Figure 3. EL home page

The platform was validated by the training institutes and by the research laboratory. The former ones first defined roles and purposes of stakeholders (director, technicians, teachers, students, etc.), then populated the platform with learning materials and shared knowledge on the social network. The latter superintended the evaluation amongst the available technologies, ensuring its readiness in terms of security, flexibility, coverage, etc. The training phase consisted in testing platform functioning along a set of predefined navigational paths, and in collecting end-user feedbacks in terms of portability, scalability and ease of usage. At the time of writing this abstract, the available 6 learning courses had been attended by about 100 learners (who also subscribed to the social network).

IV. Conclusions

In this paper we presented an on-line innovative platform for e-learning. The platform enhances cooperation by integrating several Social Network components. It was implemented by customizing a general-purpose framework to the construction sector. Indeed, after a strong effort in requirement elicitation, and thanks to a co-modeling strategy, a rigorous adaptation to rigid requirements in such a critical sector was achieved. Indeed, we are going to replicate this experience in other critical areas, such as public administration and health-care, and to extend e-learning functionalities to provide mobile access, by implementing suited “mobile apps”, and to support “just-in-time” course design and delivery.

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The use of web 2.0 to support informal learning in third level through the library

Emma O'Brien, Sinead Mellett, Michael o hAodha

Abstract **-** The library is an optimum area to encourage informal learning in a third level setting. However as students learning paths become more 'dispersed' between work and education. Learning is no longer limited to a campus setting, more than 92 percent of third level learning is informal (Banks 2007) Many educators provide opportunities for module based informal learning, however it does not allow students to foster links with others outside their course or area of study. It is important that libraries offer the capabilities for such learners to continue informal learning on and off campus which is key to third level education.

This paper explores the use of Web 2.0 tools in providing virtual informal learning space and a means of personalising content independent of course and discipline. Given the varied learning paths students undertake.

Keywords—informal learning, library, third level, web 2.0

I. LEARNING IN THIRD LEVEL

Although constructivist theories have been around since the early 1900's by John Dewey (1938) it only began to gain momentum in the 1970s with further work by Piaget 1970 and vygotsky 1978. These theorists focused on the active engagement of the learner in authentic learning activities.

Learning was largely learner focused and they were responsible for constructing their own knowledge through personal (Piaget 1970) or social means (vygotsky 1978; Lave and Wenger 1991). Or a combination of both (Cobb 1994). These theories had a huge impact on engaging the learner in a social, challenging learning environment. Content was no longer the central role, the use of the content and application of it to construct new knowledge was seen as the central feature. Interaction between peers and tutors was seen as vitally important to the success of education to reduce isolation and to maximise the learning process.

Many educators try to implement these constructivist theories in teaching. However it is still common practice that much of the learning that takes place in third level is informal learning which accounts for 8% of all learning in undergraduate years. (Banks 2007) It is difficult for an individual to assimilate and apply new material in weekly three hour sessions. Third level education is largely considered to be adult education which is self directed, experiential with an orientation and motivation to learn. (Knowles 1950). However often undergraduate students are coming from a formal learning environment that does not encourage these learning characteristics. Despite this these students readily collaborate and exchange personal information and learn new skills relevant to their personal lives and are very 'self directed' in this context.

Schugurensky 2000, outlined three forms of informal learning. Self-directed in which an individual decides they need to learn an new skill e.g. a student decides they need to use linked in to post their professional data. Incidental learning is when they learn something they did not intend to learn e.g. while looking at a friend's facebook profile they see that they are interested in campanology and they search for the meaning of this term and socialisation when knowledge or skills are developed by interacting with people e.g. the meaning of emotion icons or abbreviations used in texting or tagging. Many of the forms and traits of informal learning match those of a constructivist nature it is social, the learner is actively engaged, it is authentic as the learning often takes place in the context in which it is required.

In third level informal learning is encouraged outside the classroom through research projects, peer learning, group projects and problem based learning. The library acts as one of the main places in which informal learning can take place and it is important that this is integrated into module curricula. The next section examines the role of the library in informal learning.

II. INFORMAL LEARNING IN THIRD LEVEL THE ROLE OF THE LIBRARY

As mentioned previously much of the learning that takes place in third level is outside of the classroom Chen and Bryer, 2012 highlighted that "the role of informal learning is becoming more important because learning can happen anywhere, anytime". Many educators try to facilitate this type of learning through encouraging group work, peer learning and problem based learning. This learning takes place in many spaces the student canteen, common areas and the library (Walton and Matthews 2013). Libraries play a key role in enabling informal learning, they provide space and resources to allow students to learn. Many libraries now

contain common areas, digital resources and facilities to allow students to collaborate and learn.

In addition Batson 2009 highlights that students are no longer choosing a linear learning path and choosing combinations of work experience, part time work, travel opportunities and multiple learning institutes. Thus learning is taking place in multiple locations. Technology can facilitate this by removing the need for physical common areas. Libraries are now using this technology to offer additional resources to these types of learners.

Furthermore the library has taken on a new role; with the increase of information available online many librarians are responsible for educating students on the concept of information literacy (Oakleaf 2011). This is the "set of skills and knowledge that allows us to find, evaluate, and use the information we need, as well as to filter out the information we don't need". (Eisenberg, 2008) However few skills are taught on how to enable students to leverage off existing content to develop their own content for informal learning purposes.

Kwayana 2008 outlined 8 different types of library service models with the library offering different roles depending on the context in which they operate.

1. Traditional library – this service offers a physical location with resources during fixed time restrictions. Users are served through rigid processes. They are located in densely populated areas.
2. Library 2.0 – this service offers a flexible service to users that interacts with other digital resources and applications with ease of use. The service is available to users without time restrictions
3. Information commons – this model offers more than information resources, it includes electronic resources and communal areas for people to collaborate.
4. Community library – this service offers information resources within large communities. Kwayana, 2008 stated that these information needs could be categorised as survival information and citizen information. There is a lot of interaction between the librarian and the user and community groups
5. Mobile library – this is a travelling library that moves between remote locations
6. Embedded library – this model services particular users and is located in a particular school, campus or business. Often the librarian actively participates in the department they are involved with. For example in universities there is often a librarian for each faculty that supports staff and students with any queries related to a discipline within that faculty
7. Bookstore library – this model does not offer resources for information, it offers services for recreational reading
8. Library outpost model – these services are located in areas where people congregate (Koerber, 2008).

A combination of the information commons and embedded model is most often used in third level settings. It offers support to students and staff, training in information literacy, space for collaboration and the sharing of common resources both physical and electronic. The combined model provides literacy advice to students. Much work has been done in the use of Web 2.0 in offering training, promotion and physical resources online. However the replication of the physical collaboration space in a virtual environment has not yet been investigated , the Web 2.0 technologies in libraries have been used as a means of interacting with users rather than a learning tool.

III. HOW WEB 2.0 IS USED IN THIRD LEVEL

Web 2.0 is defined as "a space that allows anyone to create and share information online – a space for collaboration, conversation, and interaction; a space that is highly dynamic, flexible, and adaptable (Coombs, 2007)

Web 2.0 consists of technologies such as "collaborative publishing sites (Facebook, Bebo, MySpace and Friendster etc), wikis, blogs, social bookmarking sites (del.icio.us, furl, digg etc), and photo sharing sites (flickr, photobucket, etc.)." Harinarayana, 2010

Web 2.0 is being adopted by many educators mainly to facilitate social learning. Communities of practice, discussion forums and other such tools are being fostered to continue classroom discussion and motivate students to reflect about their studies throughout the week. Blogs have been used to encourage students to reflect on their learning and how it can and could be applied. Social networking has been used to communicate with students on a daily basis. (Kassens-Noor, 2012) These methods are all in line with the constructivist social theories of Vygotsky and Puget . In addition they are active, and of an informal nature as learning takes place outside the classroom. However they are often not self-directed but instructor led, they may or may not be experiential and authentic, also depending on the way they are executed the learner is not always motivated. Often students are given a mark in return for participating in such informal practices. However on a personal level students freely use these technologies to exchange personal information and are highly participative. It seems that using these technologies in the public domain is more natural and less forced. Therefore should these tools be transferred to a more natural informal learning environment?

IV. HOW WEB 2.0 IS USED IN THE LIBRARY

To date much research has been done on the use of web 2.0 tools in the library. The use of the term Library 2.0 has been used to merge the two concepts, Web 2.0 and the

library service. It was introduced in 2006 by Michael Casey in which he defined Library 2.0 as "the application of interactive, collaborative and multimedia web based technologies to web based library services and collections". Since then the research area has escalated and several web 2.0 tools have been implemented in libraries across the world. Several researchers have conducted in-depth analysis of the use of these tools (Harinarayana 2010; Xu et al 2009; Annfinnsen 2011; Han and Liu,2010; Buigues-García, 2012). The main tools used to date are:

- RSS feeds – these have been used to deliver information to users on the latest library services.
- Blogs – these are often used as a means of promoting the library, providing information on particular subject areas and training staff.
- Wikis – have been used mainly internally between library staff as a means to manage library materials or share library information.
- Podcasts – several libraries have developed podcasts as a training tool for patrons to use the library resources.
- Social networking – has been used as a means of communicating information with users on new information added to the website and promoting the library services with the user.
- Social Tagging – this technology has been used to allow individuals to tag relevant books and resources and review books and share these between students.
- Instant messaging – this has been widely used in libraries to allow virtual users to communicate with librarians with any resource based queries they may have.

Many of these technologies have been used to promote library services or allow learners to access training resources on guiding them about how to use the library facilities. Little research has been done about using technology to allow learners to create their own content from multiple sources and offering spaces for collaboration outside of formal curricula to allow students on non-traditional learning paths to avail of the informal learning experience fully.

V. TECHNOLOGIES TO FACILITATE INFORMAL LEARNING IN THE UNIVERSITY LIBRARY

With students undertaking many different various learning paths technology is playing an increasingly important role in connecting individuals. Constructivism has now evolved into connectivism which places emphasis on continual learning and connecting information sources and 'synthesise and recognise connections' (Siemens, 2005) it places emphasises on leveraging on other peoples experiences as 'we cannot experience everything' (Siemens, 2005).

Personalisation is one of the key abilities that web2.0 offers which other technologies have not permitted, the personalisation of content and of communication. (Kim, 2010) Web 2.0 allows us to personalise other peoples experiences and their information to our own needs. By the provision of these technologies through libraries, a natural space for informal learning, it may encourage learners to utilise these technologies fully without having to adhere to specific guidelines and within certain boundaries.

For example

- Wikis – could be used to allow individuals to effectively 'dump' and organise any relevant content or tagged into several areas which they may be relevant to an individual's learning needs.
- Social media – could be used for people across disciplines to share information on relevant learning material or answer each other's queries on how to utilise this material in different disciplines.
- Communities of practice and discussion forums on particular subject areas could allow students from different disciplines and courses to share information and experiences and learn from different perspectives.
- Blogs – could allow students to reflect on the overall course learning rather than at a subject level and provide mentorship for younger students.
- Tagging facilities – these are already used relatively well in libraries however if they could be used at a content level to allow students to automatically extract the content into a relevant area such as a wiki to personalise content.

VI. CONCLUSION

This paper examined the importance of informal learning in third level. It highlighted the role of the library in providing physical space and facilitates for informal learning in addition to other services. It identified the need for the provision of technology to provide virtual informal learning spaces and a means of personalising content to the students learning requirements. The authors have outlined potential Web 2.0 tools that can offer these capabilities. Further research needs to be conducted in implementing these technologies and evaluating their success in a more generic context outside individual modules and courses.

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Platform from mobile learning

J. Rubiano, A. Mena, D. Sánchez

***Abstract*—** This paper presents a technological development for e-learning. It is presented in the R + D project "Design of digital educational resources" framework. The development is the academic platform version for mobile devices. The technologies used were: WAMP Stack programming, Ajax, Jquery Mobile, Node.js and socket.io. At first, was necessary to select the app kind. After a pilot version of the platform was developed and implemented. And finally the definitive version was developed. The findings show that not all content developed for desktop are suitable for mobile platforms, the native developments are too demanding because it needs development for each operation systems, and the promotion of interaction between participants which encourages joint learning.

***Keywords*—** Communication; mobile learning; mobile platform; web app.

I. Introduction

THIS paper is presented in the R + D project "**Design of digital educational resources**" framework. This project is developed at the Manuela Beltrán University´s e-learning Unit (*UMB virtual*). It aims to design and implement appropriate digital resources for learning in educational scenarios.

This project supports the educational technology development in the unit, both in tools terms, such as virtual learning objects, including the LMS **Virtualnet 2.0**. This platform provides the basic tools that any LMS have and also include: the option to video calls; a tool for collaborative work, where different users access at same time for document editing; presentations online that can be collaboratively exposed by users from different locations, notifications, calendar that can be synchronized with email accounts, etc. About virtual learning objects, *UMB virtual* develops multimedia resources for all courses for undergraduate and graduate programs offer, where the lineaments for development are: motivation and happy learning.

A LMS is, primarily, a communicative scenario where the pretensions are educational. Digital tools and virtual learning objects allow communication.

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The communication nature has changed. The information and communication technologies (ITC) allowed, as Castells (1997), the "text, images and sound integration on the same system. Also, enables interaction from **multiple points** in a chosen time (real or delayed) along a global network with an open and affordable access." [1].

The terminals for digital content consumption are varied, and mobile devices are gaining ground against the desktop terminals. Cain and Sengupta [2] work the *tech giants scramble* topic in the mobile devices world. They point: "These and other tech companies are scrambling to reinvent their business models now that the old model — a stationary customer sitting at a stationary desk — no longer applies." Education is not outside of these communication changes. In this line, Ally and Prieto [3] state that "the next generation of mobile learning will be more ubiquitous." And that the "learners will learn from multiple sources rather than using one device".

It is true that the mobile devices power to process information is becoming stronger and this allow access to almost any digital resource, but it is also true that the web page (designed to desktop computer) navigation experience is significantly less nice when it does from a mobile device.

In communication terms, the mobile applications (native or WebApps) fully comply in offering content to the user, but are not strong in communication alternatives offered. This is because the communication is established through desktop computer or third party applications like skype or hangout.

From this perspective, the paper describes the adaptation and development of Virtualnet 2.0 platform for mobile devices.

II. Literature Review

A. Education and communication

The education and communication issue usually refers to individuals skills to process the information provided for mass media. In this case it is not. The subject is approached from the Language Codes Theory (Bernstein), in which "all courses, regardless the subject in question, consist in linguistic activities. Language is a central fact in schools. In our culture, teach is speak" [10]. In e-learning, the communication options are diverse. Not only **taught** through speaking, also through writing, through giving "like" in a comment, and any interaction way that Information and communications technology offer.

At this point it should be noted that rather than teaching, the new educational approach is learning [11]. From this

ISBN: 978-1-61804-238-5

perspective, learning can be enhanced through diverse communication forms.

Finally, it is useful to mencion that the comunication issue in e-learning is composed of synchronous or asynchronous **communication tools** (forum, chat, video call), and **instruments for communicate** (computer, phone, tablet).

B. Mobile learning

It understood like an alternative to learn "at any time, any place and in any way" [4], combines with "individualized (or personal) learning" [5].

Technologies are, of course, necessary to offer e-learning, but in themselves do not generate learning. That´s why "mobile learning is not about the technology, it is about the learner" [3].

Some important mobile learning properties are: "increasing enrolment, broader student population, flexibility (Lowenthal, 2010), facilitates equal opportunities for all, situated learning, negotiating knowledge" [3], interaction, sharing, collaboration, communication between cultures, etc.

C. Digital educational resources

The UNESCO´s definition [6] for *open educational resources* refers to "materials for teaching, **learning** and research in any medium, **digital or otherwise**." In e-learning, the resources are specifically digitals, and the development approach is learning.

Complementarily Minguillón [7] state that "although, the digital educational resource usually refer to educational content in web format, – including text, images and exercises– also fit other «material» in the (UNESCO´s) definition". That is why in this case, the *digital educational resources* include both **digital tools** such as **virtual learning objects**, which are not always open. Both allow communicating, but differing in the content handling. In the first case the content is not ready to use; this is just a scenario to build the content individually or together, while in the second case the content is ready, and integrates, "at least, three internal components: content, learning activities and context elements" [8].

Finally, is important to mention that although digital educational resources are developed to function as a unit, must also coordinate with the others resources used in the same academic scenario "Lima suggests that **partial or fragmentary use** for technical instruments maybe is insufficient when the interest is academic" [9]. Thus the digital educational resources (tools and virtual learning objects) should converge in the place which the educational process unfolds.

D. Technologic perspective

To perform Virtualnet 2.0 mobile application have been used some technologies and tools as:

WAMP Stack programming: Acronym used to describe a system of internet infrastructure that uses the following tools: Windows: As operating system. Apache: As a web server. MySQL: As manager databases. PHP: As programming language.

Ajax: One of the techniques used for delivering information between client server and combining some technologies is called AJAX (Asynchronous JavaScript And XML) which allows to create interactive applications or RIA (Rich Internet Applications).

This development technical is running on the client, keeping the asynchronous communication with the server in the second plane. In this form, can make changes perform on the pages without the need of recharging, improving interactivity, speed and usability in applications [12].

Jquery Mobile: The application is delivered to users through a WebApp Installed, which gives the user aN interface to easy handling on the mobile device that is deployed. For this purpose we have made use of the framework Jquery Mobile [13], it provides a series of interfaces, transitions and other interactions using the touch events that can be done through the phone.

In addition to these features, also have Jquery is a JavaScript library that simplifies the form to interact with HTML documents, manipulate the tree DOM, handling events, developing animations, and add interactions with the technique AJAX to web pages. This library has positioned as the most widely used JavaScript library. [13]

Since perspective of real time communication there are other tools as:

Node.js: Programming environment in the server layer based on the language JavaScript programming with I/O data to an architecture oriented to the events and based on the Javascript V8 engine. It was created with the approach to be useful in creating network programs highly scalable , for example, web servers.

WebSocket: Technology that provides a bidirectional channel full-duplex communication over a single TCP socket. Is designed to be implemented in browsers and web servers, but can be used by any application client / server.

Finally, **Socket.io:** Although WebSockets is a relatively new technology, it is not available on older browsers desktop, problem that has largely mobile browsers, so to bring the communication to the system chat, not only between mobile, also between mobile-desktop, it became necessary to use the Socket.io library, which frees the developer and end user of this difficulty because it selects the mechanism of communication that is present in the browser where is the application is being deployed, of course if this suffers from WebSockets will use techniques such as: long polling, hidden Frames, Ajax, Comet or Flash, ensuring communication.

As an application whose niche objective are mobile devices, making use of the web browser, the use of plugins is not possible because the use of these new technologies and standards it possible today to make from a native application.

III. DEVELOPMENT PROCESS

A. App selection

To start, the application type was selected, according with the *UMB virtual* particularities, as its education model. The alternatives were: native app and web app. The first enables developers to take full advantage of the device capacity on which they work, but requires a version for each operating system in a different programming language (Android-Java,

iOS Objective-C, Windows Phone-C#). Phonegap, and Appcelerator Xamarin are initiatives that offer a solution for cross-platform development. These become the programming language used to any other, according to the device. However, this conversion, in some cases, does not provide the same functionality as the native application. The other alternative is web app, which, thanks to HTML5 and CSS3 allow luxury display on mobile devices. The main advantage is that it can be viewed on any mobile device with a browser, regardless of operating system. For optimum performance, it is necessary to incorporate some special code lines for each mobile operative system. Additionally, this kind of app does not need to be downloaded from the app stores (play store, iPhone), so do not pass the validation process to impose such stores. Neither need to download updates, because as a web page always access to the latest version. Finally, we mention that the new Web standards (HTML5/CSS3/Javascript) have allowed a particular version of the web app: **web app installable**, which are located in the cell as a native with nearly all of these benefits. The biggest disadvantage is that, unlike native, for access to web app (installable or not), an internet connection is inevitably required. From the above, it was decided to develop the installer web app.

B. First version of the mobile application – Pilot

The development was gradually undertaken. At first was prepared a consultation version, where users had not the option to interact with peers; specifically: the chat was not enabled and the email had the reading option but not the writing one. The objective of this version was to determine if the users accessed to mobile platform. It was launched on July 4, 2012 (Fig.1).

Fig.1. First version. Mobile platform general menu

The percentages access to the mobile application has increased, as can be seen in Fig.2.

	2012*	2013	2014**
Total revenue amount from users to the system	280.134	688.436	191.307
Revenue amount from mobile platform	4.181	22.745	11.553
Revenue percentage from mobile platform	1.5%	3.3%	6%

Fig.2. Access to VirtualNet 2.0 system

* Data taken between July 4 and December 31, 2012
** Data taken between January 1 and April 1, 2014
Source: google analytics, developed by the authors

Whereas the access to the system from mobile devices increase between 2012 and 2013, since January 2014 started the second version development.

C. New version of the mobile application

The development aim was offered to students a mobile alternative for study. The following criteria were taken into account:

- the content for the mobile version should be both aesthetically and pedagogically appropriate (this criterion was considered from the first version)
- the mobile platform presentation should be enjoyable and intuitive
- It must be able the access from any mobile device, regardless of screen resolution

The technologies used were: WebSockets for handling real-time communication; Ajax content delivery asynchronously; HTML / CSS / Javascript for handling customer information and communication with the server; WAMP as programming stack (Fig.3).

Fig.3. New version. Mobile platform general menu

D. Some academic consideration to develop

A fundamental part of the process teaching-learning, in the virtuality, is the interaction that develops between students and even teacher engaged orientation which allows the proper construction of knowledge. The device potentiates this interaction is centered on everyday technological devices that people use every day, in our case are mobile.

Considering the mobile as the medium that will transmit the information desired, the functional requirements are present: user profile, email, chat -online and offline- content, comments, newsletters, calendar and score ratings. Thinking about the basic needs of students and teachers, the requirements were taken three times: the first would be to identify, to recognize who he would be talking; the second is to information found on results qualifications, dates and class topics; third time as the communication that are given to establish the conversation, as chat and email.

Finally, were not taken into account the qualification requirements, some content, forum, reviews, online presentations and more, because the Web App does not allow viewing on mobile devices because the information and decoding are presented more robust and would require that the devices were the latest technology, keep away the idea that on

any mobile it can be used, significantly compromising the interaction.

IV. RESULTS

The features of the web app are described as follows.

The first feature is access to some basic information, such as: own profile (can be edited), others participant's profiles, activities schedule made by the teacher in calendar tool and option where ratings assigned by the teacher are recorded.

Calendar tool was considered important because the content and activities are enabled for a specified time and because the mobile platform aims facilitate the organization of time.

The second feature is the reinforcement of asynchronous communication. The first tool is the newsletter through which the teacher can leave short notes on the course highlights. The second is email (Fig.4).

Fig.4. Email

Email users can send, reply and receive messages to and from the classroom participants. An important feature is that all email sent from platform have an immediate copy to the personal email account (Outlook, Gmail, Yahoo)

Another communication tool enabled is social chat (Fig.5). Unlike the previous tools, social chat enables talks in real time inside of platform. This allows communication to all users through the "Public Chat" or private one on one conversation.

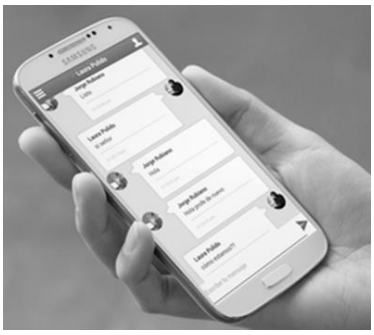

Fig.5. Social chat

Finally there are the contents (Fig. 6). The teacher has the option to decide if want that the contents can be seen only in desktop version or in mobile too. This alternative is offered considering that not all materials are suitable for mobile devices (eg flash format).

The types of content that can be posted are videos, audios, texts, animations. These can be played because of new web standards (HTML5/Css3/Javascript).

Fig.7. Contents

A new feature from content is the comments. This promotes interactivity around the contents with other users. Respecting content mobile aesthetics, comments have a character restriction.

V. PROJECTION

A. *WebRTC*

WebRTC is a new technology that allows makes video calls without plugins and specialized software. Right now is already being used in the desktop platform version, and will be incorporated in mobile version.

B. *Native application*

The google analytics data showed that the most used operating system is android. This would allow use more phone features.

VI. CONCLUSIONS

Mobile platforms enhance interaction and learning together. This, from the perspective of the zone of proximal development from Vygotsky [14], allows learnings that would not be possible individually.

The amount of hits to the mobile platform demonstrates the student interest for this study alternative.

Transfer the contents of the desktop version to mobile would make the same mistake that when was transfer the contents from traditional education to virtuality. It is important recognize that exist differences in presentation and develop content. At first, the mobile device screen is smallest than the desktop computer screen. From this, the contents (text, video, audio, image) should be compact, concrete and specific. At second, the mobile device cannot process some formats, like flash. So, the programming language must operate in those. And finally, the navigation is different when is done with mouse and keyboard, that when is done with fingers.

If platform versions for desktop and mobile devices are needed is important to think about programming languages that are suitable for the two scenarios. Take into account the possibilities for develop a mobile version from when the technologies choice for desktop computer develop is made, helps a lot in the unification.

ISBN: 978-1-61804-238-5

The installable web app version has significant benefits for the mobile platform, for the development effort is less than if it were a native to each operating system, also because does not need updating, and because the only software that need is the navigator.

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Collaborative learning in superior education with learning virtual objects LVO

Yaneth Patricia Caviativa Castro, Ruth Molina

***Abstract*—** This characterization with OVA in higher education face collaborative work processes is implemented with college students in the area of health as a pedagogical tool for teaching and strengthening technological concepts, it is necessary in college because Manuela Beltran repetition presented in the areas of health being the consequence of the national education system that does not allow an integral step between education. Analysis of determinants of attrition in Colombian higher education based on the SPADIES, (the System for the Prevention and Analysis of Desertion in Higher Education Institutions-SPADIES), MEN (2008).

Other causes can identify the low academic level of secondary education leading to shortcomings in terms of core areas such as math, language, science and social studies, among others. Thus it is required to execute a novel implementation as a collaborative learning strategy with a learning object, focusing ***this project in the University*** Manuela Beltrán, where young students do not approve subjects and at the time of coursing it again, they desert. LO implementation within the collaborative work process would be beneficial for strengthening theoretical-practical themes in the area of biology in the University, having the opportunity to promote this didacticism which could generate good results and create expectations in themes or thematic, since it is not a methodology used before and teachers can modify it according to students or program necessities, besides the relevance of collaborative learning as a factor that could help university students in health area.

***Keywords*—** Collaborative learning, LVO (Learning Virtual Object), social constructivism.

I. INTRODUCTION

THE characterization with LVO in superior education as a pedagogical tool in the face of collaborative work processes is a didactic and technological strategy for the strengthening of concepts. The objective of this research is determine the characteristics of collaborative learning in a LO which is implemented in university students in health area, and identify analysis criteria of collaborative learning that is generated from the design of learning objects.

Therefore, the elaboration strategy of the LO as an external agent which encourage collaboration in the student, seeks for improving their academic performance and so contribute to their learning through the use of collaborative strategies. Regarding effectiveness of collaborative learning of this project, with the master in science and technology education, it should be revise the use of virtual resources, and observe if it favors collaborative work strategies in educative and pedagogical aspects, giving then solution to this problematic which would benefit university community as an educational strategy.

II. BACKGROUND

One of the lines of thought that guides educative change is the one that links with collaborative learning, understood

> "As a learning where ideas are shared to solve a task favoring with dialogue, reflections about own approaches; and in individualized learning systems it is tried to create a model of tutor that guides the student, as in collaborative systems is about finding a model which includes the different participants, the tasks to do, and the ways of collaboration. Besides, to the extent that is provided the possibility of registering the processes of work, it also can be established models that allow analyzing and monitoring them and so, proceed, intervene to improve them" [1].

Consequently formation activities executed by university teachers have made obvious new problems, which make necessary advancing in conceptualization of collaborative learning through educative investigation. One of the first elements to considerate as base of all learning, and especially in collaboration, is communicative interaction. In a wide sense, communication is the relation which establishes between two or more people. For the existence of real communication there must be an exchange of messages between the participants.

When analyzing the theme of collaborative learning is necessary to point some details, according to Dillenbourg, et. al, (1996), corresponds differentiate learning from problems resolution, and collaboration from cooperation. From the psychology it is considered that learning and problems resolution share similar processes, but from computational sciences, it is considered different. At the moment, it is shared with [2] Wessner, M. and Pfister, H., (2001), that collaborative learning implies the participation of

> *"Two or more people with the common objective of acquiring knowledge, who are in disposition of sharing their knowing and experiences, in the frame of interaction and communication actions directed to achieved such purposes*" [3].

ISBN: 978-1-61804-238-5

This way of learning is offered as an alternative to competition and individualism where ideas of solidarity underlie, as well as concepts of conjunctions of efforts and, agreement and interdependence between people.

> *"A collaborative team should have positive interdependence, individual responsibility, promoter interaction and appropriate use of social skills; are elements which provide the conditions for an effective collaboration"* [4].

As it can be seen in the above described elements, there are some basic principles of group constitution added to actions, skills and abilities that can be enhanced by the implementation of a mechanism of the type promoted by collaborative learning, since this is characterized by its autonomy, leadership, tasks assignment, time management, responsibility in activities and others, while cooperative work is intended to the construction of new ideas, the professor predetermines groups of work and gives the lineaments for working.

Consequently,

> "In order to execute this formation labor it was worked in the definition of a pedagogical model that guides this process of transformation of teachers action and in a methodology for designing learning objects, based on that model, makes sense the *collaborative work* with pairs and the professor regulatory interventions *(teaching and orientation*), the first makes more dynamic self-learning, and the second guides the activity towards the goal of reaching socially shared significations. The model contemplates three activities which are*: individual study, collaborative learning* and *accompaniment and orientation*. Articulation of these three activities constitutes a mechanism which influences the student autonomy development in their formation processes, as essential and indispensable element of Educative Model" [4].

III. RESEARCH DESCRIPTION

PROBLEM AND JUSTIFICATION

According to (ECAES) from the identification of repetition causes, it becomes necessary in a superior educational level, to inquire and analyze desertion determinants in Colombian superior education based in the System for Prevention and Analysis of Desertion in Superior Educative Institutions, (or SPADIES for its initials in spanish), and based in repetition of students of the University Manuela Beltrán, M.E.N. (2008).

Thus it is required to execute a novel implementation as a collaborative learning strategy with a learning object, focusing this project in the University Manuela Beltrán, where young students do not approve subjects and at the time of coursing it again, they desert. LO implementation within the collaborative work process would be beneficial for strengthening theoretical-practical themes in the area of biology in the University, having the opportunity to promote this didacticism which could generate good results and create expectations in themes or thematic, since it is not a methodology used before and teachers can modify it according to students or program necessities, besides the relevance of collaborative learning as a factor that could help university students in health area.

For students who enter in university careers, some elements that determine studies abandonment are of external, internal or intrinsic type. Thus, the strategy of LO elaboration as an external agent which promotes the motivation in student can improve academically and contribute to diminish university desertion rating, besides of implementation of collaborative learning. Regarding effectiveness of collaborative learning of this project, with the master in science and technology education, it is clear, because the utilization of virtual resources favors collaborative work strategies, amplifies decreasing of university desertion in educative and pedagogical aspects, providing so a solution to this problematic which would benefit the university community.

Research question

Which are the characteristics of collaborative learning with a learning virtual object?

GUIDING QUESTIONS

It is fundamental to formulate clearly the principal question that requires to be answered concretely in context of the problem to which solution or understanding will be contributed with the execution of the approach.

From above, it is recommended to ask guiding questions that will be answered in the development itself of the research and that helps answering the principal question.

OBJECTIVES

GENERAL

Determine the characteristics of collaborative learning in a LO that is implemented with university students in health area.

SPECIFICS

Determine and implement a strategy of collaborative learning in a learning object.

Identify analysis criteria of collaborative learning which is generated from the design of learning objects.

IV. METHODOLOGY

The methodology that wants to be implemented is qualitative; a descriptive type of study and the study model will be done by the characterization of reference population: the students of the University Manuela Beltrán in health area. In the type of study will be used the description and interpretation of data; and the investigative model is based in a *case study*, a field work.

RESEARCH ANALYSIS FROM PEDAGOGIC

First, will be done a recompilation of data and investigations, about factors directly implicated in the increasing of this problematic, through bibliographic sources, virtual resources, and field work to get to know advantages and disadvantages that could reflect with the characterization of collaborative learning with a virtual object in biology are of the University Manuela Beltrán.

Latter, can be considered look at thematic contents in which students present difficulties, so it is counted on the characterization of collaborative learning, having to include some aspects as standards, achievement to recover, objective of learning, generator topic, thematic, subthemes, performances and achievements (knowing, doing and being) for each LVO using curse lab programs for the LVO and constructor for activities. Thus It is necessary clarify that, according to Pithamber [5]:

The design of a LO must content at least three basic characteristics: a) being referable, for which should be labeled to guarantee its access; b) being reusable, which implies that it should adapt to different learning contexts, and c) being independent of the environment in which is provided and of the system that will use them, guaranteeing its inter operation.

Kolb [6] marks that there are four learning modes: by concrete experience, by reflexive observation, by abstract conceptualization and by active experimentation. Combined together, they can create at the same time, four learning styles: divergent, assimilator, convergent and accommodator.

Fig. 1

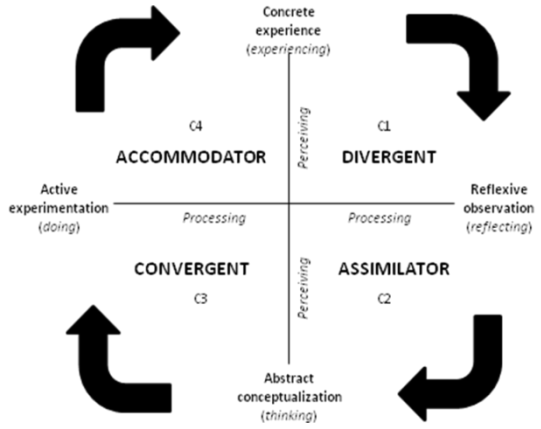

Fig. 1 resumes the approach of Kolb that helps to select the activities and guide the design of the strategy implemented in the LO. Therefore it will be used to design a LO.

- Divergent style (random concrete or imaginative) describes imaginative people who prefer to learn based on feelings and observations. Requires knowing "WHY". It is recommended to do activities that combine concrete experience and reflexive observation.
- Assimilator style (abstract-sequential) is proper of analytics that base principally on reason and observation. Wishes to know "WHAT". It is recommended to do activities that combine abstract conceptualization with reflexive observation.
- Convergent style (concrete-sequential) describes people who prefer to learn using common sense and based on reason accompanied by action. Wishes to know "HOW". It is recommended to design activities where it can be apply what is learnt, seeking for utility and develop the ability of implementing what was learnt.
- Accommodator style (random abstract) describes dynamic people who prefer to base on feelings accompanied by action at the time of learning. Requires knowing if it is correct and how can be modified to do the proper work. It is recommended to design activities where one can modify from what was learnt and do information adaptations, analyze its use and the importance of complex experiences [7], [8].

Afterwards, the characterization of students with the implementation of collaborative learning in the application of LVOs as pedagogical strategy, will be execute through pedagogical surveys to repeating students who are exempt of handling the collaborative work applied in them. Focusing this project in the University Manuela Beltrán, this research would be beneficial LO implementation within the collaborative work process would be beneficial for strengthening theoretical-practical themes in the area of biology in the University, having the opportunity to promote this didacticism which could generate good results and create expectations in themes or thematic, since it is not a methodology used before and teachers can modify it according to students or program necessities, besides of the relevance of collaborative learning as a factor that could help university students to learn in health area.

V. THEORETICAL FRAMEWORK

RESEARCH ANALYSIS FROM THE TIC

To guide the methodology of learning objects design were taken two definitions, one of David Wiley (2000), who explains that learning objects: [9]

> "…Are elements of a new type of instruction based on computer and computational paradigm of 'orientation to object' [10].
> It is valued above all, the creation of components (objects) that can be reused in multiple contexts. This is the fundamental idea that hides behind learning objects: instructions designers can build little instruction components (in relation with the size of a whole course) that can be reused many times in different study contexts."

And the definition of the National Education Ministry of Colombia that defines it as "a set of digital resources that can be used in different contexts, with an educational purpose and constituted by at least three internal components: contents, learning activities and contextualization elements" [10].

From above we can conclude that LVO are pedagogical mediators that are design with a learning purpose given the following characteristics: timelessness, so it will not lose validity through time; didactic; usability; interaction and accessibility.

According to these definitions, an already validated LVO is taken, and the collaborative learning that generates the object is characterized, with the possibility that these objects have of being reused, inter operable and scalable.

In recent times, incursion of information and communication technologies -ICT-, has made an important mark in the approach of strategies having the possibility of being considerate at the interior of technology education processes, as study subject ; besides of their impact in the actual society and cultural conformation.

RESEARCH ANALYSIS FROM DIDACTICS

This background contributes to the scientific field which major concern centers in the study of teaching – learning processes of science and in particular, of scientific fields.

Reference [11] shows that Adúriz-Bravo and Izquierdo, (2002), explain that: Metatheoretical reflections about epistemic nature of didactic of science, contribute to this tradition. All of us who have dedicated to the educational labor, have tried to give answer through different points of view to questions about: what to teach, how to teach, when to teach, why teaching, and how and when to evaluate.

What follows the above is that:

> "Our vision of science didactic is then the one of a discipline, for the moment, autonomous, centered in science contents from the point of view of its teaching and learning (this is, a majorly based epistemic discipline), and nurtured by the findings of other disciplines occupied in cognition and learning (psychology and others of cognitive science area)" [11].

This definition is not coherent with an approach of social construction of knowledge, but allows affirming that the didactic is: the science of teaching science is an emergent, autonomous, cognitive discipline, a science of design. According to the same authors that situate the science of studying science and in particular, as Izquierdo presents, let us start by establishing what is science [11].

> "…considers that to comprehend the dynamic of science, it is not enough the logic justification of knowledge, but that we need to appeal also to the value system that justify human actions" [12].

For the above mentioned this approach seeks to propound pedagogical strategies, didactical for its use, develop virtual objects for its implementation, do an evaluation of its impacts in learning processes and construction of knowledge. For this it will be taken in count the following thematic for implementing learning object.

Biosecurity is a theme of universal importance especially in health area for this reason there is a reference in this guide to the relatives dangers that carry microorganisms which will be worked with in laboratory, and to evaluation of hazard that entails each and every one of the practices proposed in the course development.

Biosecurity or biological security: is the term used to refer to applied principles, techniques and practices, in order to avoid non intentional exposition to pathogens and toxins, or their accidental liberation.

Bioprotection or biological protection: it refers to protective measures of the institution and staff, destined to reduce the risk of lost, theft, wrong use, deviations or, pathogens or toxins intentional liberation.

Biohazard: it is a biological origin agent that has the capacity of producing deleterious effects in human beings, for example microorganisms, toxins and allergens derived from plants and animals.

Biological risk: it includes infectious or etiological (that causes diseases) agents, potentially infectious materials, certain toxins and other dangerous biological materials.

Between biohazard agents there are: microorganisms, recombinant products, allergens, human and animal cells cultivation and potentially infectious agents that these cells contain, viroids, prions and other infectious agents that are contemplated in laws, normative and rules.

Danger: probability of occurrence of a potentially harmful event.

Risk Group (RG): risk for the individual and community.

(RG-1) Little or null individual and community risk. Microorganisms that have low probabilities of causing diseases in human being or animals.

(RG-2) Moderated individual risk, low community risk. Risk group constituted by pathogens agents that can cause diseases in humans or animals, but have low probabilities of carrying serious risk for laboratory staff, community, animals or environment. Exposition in laboratory might cause infections, but applying effective treatment and prevention measures, the risk of propagation is limited.

(RG-3) High individual risk, moderated community risk. Risk group constituted by pathogens agents that can cause serious diseases in humans or animals, with low propagation risk in community. It will apply to diagnostics, investigations and productions in which it is worked with agents that might cause a serious disease or potentially lethal, principally as a result of exposition to aerosols. It might dispose or not of effective treatment and prevention measures.

(RG-4) High individual and community risk. Risk group constituted by pathogens agents that can cause serious diseases in humans or animals, with high propagation risk in community. Usually there is no disposition of effective treatment and prevention measures.

(*Source*: W.H.O. Manual (2005)).

It is important to know that in the task of avoiding the occurrence of hazards, there are universal codes that help space signaling. Adequate interpretation of these security signals is a fundamental tool to identify behavior that must be followed in a place. Another valuable information of great utility is provided by the Harmonized Globally System of classification and labeling of chemical products. This is an international instrument for the communication of chemical hazards and normalized dispositions for security labels and files.

THE ROLE OF ICT

In the past few years the newness of information technologies ICT has marked a lineament in formation strategies approaches, supported by virtual media, having the capacity of generating new knowing in any field of knowledge, which has allow it to configure as a source of production, wealth and power. Within the characteristics of knowledge society it is found the presence of information and communication technologies in a global way, seeking for an approach with time and spaces generated for this communication, a cyberculture [6].

A culture that accelerates abilities, developments, knowledge, that exists in cyberspace generating that strengthening in collective and individual intelligence, participating in the construction of knowledge. At this point lies the important role of education, which must take the challenge, not only of adopting information and communication technologies -ICT- to its teaching and learning processes, but also the challenge of transform itself from the use of this tools to respond to the requirements of present society.

Always noting that knowledge is constructed socially, without leaving aside the real development zone, the proximal development zone, seeking for being mediators of knowledge. In this social interaction of knowledge construction, it should not be left aside the role distribution, positive interdependence and coevaluation.

Social constructivism has as premise that each function of people cultural development appears doubly: first at social level, y later at individual level; at the beginning, between a group of people (interpsychological) and after in themselves (intrapsychological).

This applies both in voluntary attention, and logic memory and concepts formation. All superior functions originate with the present relation between individuals (Vygotsky, 1978) [13].

The constructivism of Vygotsky focuses on social base of learning in people. Social context gives the students the opportunity to implement, in a more successfully way, abilities that are more complex than what they can do by themselves. In individuals, social component is very important, having friends and sharing with them. New technologies focus on this theme, providing the necessary tools so that people that access them can share with others their knowledge, interests, ideas, likes [14].

VI. CONCLUSIONS

The correct data recompilation will allow determining the characteristics of collaborative learning in a virtual object fulfilling the established standards and strengthen the academic plan contents of students of the University Manuela Beltrán in biology area; generating thematic strategies where students present difficulties to intensify the academic plan contents. Also, will allow determining the factors that intervene in scholar desertion, and the advantages and disadvantages of collaborative learning characterization of LVOs as pedagogical strategies. As a virtual resource of good quality which fulfills with the organization and objectives scheme that was traced, it will allow increasing the collaborative work and the implementation of a pedagogical innovative strategy for the career. The evaluation of this tool will give good results regarding opinions of teachers and students.

The expected results will contribute as research not in formation at an university level, but in national education, since the established problematic affects Colombia in general, for the increment of desertion at scholar levels, not only un basic high school, but in a superior education level. It would be an innovative, creative, didactic and motivational strategy, since it increases collaborative work. From any place that the student is, he will be able to access to the platform and strengthen, complement and generate results that would be evaluated by their tutor making use of ICTs as pedagogical favorable tool for basic, media or superior education.

Collaborative learning will be a diverse experience, both for the size of groups and the internal organization of themselves. For the collaborative learning we expect the implementation of learning experiences in interaction. As a tool that favors learning and the use of software that allows providing more tools, these are all channels for the production of group interaction originating collaboration and learning processes.

The contributions of the integrants of a group put in a collaborative learning situation, offer a change in the knowledge of participants in that process. Other development lines can deepen from the technological perspective, analyzing the elements that characterize collaborative learning found in the investigation and evaluating them. Definitely there is a very important number of approaches, developments and investigations that can be done to enlighten this complex educative ambit.

ACKNOWLEDGMENT

The author would like to thank Richard Jose De Sousa Da Silva for his translating collaboration and adjustment of the text to the corresponding and required format.

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ROBIN - ROBotic INteraction system for visual-spatial data presentation for effective learning

Massimo Pistoia, Paolo Casacci, and Gianfranco Borrelli

***Abstract*—**The ROBIN project aims to develop a computer-based exercise platform that can promote a multi-faceted representation of data and thus constitute a valid tool in teaching activities, mainly in presence of specific learning impairments. The platform is reinforced by the use of an anthropomorphic robotic system, in order to build a playful and stimulating environment able to support children affected by dyslexia.

***Keywords*—** Dyslexia, teaching, robot-aided learning, learning impairment.

I. Introduction

THE ROBIN project creates a multimedia robotic system integrated with the OMNIACARE software platform, developed by eResult, that enables to cope with the miscellaneous disability-related conditions. Among the different types of disabilities, the SLD – Specific Learning Disabilities take on great importance and among them in particular the ones related to dyslexia disorders.

"Dyslexia" is a specific difficulty that refers to the ability to read accurately and fluently and which is often characterized by poor writing skills. The dyslexic subjects have great difficulty in learning to read: reading is slow, laborious, and usually inaccurate. The ability to read is hard to achieve through repetitive tasks, rather it requires a major investment of cognitive resources.

Reading disability affects about 3-5% of Italian children [1] and it is the most prevalent of all learning disabilities. Developmental dyslexia is diagnosed by specific difficulties in reading that cannot be explained by causes related to intelligence or lack of educational opportunities. Literature prove the usefulness of Information and Communication Technologies to support dyslexic pupils in learning tasks, but often such technological tools are developed to be used in one by one rehabilitation treatments, hardly usable in the context of teaching class [2].

ROBIN, by means of OMNIACARE-based exercise platform, develops a playful and stimulating environment able to support children affected by dyslexia not only in the cognitive stage in order to facilitate their learning activity, but also and particularly in their relational and growing path.

II. Technology

The goals are pursued through the use of a kit consisting of an anthropomorphic robot, NAO, developed by the French company Aldebaran Robotics. NAO interfaces with a laptop and an LMS - Learning Management System platform, OMNIALEARN, hosted on a remote server – OMNIACARE – accessible via the Internet and capable of recording all the performance data of the exercise. The OMNIACARE platform, specifically developed for the remote monitoring and assistance of frail users, has been extended in order to communicate with the robot and to make use of the different sensors and devices whom it avails of to implement specific algorithms that enable a multidimensional representation of the information. NAO is a hi-tech robotic device characterized by 25 degrees of freedom, which allow it to perform even the most complex motions and it is suitable for structured and unstructured environments. It is equipped with:

1) Ultrasonic proximity sensors pointing towards different directions, that allow to detect and evaluate the physical distance
2) Pressure sensors located under the lower limbs
3) Advanced multimedia system with 4 microphones and 2 speakers
4) 2 CMOS cameras designed for speech synthesis, space location, face and object recognition
5) Interaction sensors such as 3 touch areas above the head of the robot
6) 2 infrared led and 2 contact sensors on the front of the lower limbs

This work was supported in part by the Apulia Region in Italy by means of the Regional Framework Program FESR 2007-2013, Convergence Objective – ASSE I – Line 1.4 – Action 1.4.2 " Supporto alla crescita e sviluppo di PMI specializzate nell'offerta di contenuti e servizi digitali – Apulian ICT Living Labs - Investiamo nel vostro futuro".

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III. Methodology

The ROBIN system and the services it provides have been shaped around the UCD - User Center Design methodology. It is a design philosophy and a process, which focuses the attention on the user's need, expectations and limits in respect to the final product. The user is placed at the center of each step of the development process in order to maximize the usability and acceptance of the product, optimizing it around the needs of the users. The UCD methodology is characterized by a multi-level co-design and problem solving process. It requires designers not only to analyze and foresee how the user will utilize the final product, but to test and validate their assumptions at the same time by taking into consideration the end-user's behavior during the usability and accessibility tests (test of user-experience) into the real world. The UCD methodology leads to the creation of the final product through an interactive process that provides the development of a first prototype and a following test and assessment stage on the basis of which to proceed with the development of the next prototype. Each cycle therefore leads to the creation of a product that is closest to the real and practical needs of the user.

IV. Analysis of Users

Although over the last twenty years much hardware and software for education has been tested and produced, even for students with special needs, it often have been developed without a real and critical analysis of the user needs. The starting point of Robin, however, was just that [3]. The desire to explore and embrace the experiences, attitudes, expectations and needs of technology of the school community. To explore the problems and potential of ICT in support of learning processes with dyslexic students, the survey technique of focus groups (FGs) was used. This is a special type of group interview that is designed to produce data on a specific topic by comparing participants [4].

The comparison between the clusters of focus groups conducted with groups of adults (A, B, C, E), has also highlighted three different macro-narrative categories.

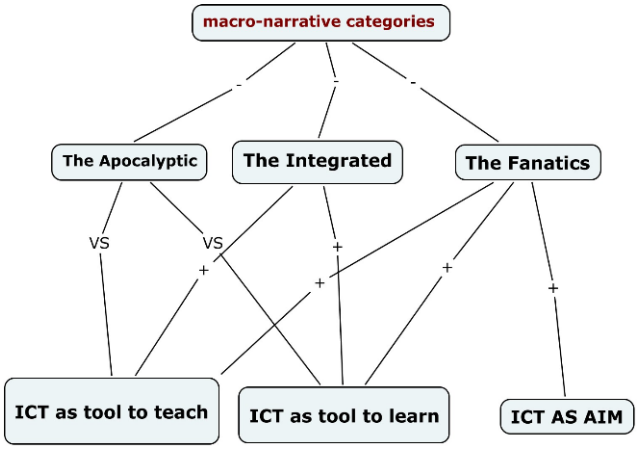

Fig. 1 Types of users

In the focus groups with adults, four meaning cores emerged about the function of the interaction with ICT and with the NAO robot. Discussion in the focus groups concerned these cores and went through an analysis in terms of expectations and critical aspects. In the first case *desiderata*, in the second one suggested solutions to some of the problems emerged.

The results of the focus groups have become the guidelines for the development of the LMS. The LMS platform provides three main categories of work, each with three different types of activities. Each activity is calibrated to three school levels: first cycle of primary school, second cycle of primary school, first cycle of secondary school. For each school level, all activities are graded on at least three levels of difficulty.

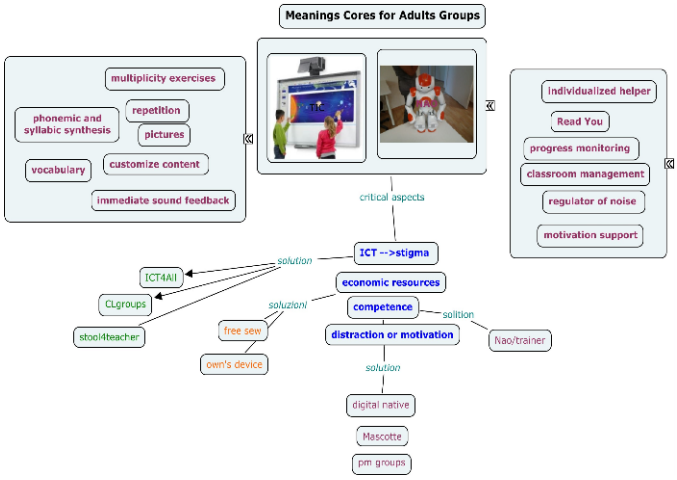

Fig. 2 Map of the results for the adults'focus groups

V. Activities

The platform provides exercises to the pupil, accessible via a PC or notebook. During the execution of the exercise, children benefit from motivational hints by the robot. The robot through automatic pre-set questions verifies then the pupil's understanding level and returns positive and/or reinforcement feedback. By doing so, the pupil increases its own autonomy and perceived self-confidence and gets strong sensation of gratification.

Three categories of exercises have been devised:

1) Didactical games. These exercises consist of simple games shown on screen with questions that require answers on the computer by the student. The level of difficulty can be configured and adapted by the teacher to the single student,, based on age, capability and specific impairments. The first game proposed is "memory", through which the student has to find couples of the same cards, that can contain text or images. At any trial, and from time to time, the robot will give feedback and encourage the pupil. The second game is "rhyming", through which the student has to detect words in rhyme for a list shown on the screen. In this case also the robot

ISBN: 978-1-61804-238-5

will give feedback and encourage the pupil. The third game built in the platform is "syllabizing", through which the student has to count the number of syllables in a list of words proposed on the screen, while the robots provides feedback.

2) Reading comprehension. These exercises are defined with the Gullpease evaluation index of readability. They are devised with the possibility to hear reading suggestions by the robot or by the software platform. This category of exercises is currently under development, as it involves a considerable effort by programmers. The first example of exercise allows the teacher to define a text and then to put grammatical and semantic errors on purpose, so that the student will have to find out and correct them (with the help of multiple-choice list), while at the same time getting feedback and hints by the robot. A second type of exercises consists of a text with missing words in it, that the student will have to fill in, choosing in a list of multiple choices. The system will provide feedback through the robot and help the pupil in selecting the correct answer. A third type of exercise exploits conceptual maps. The teacher will input a text in the system and define the most significant words in it. The student will have to read the text through and, each time a significant words is spoken, the system highlights it on the screen and progressively builds the map in order to help the pupil understand the concept behind the text. The exercise is carried out with the robot speaking after the pupil.
3) Visual-spatial understanding. These exercises still require definition. The concept behind them is to help pupils affected by dyslexia to associate 3D situations to 2D animations, in order to fill in the gap to project two-dimensional images in three-dimensional patterns. An example of such exercises may be the design of a maze on the screen with the robot trapped in. The pupil must work the robot's way out of the maze and, each time a movement in made on the screen, the same movement is made by the robot on the floor beside the computer table.

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Paolo Casacci is an ICT Software engineer specialized in automation, with more than 15 years of experience in system development. He has strong skills in LAN and WAN networks and wireless sensors networks, aimed at acquiring environmental and vital parameter. He is also experienced in servers management and DBMS administration. He has realized several ICT platforms for industrial automation, quality control, and data management. He has also developed traceability systems and related data warehouse and reporting services. He has cured the hardware realization within the remote assistance support system to caregivers.

He was the technology manager for a project related to seniors' remote home assistance, facing hardware issues related to sensors and wireless communication.

Gianfranco Borrelli is a Telecommunication engineer. He works as a technology consultant for small and medium companies, leveraging his experience in the field of ICT software design and implementation of complex systems. His 15-year experience in the field include strategic management of technological innovation, along with ICT design, development, and contiuous improvement.

Engineering Students' Acceptance of mLearning in Formal English Language Learning: Application of UTAUT Model

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***Abstract*—**The paper describes the investigation into the undergraduate Engineering students' acceptance level towards the incorporation of mLearning in their formal English Language course. The researchers posit that before mLearning could be implemented, students' acceptance and intention to use mLearning need to be determined to justify the cause of the implementation. The study adopts a needs analysis survey technique to probe into the undergraduate students' acceptance. The survey questionnaires was designed based on UTAUT model to seek elaborative findings specifically on students' acceptance and intention to use mLearning in their formal language learning. This study was conducted on 220 undergraduate engineering students of a Malaysian private university who were undergoing an English Language communication course. The findings indicated that the overall result on all the key constructs (based on UTAUT model) concluded that the students highly accepted mLearning as intervention in facilitating their learning needs and they intended to use it. These findings justified the incorporation of mLearning as learning support to the students' language learning needs to improve their language competence as well as fulfilling the learning course outcomes as the literature dictated that a language course or program should accommodate not only the target needs but also the students' learning needs. This is vital for the success implementation of a learning solution such as mLearning because learners should accept and intend to use a proposed solution before the solution could be implemented.

***Keywords*—** Engineering education, English Language learning, mLearning, UTAUT model.

I. Introduction

The language discipline is distinctive from other subjects in the curriculum as language learning involves integration and fluent application between the explicit learning of vocabulary and language rules with unconscious skills development (Milton, 2006). This implies that language learners need to master not only grammar knowledge but fluent language use too. At tertiary level, this poses a problem especially among undergraduate students with low language proficiency in coping with English for Specific Purposes (ESP) courses such as Business English, Academic writing, Professional and Communicational Skills, and others. In ESP courses, undergraduates are usually expected to be proficient in basic written and spoken language beforehand. ESP courses are usually context-based although grammar and structures are occasionally instructed indirectly and integrated in the courses, unlike General English which focuses more on mechanics, language rules, pronunciation and structures (Friorito, 2005; Mihai, Stan, Moanga, Adam, & Oroian, 2012).

Coupled with factors such as time constraint and imbalance lecturer-student ratio, ESP lecturers tend to focus more on completing the university ESP syllabus than attending to students' language competence needs. As a result, students who lack in language competence compared to their more proficient peers obviously have to deal with their handicap while undergoing their required undergraduate ESP courses (Chowdhury&Haider, 2012).

Nevertheless, the students' language learning needs could be assisted naturally through the integration of formal, informal, and social learning activities (Quinn, 2011a, p. 19; Quinn, 2011b). Since, mobile technology could act as an efficient mediator for these activities,mobile learning (mLearning) is proposed to support students' learning needs as well as achieving the target needs of their ESP course. The argument is that mLearning as a support to a learning problem could be more sustainable in its adoption compare to it as a learning replacement to conventional learning (Abdullah, 2013). However, although mLearning could be a viable support to cope with their language learning needs, the support could prove ineffective in the implementation later if the students resent the use of it (Sharples, Taylor, &Vavoula, 2005). Venkatesh et. al (2003) argued that the learners should accept and intend to use a proposed solution before the solution could be implemented. Hence, this study aimed at investigating language learners' acceptance in the incorporation of mLearning in formal learning course. The focus of the study was conducted among engineering undergraduate students of a private tertiary institution in Malaysia in probing their acceptance and intention to use mLearning as support to facilitate their language learning needs and their intention to use mLearning as extension to their existing formal language classroom learning.

This work was sponsored and financed by Universiti Teknologi PETRONAS.

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II. Method

A. Sample of Study

This study involved 220 undergraduate engineering students of a Malaysian private university who were undergoing an English Language communication course. Based on Cohen, Manion and Morrison (2007), samples numbering 30 and above are suitable for research study employing statistical analysis. The students were selected from the whole population of students who took the course subject 'HAB 2033/HBB 2033- Professional and Communication Skills Course' an undergraduate English for specific purposes course. Since the study attempted to assess the need to incorporate mLearning into the language course subject, purposive sampling method was used to select the students for the study. The course was offered as a compulsory elective subject by the institution to inculcate soft skills in students to improve their competitiveness in the job market. The students need to complete the compulsory subject as fulfillment of a four-year undergraduate study. This course emphasizes the theory and practice of professional English Language communication at the interpersonal level, in teams and to a large group. The course serves to build upon the students' academic and professional knowledge acquired through other core engineering or technical courses, and aiming at enabling them to be highly effective in expressing themselves and in imparting their professional and technological expertise in a variety of jobs, business, and professional settings. The whole course is designed for fourteen weeks offered in each semester and is divided into four parts: Process Description (Group Poster presentation), Technical Oral Presentation (Individual presentation), Business Meeting (Group presentation), and Persuasive Oral Presentation (Individual presentation).

B. Instrument of the Study

The instrument used for this study was a set of needs analysis survey questionnaire. The questionnaire consisted of 28 questions to gauge students' acceptance and intention to use mLearning. A pilot study was conducted on 70 undergraduate students from the same higher institution using the instrument to improve the questionnaire items. However, the 70 students were not included in the actual needs analysis study. Six (6) curriculum and instruction technology experts were referred to validate the instrument. Reliability test was conducted on the survey questionnaire for all items, which registers a cronbach alpha coefficient of .872 as shown in Table 1.

Table 1

Reliability Testing of Needs Analysis Questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.872	.829	70

The questionnaires were posed to the students to assess the students' level of acceptance on the incorporation of mLearning into their current formal language communication course and more importantly the degree of their intention to use mLearning. The items for the survey questionnaire were constructed based on unified theory of acceptance and use of technology (UTAUT), a technology acceptance theory proposed by Venkatesh, Morris, Davis, and Davis (2003). The theory posits that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behavior (Venkatesh et al., 2003) as illustrated in Fig. 1.

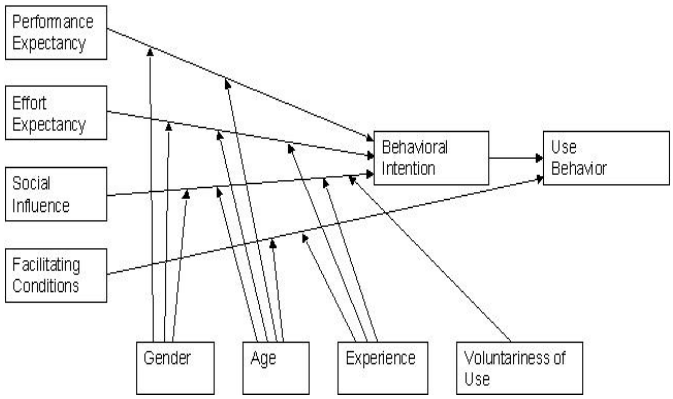

Fig. 1 Unified theory of acceptance and use of technology (UTAUT) by Venkatesh et al., (2003). Adapted from "User acceptance of information technology: Toward a unified view", by V. Venkatesh, M.G. Morris, G.B. Davis and F.D. Davis, 2003, MIS quarterly, p. 447

Based on the key constructs, the items for the questionnaire were divided into eight expectancies:

1) Performance expectancy – In this study, performance expectancy dealt with the extent of the effectiveness of mLearning as a support in accommodating students' language learning needs. For example, how students perceive the usefulness of mLearning in their learning process to accomplish learning tasks easily, and how mLearning could improve their learning productivity or even their course grades.
2) Effort expectancy – Effort expectancy is defined as the degree of ease in using mLearning (Venkatesh et al., 2003).

ISBN: 978-1-61804-238-5

3) Social influence – Social influence is defined as the degree to which an individual perceives how important others believe he or she should use mLearning (Venkatesh et al., 2003).
4) Facilitating conditions – Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of mLearning (Venkatesh et al., 2003).

C. Procedure

Needs analysis was conducted on the participants (undergraduate students) to assess the need to incorporate mLearning in their formal English Language learning. In the language field such as English for special purposes, needs analysis has long been identified as an important methodology used in educational planning (Benesch, 2001). Hyland (2005) argued that needs analysis could be classified as a technology in education, which can be employed at the preliminary stage of a language course, during the language course or post language course. In the research on language needs, most studies are largely based on classroom settings mainly to improve classroom tasks (Marlyna, SitiHamin & Mohamad Subakir, 2012). However, Zhu and Flaitz (2005) observed that experiences outside the classroom affect students' overall academic performances where their interactions in a larger institutional context influence their in-class performance. Thus, it is necessary to investigate language skills needed for the students to perform beyond the classroom settings as findings from the study could dictate the types of suitable language activities in the classroom for effective language learning.

The main issue of any English Language course for specific purposes is that the learning needs of the students at large were not effectively addressed in the conventional classroom learning to satisfy the course outcomes. The study seeks to investigate mLearning as a support to solve the problem. The needs analysis aimed at investigating existing issues and the need to incorporate mLearning to aid students' language learning. The needs analysis in this study will be conducted via survey technique to identify the need for the mLearning incorporation in formal language learning based on students' views. The participants of the study were given a set of survey questionnaires to respond to, in order to solicit their needs for mLearning.

Data were analyzed using descriptive statistics via the Statistical Package for Social Science (SPSS) version 20 software. The researchers propose the analysis of mode and mean scores for this phase to determine the needs of mLearning at the undergraduate level based on students' views. Fig. 2 shows a flowchart of the steps presented above to describe the methodology used for this phase. The main aim of the results of the data was to justify the need to incorporate mLearning.

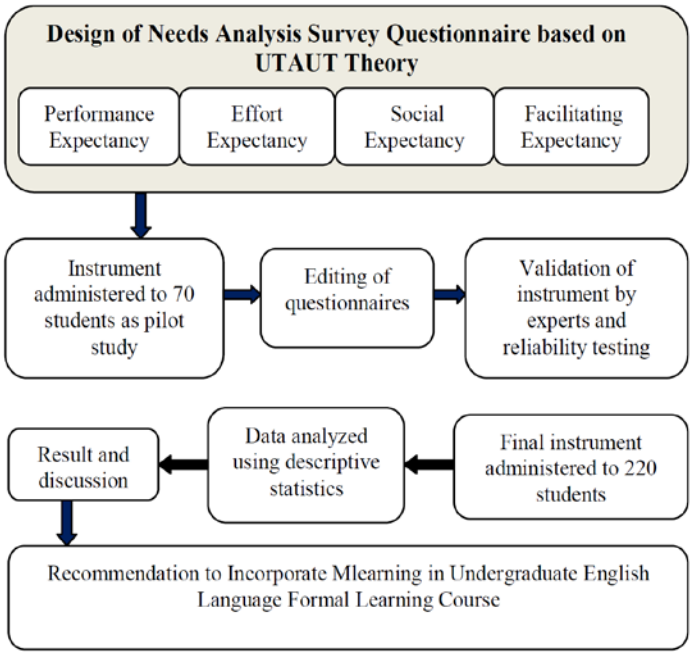

Fig 2. Flowchart of Needs Analysis

III. Findings

As mentioned in the methodology section, the investigation into students' acceptance and expectation of mLearning as a support to their language learning needs was based on the unified theory of acceptance and use of technology (UTAUT), a technology acceptance theory proposed by Venkatesh et al. (2003). The report of the findings reveal the students' acceptance, readiness, and intent to use mLearning as support to their language learning needs through the key constructs. Thus, the following section reported on the needs based on the eight parts of the UTAUT key constructs.

Performance expectancy. Performance expectancy deals with students' perception on the effectiveness of mLearning as a support in accommodating students' language learning needs as well as the fulfilling the course outcomes (Venkatesh, 2003). In this aspect, Table 2 shows a high rate of performance expectation with 89.5% (n = 197) students agreed or strongly agreed that mLearning could be useful for their English Language communication course.

ISBN: 978-1-61804-238-5

Table 2

mLearning Useful for My Course (PCS)

		f	%	Valid %	Cumulative Percent
Valid	Strongly Disagree	1	.5	.5	.5
	Disagree	6	2.7	2.7	3.2
	Neutral	16	7.3	7.3	10.5
	Agree	83	37.7	37.7	48.2
	Strongly Agree	114	51.8	51.8	100.0
Mean	4.38				
SD	.775				
	Total	220	100.0	100.0	

A majority of the respondents (74.1%, n = 101) either agreed or strongly agreed that mLearning could increase learning productivity as revealed in Table 3.

Table 3

mLearning Could Increase Students' Learning Productivity

		f	%	Valid %	Cumulative %
Valid	Strongly Disagree	24	10.9	10.9	10.9
	Disagree	54	24.5	24.5	35.5
	Neutral	41	18.6	18.6	54.1
	Agree	68	30.9	30.9	85.0
	Strongly Agree	33	15.0	15.0	100.0
Mean	3.15				
SD	1.256				
	Total	220	100.0	100.0	

In terms of the performance expectancy aspect, Table 4 indicates a majority 79.5 % (n = 175) of the respondents agreed or strongly agreed that mLearning accomplishes their learning tasks more quickly as mobile tools and mobile environment offers a larger array of communication possibilities at greater speed and accessibility.

Table 4

mLearning Aids to Accomplish My Task Quickly

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	1	.5	.5	.5
	Disagree	14	6.4	6.4	6.8
	Neutral	29	13.2	13.2	20.1
	Agree	72	32.7	32.9	53.0
	Strongly Agree	103	46.8	47.0	100.0
	Total	219	99.5	100.0	
Mean	4.20				
SD	.930				
Missing	System	1	.5		
Total		220	100.0		

Furthermore, Table 5 shows another majority 78.2 % (n = 145) of the respondents either agreed or strongly agreed that mLearning increases their chances of obtaining better grades for their course as mobile learning offers more avenues for them to access assistance for learning. These findings revealed that the respondents perceived high expectation on the performance of mLearning in aiding them to meet their language learning needs if it is incorporated in the current PCS classroom learning.

Table 5

mLearning Increase Students' Chance of Obtaining Better Course Grades

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	3	1.4	1.4	1.4
	Disagree	26	11.8	11.8	13.2
	Neutral	46	20.9	20.9	34.1
	Agree	100	45.5	45.5	79.5
	Strongly Agree	45	20.5	20.5	100.0
Mean	3.72				
SD	.966				
	Total	220	100.0	100.0	

Effort expectancy. Venkatesh (2003) defines 'Effort expectancy' as the degree of ease in using a proposed system; in this study, the system is mLearning. In this aspect, a majority of the respondents (71.8%, n = 158) agreed or strongly agreed that mLearning facilitates interaction with their peers, the lecturers, as well as content, as mobile technology offers multiple channels of interaction both synchronously and asynchronously (refer to Table 6). Only 10.9% (n = 24) of the respondents chose to disagree or strongly disagree with the interaction facilitation through mLearning while 17.3% (n = 38) of them were undecided.

Table 6

mLearning Facilitate Interaction Among StudentsBetter

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	3	1.4	1.4	1.4
	Disagree	26	11.8	11.8	13.2
	Neutral	46	20.9	20.9	34.1
	Agree	100	45.5	45.5	79.5
	Strongly Agree	45	20.5	20.5	100.0
Mean	3.72				
SD	.966				
	Total	220	100.0	100.0	

However, although a slight majority of the respondents (53.6%, n = 118) agreed or strongly agreed that it is not be difficult to gain the skill to use mLearning as indicated in

Table 7, only 45.9% (n = 101) of them were confident that mLearning would be easy to use as shown in Table 8. Some 35.4% (n = 78) of them perceive that mLearning could be difficult to use while 18.6 % (n = 41) could not decide whether mLearning could hinder their learning process or facilitate them better. Nevertheless, based on Table 7, a lower 25% (n = 55) of the respondents were not confident that they would find easy to be skillful in using mLearning later.

Table 7

Easy for The Students to Be Skillful in Using mLearning

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	11	5.0	5.0	5.0
	Disagree	44	20.0	20.0	25.0
	Neutral	47	21.4	21.4	46.4
	Agree	74	33.6	33.6	80.0
	Strongly Agree	44	20.0	20.0	100.0
Mean	3.44				
SD	1.163				
	Total	220	100.0	100.0	

Table 8

Students Would NOT Find mLearning Easy to Use

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	24	10.9	10.9	10.9
	Disagree	54	24.5	24.5	35.5
	Neutral	41	18.6	18.6	54.1
	Agree	68	30.9	30.9	85.0
	Strongly Agree	33	15.0	15.0	100.0
Mean	3.15				
SD	1.256				
	Total	220	100.0	100.0	

Social influence. Social influence is defined as the degree to which an individual perceives that people who are important to them believe they should use mLearning (Venkatesh et al., 2003). In other words, the respondents' decision to use mLearning was being influenced by important parties. In this aspect, the overall findings showed that people who are important or having influence on the respondents' behavior did not have a significant effect on their motivation in deciding to use mLearning. For example, respectively, only 44.5% (n = 98) respondents (Table 10) and 48.6% respondents (n = 107) (Table 9) perceived that people who are important to them or people who have influence on their behavior thought that they should use mLearning. In fact, only 45.9 % (n = 101) of the respondents perceived that the university supported the use of mLearning (Table 12). However, Table 11 reveals that more of the respondents (67.7%, n = 149) perceived that their decision to use mLearning could be influenced more by the encouragement of their course lecturer. Thus, the role of the lecturer is a motivation factor in encouraging the students to use mLearning.

Table 9

People Who Influence My Behavior Think I Should Use mLearning

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	15	6.8	6.8	6.8
	Disagree	42	19.1	19.1	25.9
	Neutral	56	25.5	25.5	51.4
	Agree	58	26.4	26.4	77.7
	Strongly Agree	49	22.3	22.3	100.0
Mean	3.38				
SD	1.216				
	Total	220	100.0	100.0	

Table 10

People Who are Important to Me Think I Should Use mLearning

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	36	16.4	16.4	16.4
	Disagree	51	23.2	23.2	39.5
	Neutral	35	15.9	15.9	55.5
	Agree	59	26.8	26.8	82.3
	Strongly Agree	39	17.7	17.7	100.0
Mean	3.06				
SD	1.367				
	Total	220	100.0	100.0	

Table 11

My Lecturer Has Been Encouraging Me to Use mLearning

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	5	2.3	2.3	2.3
	Disagree	21	9.5	9.5	11.8
	Neutral	45	20.5	20.5	32.3
	Agree	81	36.8	36.8	69.1
	Strongly Agree	68	30.9	30.9	100.0
Mean	3.85				
SD	1.040				
	Total	220	100.0	100.0	

ISBN: 978-1-61804-238-5

Table 12

In General, My University Supports The Use of mLearning

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	24	10.9	10.9	10.9
	Disagree	54	24.5	24.5	35.5
	Neutral	41	18.6	18.6	54.1
	Agree	68	30.9	30.9	85.0
	Strongly Agree	33	15.0	15.0	100.0
	Total	24	10.9	10.9	10.9
Mean	3.15				
SD	1.256				
Missing	System	1	.5		
Total		220	100.0		

Facilitating condition. Facilitating conditions on the other hand are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of mLearning (Venkatesh et al., 2003). In this aspect, the overall findings indicated significant positive result on the students' perception on the organizational and technical support on their use of mLearning. For instance, Table 13 shows that the majority of the respondents (63.7%, n = 140) either agreed or strongly agreed that they have the resources to aid them in using mLearning but only 44.1% (n = 97) of them perceived that they have the necessary knowledge to use mLearning (refer to Table 14). Alternatively, the majority of the respondents (69.1%, n = 152) were confident that they have specific personnel to assist them in using mLearning later (refer to Table 15).

Table 13

I Have The Resources Necessary to Use mLearning

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	3	1.4	1.4	1.4
	Disagree	41	18.6	18.6	20.0
	Neutral	36	16.4	16.4	36.4
	Agree	102	46.4	46.4	82.7
	Strongly Agree	38	17.3	17.3	100.0
Mean	3.60				
SD	1.023				
	Total	220	100.0	100.0	

Table 14

I Have The Knowledge to Use mLearning

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	13	5.9	5.9	5.9
	Disagree	66	30.0	30.0	35.9
	Neutral	44	20.0	20.0	55.9
	Agree	73	33.2	33.2	89.1
	Strongly Agree	24	10.9	10.9	100.0
Mean	3.13				
SD	1.137				
	Total	220	100.0	100.0	

Table 15

I Have Specific Support Personnel to Assist Me in Using mLearning

		f	%	Valid %	Cumul. %
Valid	Strongly Disagree	3	1.4	1.4	1.4
	Disagree	20	9.1	9.1	10.5
	Neutral	45	20.5	20.5	30.9
	Agree	116	52.7	52.7	83.6
	Strongly Agree	36	16.4	16.4	100.0
Mean	3.74				
SD	.888				
	Total	220	100.0	100.0	

IV. CONCLUSION

Based on UTAUT theory, Venkatesh et al (2003) posits four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) as direct determinants of usage intention and behavior of experts to accept and use technology. Added to these key constructs were attitude expectancy, self-efficacy expectation, anxiety, and behavioral expectancy (refer to Fig. 1) used in this study to determine the students' acceptance and intention to use mLearning for their learning needs. Referring to the findings in this section, students placed high confidence in mLearning performance in aiding their learning tasks for performance expectation (refer to Tables 2 to 5). However, in effort expectancy, the majority of them did not perceive that mLearning would be easy to use (Table 8), but most of them were confident that it would not be difficult to gain skill in using it (Table 7) and a majority thought that mLearning could facilitate interaction among them (Table 6). As for social influence, the students did not perceive that people who have influence on them or are important to them including the university could influence them to use mLearning except the encouragement from their lecturers (Tables 9 to 12). Thus, the role of the lecturer or course instructor is important in motivating the students to use mLearning. In the facilitating condition aspect, the overall findings indicated significant

positive result on the students' perception on the organizational and technical support on their use of mLearning (Tables 13 to 15). Thus, it can be concluded that from the findings, the students not only accept and intend to use mLearning but they are also eager to use it as soon as possible.

These findings justified the incorporation of mLearning as learning support to the students' language learning needs to improve their language competence as well as fulfilling the learning course outcomes. This supports Vifansi (2002) and Momtazur Rahman et al. (2009) who argued that a language course or program should accommodate not only the target needs but also the students' learning needs. This is vital for the success implementation of a learning solution as Venkatesh et al. (2003) argued that the learners should accept and intend to use a proposed solution before the solution could be implemented. The views of the learners as end recipient of a learning solution is vital as their acceptance will define the solution better as it ideally shift learning ownership to learners themselves, one which allow these learners the liberty to choose suitable ways to fulfill their learning needs according to their ability, competence and pace (Abdullah, Ridhuan, Hussin & Razak Zakaria (2013). This would contribute to a sustainable incorporation of mLearning in mainstream education.

ACKNOWLEDGMENT

We would like to acknowledge Universiti Teknologi Petronas for the financial support to conduct this study as well as the presentation of the outcome of the study in the conference.

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Modern educational technologies in scientific information evaluation

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Abstract— The evaluation criteria of the scientific information on websites may generate a management system of the information quality used by young researchers during Ph.D thesis elaboration. Information culture is a subject which is considered important in the scientific development of students in Transilvania University of Brasov. The students are familiarized with the new information communication and management technologies, with open access sources offered to manage, communicate and respect intellectual property rights in informational society.

The students of the doctoral school within the university participated in a quality marketing research concerning the assessment of the scientific information available on websites. The research was based upon an evaluation model and the specific criteria of various information sources. Analyzing the research results we propose a new important module as a compulsory tutorial regarding the evaluation criteria of the information quality. The research has led to the conclusions and recommendations that are presented below.

Keywords— information literacy, quality of information, evaluation model, educational marketing, PhD student

INTRODUCTION

The information quality is concerning us all, especially those in academic environment. The information quantity available to us creates a complex framework of access and use in the informational society. We have tools to retrieve information, the internet as an extraordinary environment of communicating information, search and retrieval engines and tools for publications classification.

The use of web information becomes an increasingly used practice. There are more and more available sources and their access easier. Gils proposes a model of information quality "based on the observations that objects (dubbed artefacts in our work) can play different roles (i.e., perform different functions). An artefact can be of high quality in one role but of poor quality in another. Even more, the notion of quality is highly personal." [1]

What is utterly important is the correct formulation of information need even from the beginning, to know the characteristics of the information source and select according to the information need. The notion of quality is particularly important in this area as it is a driving force in the information market. It is interesting to observe that the attribution-interpretation of the quality notion has been studied since the ancient philosophers. For example, in his work on the Philosophy of Nature Aristotle defined the word quality as the category according to which artefacts are said to be like or unlike [2]. Other great philosophers such as Descartes, Bacon, Newton, and Galileo opposed to Aristotle's view on (the quality of) matter. [3]

Quality assessment systems have to somehow deal with the uncertainty involved with measuring whether or to what degree a resource a certain property has, as well as determine the constraints that the actor uses for quality assessment.

Various definitions exist for the term information quality.[4] They use different criteria for good quality of information such as completeness, accessibility, accuracy, precision, objectivity, consistency, relevancy, timeliness, and comprehensibility. Some studies measured the quality of information in several databases in terms of data-availability [5] or satisfaction level for search results. [6]

In information society, researchers have at their disposal new technologies and services that allow them to discover, locate, gain access to and create information resources on their desktops. However, there is evidence that research information skills have not kept up with the rapid change in this area. This raises important questions about how researchers acquire the appropriate skills in information handling, and the take-up of the training opportunities provided. Information literacy concepts have to be harmonic with this level of research. PhD students are the future researchers and they need special skills to be successful in information explosion and information technology developing. The report *Mind the skills gap: Information-handling training for* researchers, [7] concludes that training for researchers on information seeking and management is uncoordinated and generally not based on any systematic assessment of needs. The report focuses on the information-related training for researchers that is provided by universities and other higher education institutions. It looks at the roles that librarians and other specialists play and how the training that they provide it with the wider training provision.

As an example, Wageningen Graduate Schools from United States of America organised Information Literacy courses to PhD students and post-doc researchers of Wageningen UR and organised by the Wageningen UR Library. It covers the following topics: Effective use of UR

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Digital Library, including My Library, bibliographic databases on different platforms, portals, electronic journals, etcetera, Getting to know the different types of scientific information sources: when to use what, How to select proper information sources for your research, Introduction to Citation Search and getting acquainted with Impact Factors of journals, Individual instruction and help in developing a balanced search plan, that will be beneficial throughout your PhD period.

"PhD students can be said to have the same, if not a greater, need to be information literate as any other university student. But there is one information related aspect that seems to be of a greater importance for PhD students: the ability to handle large amounts of research information is of particular importance for this group of students. Their studies are often taking place over a long period of time and they tend to penetrate their subjects thoroughly, hence they are subjected to and collect large amounts of information. The majority of the students participating in the course indicated that it is very important to be able to organize and develop rational ways for easy and quick access to information." [8] Information management for knowledge creation, information management for PhD-candidates, is one project developed by University of Bergen, Norway in collaboration with Bergen University College, Norwegian School of Economics and Business Administration, University of Oslo Library, University of Aalborg Library- http://inma.b.uib.no/ . The aim of the project is to develop information literacy education modules for PhD students. The modules will be tailored to this target group by taking into account their information searching behaviour and information needs, as documented in the existing literature and as revealed by the project own findings. The modules will contain open access online resources and teaching portfolios for seminars within PhD programmed. The project will be run as collaboration between five Nordic academic libraries. [9]

II RESEARCH METHOGOLOGY

We surveyed doctoral school PhD candidates from Transilvania University of Brasov. Our data were collected in the first semester of 2012, during 2 weeks. We used one electronic survey, using the free tools site: https://www.surveymonkey.com. The survey was called: *Scientific information evaluation.* We sent invitations for this study on their entire discussion list. The sample was validated from the point of view of women-men proportion and from the point of view of the respondents' proportion in distribution of year of doctoral school stage and distribution on PhD field research.

Our survey contained two distinctive parts: information literacy and a scientometric elements part. The scientometric elements survey made use of a Likert scale.

The model and criteria of information quality assessment were based upon the matrix in fig.1

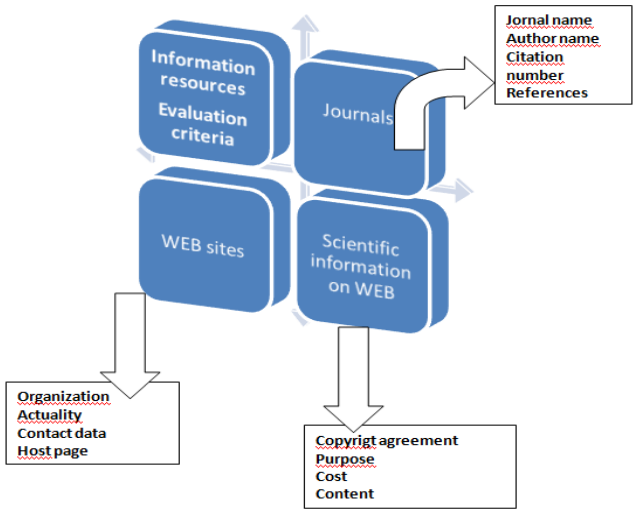

Fig. 1 - Information quality assessment model

III DATA ANALYSES

The fields in which the university owns the skills of doctoral school development are: Engineering, Economical Sciences, Sports and Education, Medicine and Literature.

The most respondents, 74%, belong to engineering field, which is a traditional domain within Transilvania University.

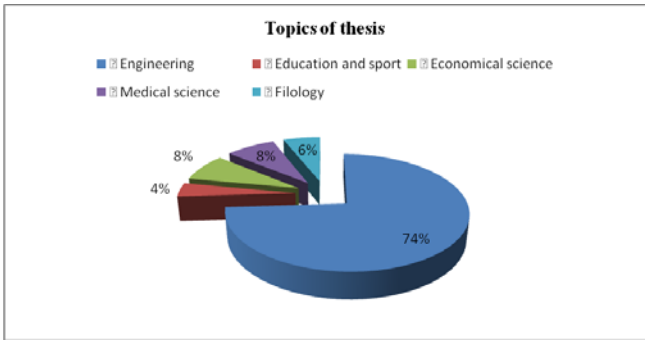

Fig.2 - Topics of thesis

The main sources of documentation are the scientific databases to which university has subscribed for 61 % of the PhD students. The direct access journals are sources of documentation for 3% of the PhD students, and the university library represents the place where students get access to their resources for 10%. Although they are the Google generation, only 2% access Google Scholar, Google Academic and only 4% institutional digital repositories.

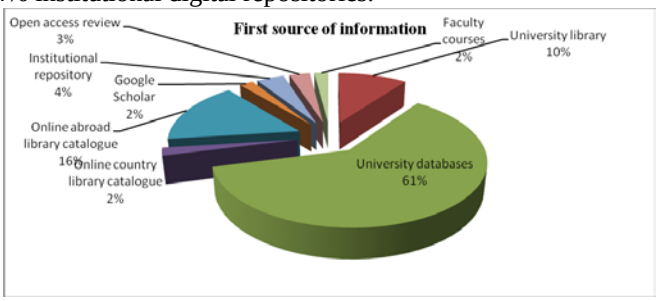

Fig 3. - Information sources

68% of PhD students prefer online resources, 24% traditional and only 8% media resources.

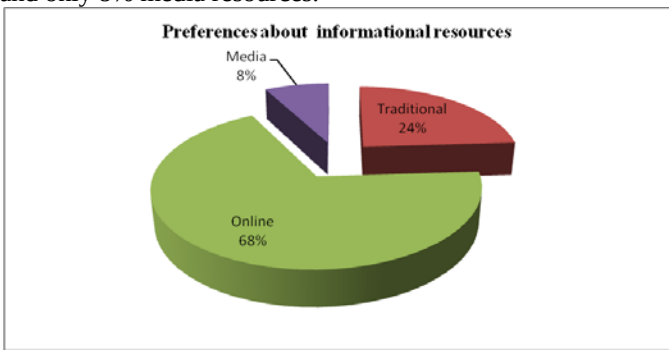

Fig 4. - Preferences about information resources

Referring to knowledge level of scientific information evaluation only 17% have a high level of information evaluation, 50% have a low level and 33% have a medium level.

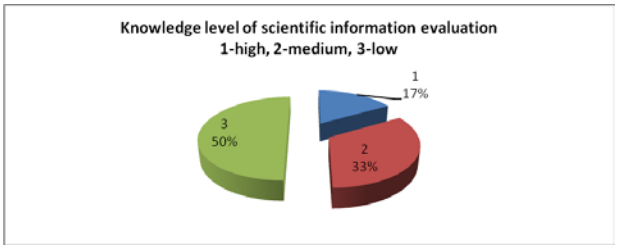

Fig. 5 - Knowledge level of scientific information evaluation

In order to assess information several different criteria were proposed. The criteria for scientific information evaluation were accepted as follows: Author's name 28%, number of citations 27%, journal's name 24% and article references 21%.

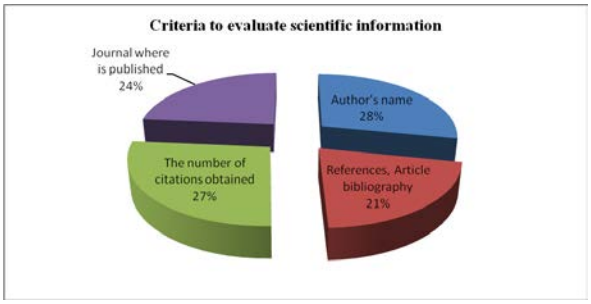

Fig. 6 - Criteria used to evaluate scientific information

The criteria proposed to evaluate websites obtained the following results: 34% of the respondents use the criterion of site organization during their assessment, equally, meaning that 27% check the site host and author's data while 12% are interested in how up to date the site is.

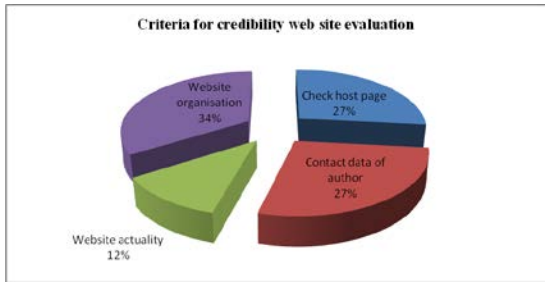

Fig. 7 - Criteria for credibility in web site evaluation

Regarding the assessment criteria of the scientific information quality disseminated by the web pages, all respondents consider equally (20%) the copyright restrictions, scope, information costs, content, form and availability.

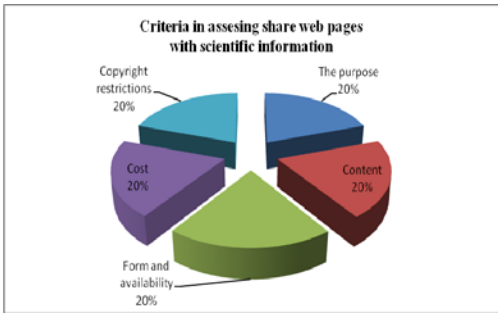

Fig. 8 - Assessing web pages criteria

The most used criterion in assessing the content of a scientific paper is accuracy, 23% followed by originality 21%. The other criteria, in order of importance are the references – 15%, the evolution of the presented phenomenon – 14%, links to other resources and quality of expression – 11% also the scientific committee – 5%.

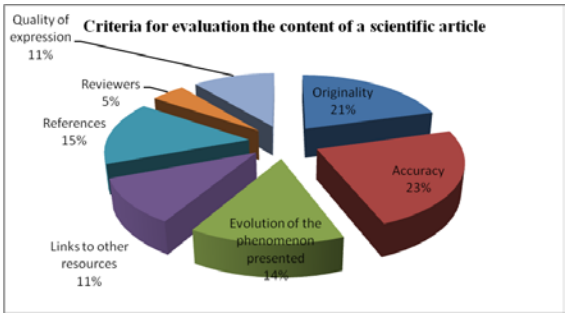

Fig. 9 - Assessing content of scientific article

In case of a blog or website evaluation, criteria are considered at the same extent, namely: is the scope clear?, what is it dealt with?, novelty, format and presentation thoroughness.

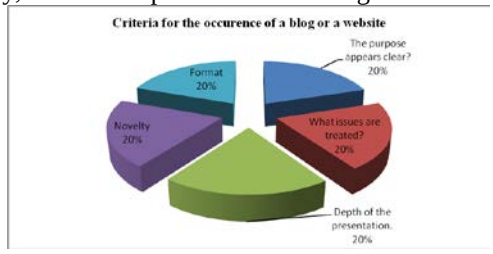

Fig. 10- Assessing criteria for blogs and websites

ISBN: 978-1-61804-238-5

IV DISSCUTION

The period of research and writing PhD thesis is an edifying stage in the future researcher's development. During this period the PhD students must have research skills. The culture of information - which is necessary to any student through his/ her abilities to identify the need of information, to localize sources, to evaluate and use these sources efficiently, to use them in the process of learning and content creating and then to be able to generate knowledge - becomes impetuously necessary during the doctoral school.

The dissemination of the PhD students' research studies must be guided through presenting and acquiring knowledge of scientometrics, academic communication and critical evaluation of the obtained information.

A surprise element in the survey is the fact that a small percentage of PhD students use Google Scholar as a source of information. Google Scholar is a free scientometric base which comprises only documents that are academically indexed by Google. Every indexed document has the indexed on Google Scholar quotations enclosed as well. Another surprise is the low level of knowledge regarding the scientometric databases, especially because the most PhD students use as main sources of information the databases to which university has subscribed, among which there are also the two scientometric databases, ISI Web of Science and Scopus. We think that the fact that they do not know the institutional digital repositories, free resources comprising scientific production of universities, is at their disadvantage and at the disadvantage of the scientific research community. The principles of open access to information, namely the *green way*, the institutional digital repositories should be promoted in order to change the researchers' mentality. The results of research studies do not achieve their mission if they are not displayed at the community's disposal by open access. The research surveys are financed through public money and consequently they have to reach the community.

V CONCLUSIONS

As a result of this research we propose a concentrated model of informational sources quality assessment, formulated as an online tutorial and made available to students and Ph.D. students. [10] The information assessment criteria in the web space should be promoted and compulsory skills must be generated for Ph.D. students and university researchers and others.

The fact that the majority of the PhD students, who know these notions, know them due to their individual study imposes the organization of some presentation of the above mentioned notions. Information Evaluation as a Decision Support has to be developed in university. This should lead to the clarification of the notion of information evaluation.

ACKNOWLEDGEMENT:

This paper is supported by the Sectoral Operational Program Human Resources Development (SOP HRD), ID134378 financed from the European Social Fund and by the Romanian Government.

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Exploring the Technological Factors in SMART Learning Affecting Creativity

Soon-Hwa Kim, Ki-Sang, Song, and Se-Young Park

***Abstract*—**The attempt of applying technology to education has started with ICT education and spread into e-learning, u-learning, m-learning and SMART learning in Korea. Although the education circumstances are supposed to be changed dramatically in the near future, the theoretical consideration about the effect of applying educational technology on creativity needs to be studied more. Therefore, we have explored some technological factors affecting creativity, and 67 subjects were participated in the survey to explore the technological factors. Through the study, 4 technological factors such as technological self-efficacy, cooperativity, resource free and interactivity were revealed as a main factors affecting student's creativity.

***Keywords*—**Technological factor, SMART learning, Creativity.

I. Introduction

MODERNsociety become more complicated than in the past. Thus, it demands individual to demonstrate various ability in complicated and unforeseeable situation. Among the diverse ability 'creativity' is the key capacity in adapting modern society. The word 'creativity' has various definitions according the perspective of the researchers. However, the researchers generally reached consensus about the definition recently. The key component of creativity contains novelty and appropriateness[1][2][3][4][5][6].

At the beginning of creativity research in 1950' mainly has focused on internal individual factors, such as personality, intelligence, motivation and so on. However, external individual factors have under consideration among creativity research area. Thus, environmental factors, organizational atmosphere, freedom, fundamental resources, and colleagues' support, organizational compensation, administrator's encouragement, supports of task group, fundamental resources, challengeable task[1]. Alencer, & Bruno-Fara(1997) suggested challengeable tasks, freedom, autonomy, supports of administrator, limited hierarchical structure, flexible standards, dispersion of power, supports of organization, physical environment, incentives, technological supports, and supports of teams as an environmental factors affecting creativity[7]. Runco(2007) recorded that positive colleague group and administrator, fundamental resources, challengeable tasks, clear tasks, autonomy, cohesiveness, intellectual stimulation, proper compensation, flexibility, emphasis on the output, active participation, organizational integration, positive personal relations[8]. Though the educational circumstancesare rapidly changing as the educational technology development, the prior research have solely focused on person related factors and tasks rather than the technological factors influencing creativity[2].

The usage of educational technology started from ICT education spreads into e-learning, u-learning, m-learning and SMART learning as the development of technology[9]. SMART learning defined that intellectually customized educational system to strengthening learners' ability by the innovations of educational environments, educational contents, educational methodology and evaluation. SMART is originated from the initial letter of Self-directed, Motivated, Adapted, Resource free, Technology embedded education[10].

Changing the educational environment by using various high educational technologies is not the phenomenon appearing only in Korea. It is a global trend. 17 Korean Metroplolitan and Province Offices of Education are now operating 13 SMART learning model research school[11]. In United States, the Minister of Education, Arne Duncan announced the plan changing all the textbooks into digital textbook in several years in 2012. Digital textbook can save printing cost, offer rapid update and operate interactively. iHTs (interactive heritage traits) exploring program offer real-time interaction using ICT(GPS, broadband communications network etc.) and Smart phone technologies in Singapore. It appears that students using iHTs leads their learning personally. It makes the educational circumstances more abundant.

Even though the global trends of the active introduction of the educational technology and the needs of creative ability in society, theoretical consideration of the effects of educational technology in enhancing creativity is scarce in comparison with the research about practical use of technology. Thus, through this study, we are to explore some technological factors affecting creativity by researching the preceding studies relating to the educational technology and creativity.

II. Theoretical Background

A. SMART learning

As the smart devices are rapidly adopted in every field of society, the Korean Ministry of Education set the master plan

This work was supported in part by the National Research Foundation Korea.

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for SMART education[10]. According to the master plan for SMART learning, 'SMART' in SMART learning means that self-directed(S), motivated(M), adaptive(A), resource free(R), technology embedded(T) education. It focuses on activating online education with digital contents using smart devices. Noh, Ju, & Jung(2011) defined SMART learning as learner initiated learning which has various materials for learning and supports learner-teacher interaction[24].

SMART is not the notion that suddenly appeared. It is and extension of e-learning, u-learning and m-learning. Nowadays, not only the government bus also teachers in the education field eagerly adopting the SMART learning.

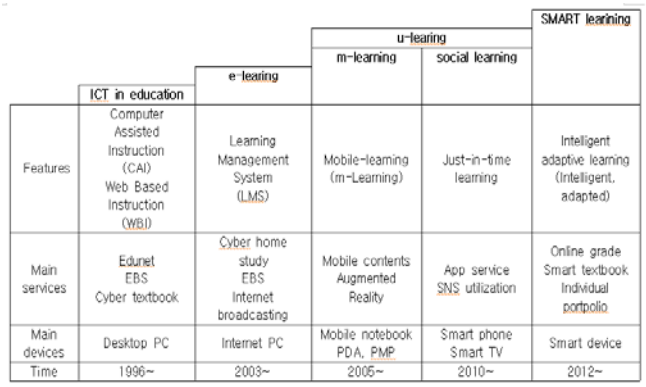

Fig. 1. A history of development

Contrary to its active introduction of SMART learning, the effectiveness of SMART learning remains uncertain. Kim, & Kim(2012) investigated the sharing thoughts using smart devices during class affects knowledge organization among learners. In that study, sharing thought using SMART devices effects learners' knowledge combination and recombination. Also, SMART learning environment is helpful to self-directed learning capacity especially for the mental weakness(Lee, & Shin, 2012). However, SMART learning has a possibility to increase economic burden to parents buying SMART devices. More seriously, students can easily be immersed in online-game in school hours(Jung, etc, 2012). Bakia, et al.(2012) suggested that the effectiveness of online is proved by the preceding researches, but the factors affecting the success of on-line education is not enough.

B. Creativity in context

The research of creativity had begun from the speech of Gilford in 1950. According to his speech, psychologists have to study personality traits of creative person. The early stages of creativity research focused on the psychological determinants for the individual genius and giftedness (Jeffrey, & Craft, 2001). But research into creativity in 1980s and 1990s became rooted in social structures effect on individual creativity (Jeffrey, & Craft, 2001). This is so-called social psychology and confluent theory of creativity.

Confluent theory of creativity concerns about the various factors affecting creativity from the intra personal factors like personal traits, motivation, intelligent to the extra-personal factors like the environmental facilities, environmental atmosphere and social interaction.

There are some representative theories - 'componential theory of creativity' [1][17], 'system theory'[4][5][6] and 'investment theory' [18][19][20]. In this paper, Amabile's Componential model of creativity will be treated as a main issue.

[1][17] focused on the importance of environmental factors and suggested that componential model of creativity composed of domain-relevant skills, creativity-relevant skills and task motivation. Domain-relevant skills are domain specific knowledge, method and technique which the basement of making result in specific domain. Creativity-relevant skills are divergent thinking, heuristic thinking which the cognitive skills affecting general domain. Task motivation operates when the start points of task. It can make person to start some task. Especially, intrinsic motivation is helpful when it comes to making creative output.

C. Technological Factors related to Creativity

To find the missing link between the technology and creativity we have investigated Eric, Science Direct, RISS and KISS which offering domestic and foreign journal. The researching keywords were 'educational technology' and 'creativity'. After researching the technological factors relating creativity, 4 factors - Technological self-efficacy, Cooperativity, Resource Free, Interactivity - have revealed as a key factors affecting creativity.

Table 1. Technological factors relating creativity

Factors	Research
Technologicalself-efficacy (TSE)	Eyadat, & Eyadat(2010) Aquda, et al(2011)
cooperativity (CO)	Koh(2012) Noh(2010) McLellan, & Nicholl(2013) Winters, et al.(2005) Vinu, et al.(2011) Loveless(2002;2007) Watson(2011)
resource enriched (RE)	Korea Ministry of education (2011) Keris(2011) Noh(2010) Vinu, et al.(2011) Moore, et al.(2011) Watson(2011) Dodge(1991) Watson(2011)
interactivity (IN)	Lim(2011) Noh(2011) Aquda, et al.(2011) Loveless(2003) Loveless(2002, 2007) Watson(2011)

ISBN: 978-1-61804-238-5

III. Method

A. Experimental process

This study aims to explore the technological factors relating creativity. The experimental processes are stated below to achieve the research object.

First, we have investigated preceding literature relating our research topic.

Second, some technological factors relating creativity were extracted through the research.

Third, we have explored some relevant questionnaire which can assess the extracted factors.

Forth, 67 subjects have been selected who do the survey.

Fifth, analysis of validity and reliability, descriptive statistics have done to verify the factors suggested are valid or not.

B. Instruments for assessing factors

Instruments for assessing factors are shown Table 2. Mccoy (2001)'s Technological self-efficacy scale was used to assess the TSE factor[21]. The Cronbach's alpha of TSES .941 which means reliable enough. Generally, researchers determine the reliability of scale if the Cronbach's alpha is more than .7.

Table 2. Instruments for assessing each factor

Factor	Researcher	Name of Instrument	Chosen Tool	Number (reversed)
TSE	Mccoy(2001) Murphy, et al.(1989) Miltiadou, & Yu(2000)	Technological Self Efficacy Scale Computer Self Efficacy Scale Online Technologies Self-efficacy scale(OTSES)	Mccoy (2001)	6
CO	Amabile, et al.(1996) Song(2009)	KEYS KEYS Korean ver.	Song(2009)	8
RE	Amabile, et al.(1996) Somg(2009)	KEYS KEYS Korean ver.	Song(2009)	6(1)
IN	McMillan, & Hwang(2002) Lee(2010)	Interactivity assessment Scale Interactivity assessment Tool	Lee(2010)	4
CR	Amabile, et al.(1996) Song(2009)	KEYS KEYS Korean ver.	Song(2009)	6
				41

Song(2009)'s scale assessing CO, the Cronbach's alpha recorded .787 in a previous research. Song(2009)'s scale assessing RE recorded .761 which means reliable[22]. Lee(2010)'s scale assessing IM also seems reliable because the Cronbach alpha is .871. Lastly, the scale assessing CR(Song(2009)'s), recorded .770[23].

C. Participants

Every participant has an experience of SMART learning at least 1 year. 67 participants have sampled to validate the explored technological factors. 41 questions have given to them. After answering the question, inappropriate or untrustworthy questionnaires have removed before begin analyzing process.

IV. Result

A. Analysis of Descriptive Statistics

To investigate the approximate data tendency of the sample, analysis of descriptive statistics has been conducted such as mean, standard deviation using 65 participants' questionnaire excluding 2 untrustworthy questionnaires. Table 3 shows the result of descriptive statistics.

Table 3. Analysis of descriptive statistics

Category	Range	N	Percentage
Age	~13	49	75.4%
	14~16	16	24.6%
Gender	Male	32	49.2%
	Female	33	50.8%
School level	Elementary school	49	75.4%
	Middle school	16	24.6%

B. Analysis of reliability

Analysis of reliability has done to determine whether the questionnaire used in this study is reliable or not. If the Cronbach's Alpha value computed above .7, we can decide the questionnaire assesses specific factor reliably (Teo, et al., 1999). Table 4 shows the results of reliability analysis.

Table 4. Result of reliability analysis

Factors	Cronbach's alpha
TSE	.707
CO	.820
RE	.749
IN	.866

The value of Cronbach's alpha ranged from .707 to .866 which means that the items composing the questionnaire have reliability assessing TSE, CO, RF and IN.

C. Analysis of validity

Confirmatory factor analysis(CFA) had conducted to validate the questionnaire using AMOS. Convergent validity and discriminant validity have revealed after the analysis of CFA. Convergent validity considers about the eigen values, C.R. value, AVE(Average variance extracted) and construct validity. Generally, if the eigen value exceed .45, C.R. value exceed 1.965, AVE surpass .5 and construct validity is over .7, the results stand for valid data.

Discriminant validity means that the discrimination of independent factors. Lower correlation coefficient($\emptyset$) represents the better discriminant validity. Table 5 shows the standards of validity analysis and Table 6 present the result of validity analysis.

Table 5. Standards of validity analysis

	Verification value	Method
Convergent Validity	Eigen value significance	Eigen value .45~.95, C.R.>1.965
	AVE	>.5
	Construct reliability	>.7
Discriminant validity	AVE and $\emptyset^2$	AVE>$\emptyset^2$
	$\emptyset \pm 2 \times \text{S.E.}$	$\emptyset \pm 2 \times \text{S.E.}$ not include 1
	Non restricted and restricted model $\Delta\chi^2$	$\Delta\chi^2 > 3.84$

Table 6. Result of validity analysis(First step)

	Nonstandard coefficient	S.E.	C.R.	P	Standard coefficient	AVE	Construct reliability
TSE→TSE1	1.000				.462		
TSE→TSE2	.721	.363	1.985	.047	.303		
TSE→TSE3	1.709	.493	3.470	***	.856	.371	.749
TSE→TSE4	1.113	.321	3.468	***	.806		
TSE→TSE5	1.344	.506	2.658	.008	.455		
TSE→TSE6	.548	.242	2.262	.024	.360		
CO→CO1	1.000				.698		
CO→CO2	.720	.163	4.407	***	.576		
CO→CO3	.064	.176	.363	.716	.048		
CO→CO4	1.113	.178	6.238	***	.830	.471	.850
CO→CO5	1.176	.182	6.470	***	.853		
CO→CO6	1.118	.168	6.650	***	.876		
CO→CO7	1.146	.176	6.497	***	.865		
CO→CO8	.188	.152	1.239	.215	.159		
RE→RE1	1.000				.812		
RE→RE2	1.038	.135	.135	***	.839		
RE→RE3	1.138	.134	.134	***	.910	.537	.852
RE→RE4	1.064	.162	.162	***	.748		
RE→RE5	-0.047	.219	.219	.831	.028		
RE→RE6	0.658	.140	.140	***	.568		
IN→IN1	1.000				.694		
IN→IN2	.973	.188	5.186	***	.698	.799	.940
IN→IN3	1.900	.294	6.470	***	.927		
IN→IN4	1.802	.291	6.189	***	.847		
CR→CR1	1.000				.487		
CR→CR2	1.143	.189	6.044	***	.568		
CR→CR3	1.278	.344	3.711	***	.728	.582	.890
CR→CR4	1.370	.350	3.919	***	.834		
CR→CR5	1.521	.382	3.983	***	.880		
CR→CR6	1.451	.387	3.749	***	.746		

TSE 1~6 indicate item numbers assessing TSE factor. CO 1~7 indicate item numbers assessing CO factor. RE 1~5 indicate item numbers assessing RE factor.IN 1~4 indicate item numbers assessing IN factor, CR 1~6 indicate item numbers assessing CR factor.
Shaded item indicate that they don't enough validity assessing each factors so the 6 item shaded needs to be removed.

In case of TSE, TSE 2 and 6 have lower discriminant validity. Thus, removing both two items can improve the validity of the factor. CO 3, CO 8 have non-significant C.R. value(C.R.< 1.965) so they also have to be removed. RE 5 shows non-significant C.R. value and inappropriate standard coefficient value(< .45). So RE 5 also needs to be removed.

After the analysis of first discriminant analysis of each factors, totally 5 items – TSE 2, TSE 6, CO 3, CO 8, RE 5 - have removed to increase the validity of the questionnaire.

Table 7 indicates the result of removing the inappropriate items in the context of validity analysis results. In terms of TSE, removing the TSE 2, TSE 6 affects increasing the C.R. value which mean that significant(C.R. > 1.965). In addition, AVE value appears .466, construct reliability increases to .765 which can secure the discriminant validity. In case of CO, elimination of CO 3 and CO 8 have its effect on securing significance, AVE(=.593) and construct validity(=.895). RE 5 has deleted from the RE factor's 5 items. After deleting the RE 5 item, eigen value(>.45), AVE(=.691), construct reliability(=.916) are changed valid.

Table 7. Result of validity analysis(Second step)

	Nonstandard coefficient	S.E.	C.R.	P	Standard coefficient	AVE	Construct reliability
TSE→TSE1	1.000				.500	.466	.765
TSE→TSE3	1.578	.417	3.786	***	.856		
TSE→TSE4	1.002	.262	3.750	***	.786		
TSE→TSE5	1.237	.445	2.779	.005	.454		
CO→CO1	1.000				.694	.593	.895
CO→CO2	.670	.166	4.031	***	.532		
CO→CO4	1.082	.182	5.949	***	.801		
CO→CO5	1.185	.188	6.302	***	.853		
CO→CO6	1.148	.175	6.546	***	.892		
CO→CO7	1.122	.180	6.218	***	.841		
RE→RE1	1.000				.812	.691	.916
RE→RE2	1.038	.135	7.688	***	.838		
RE→RE3	1.139	.134	8.489	***	.911		
RE→RE4	1.064	.162	6.585	***	.747		
RE→RE6	.658	.140	4.693	***	.568		
IN→IN1	1.000				.694	.799	.940
IN→IN2	.973	.188	5.186	***	.698		
IN→IN3	1.900	.294	6.470	***	.927		
IN→IN4	1.802	.291	6.189	***	.847		
CR→CR1	1.000				.487	.582	.890
CR→CR2	1.143	.189	6.044	***	.568		
CR→CR3	1.278	.344	3.711	***	.728		
CR→CR4	1.370	.350	3.919	***	.834		
CR→CR5	1.521	.382	3.983	***	.880		
CR→CR6	1.451	.387	3.749	***	.746		

V. Conclusion

4 technological factors affecting creativity have revealed through the study. Reviewing previous research relating technology and creativity makes categorizing 4 main factors – Technological self-efficacy, Cooperativity, Interactivity, Resource Enriched and Interactivity.

First, technological self-efficacy(TSE) is reliable and valid factors affecting creativity. Technological self-efficacy means that personal thought about fulfilling technologically complicated task by oneself. If students have confidence with fulfilling technology using task, creativity revelation can easily take place.

Second, Cooperativity(CO) is defined as various kinds of social collaboration, working together to achieve the sharing object. SMART devices can be used to improve students' communication so that it can help co-work.

Third, Resource Enriched(RE) means that using technology can access to the abundant learning materials. Accessing abundant materials relating learning materials enhances creativity.

Fourth, Interactivity(IN) is defined as interaction of students - students, tutor – tutee and learning materials – students. If students draw the response from his SMART devices, we can conclude that there are interactivity.

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Influence of the practice of virtual reality videogames on significative learning for the development of locomotor jumping pattern in 5 years old children.

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INTRODUCTION

THE use of virtual reality games has spread to different human activities in populations of all ages. Besides the technological advances, one of the reasons of why the use of these games has increased, are the familiar dynamics where parents occupy their day in labor activities and children spent their free time in videogames, Internet and television, since time for sharing with family in open air activities has decreased. This has contributed to the growth of digital culture in different countries.

Information and Communication Technologies (ICT or TICs in Spanish), as well as virtual reality games, have turned into strategically allies in learning processes since interactivity increases motivation, a process that underlies learning. In the same way, the mentioned games have been used as methods of cognitive [1] and physical rehabilitation in some neurological pathology such as strokes and Alzheimer's disease [2].

Virtual reality games have also been used in the maintenance of active lifesstyles [3], [4], [5]. Some authors establish the relation between physical activity practice and motor development [6]. Due to these findings it is possible to infer that exists a relation between the use of virtual reality games and the maturation of basics locomotor patterns.

Despite the benefits derived from the use of virtual reality games, some studies have observed negative effects derived from its practice, mainly for the visual system [7] and the muscleskeletal system [8].

Researchs recommend to increase investigations about attention processes and their relation with the maturation of locomotor patterns implied in the use of this type of videogames. For this reason the objetive of the present research is to identify the influence of the practice of virtual reality games in attention processes related with the motor jumping pattern in 5 years old children.

VIRTUAL REALITY VIDEOGAMES

A videogame is an informatic interactive program destined to entertainment that can work on different devices: computer, consoles, mobile phones, etcetera; it integrates audio and video, and allows to enjoy experiences that, in many cases, would be very difficult to live in reality.

Within the features of videogames are finded: graphics quality (in the beginning in two dimentions, nowadays in three), the control of the game must be easy and intuitive, and sound (from speaker to surround) [9].

There exist different types of videogames, amongst them it can be named the games of adventure (intelligence tests or resolution of puzzles for advancing), arcade (skills activities), sports, strategy (coordinating actions), role (the player controls a character, and keeps evolving during the game according to the user decisions) and simulation (it simulates some type of action such as flying a plane) [9].

Virtual reality games belong to an exclusive rank of tools, in which the user can creatively venture, until where their imagination limit allows. There lies, highly likely the major attractive, since imagination and creativity have both the opportunity of being execute in an artificial and limitless "world". The origin of this games is in the defense department of the United States, where they were created as material of an air force class in the 70's to make flying simulations, practicing and not risking lives [10].

LEARNING AND PSYCHOMOTOR DEVELOPMENT

Mental learning and motor learning are two aspects of human being learning. Mental learning is defined as the acquisition and perfectioning of intelectual knowledges, capacities and abilities [11]. Meanwhile psychomotor learning is the process by which the child relates, knows and adapts to the surrounding environment, it includes aspects such as expressive and comprehensive language, visual-motor coordination, gross motor, equilibrium and the social-affective aspect that is related with self-esteem.Through objects manipulation and space domain through march, the child is acquiring sensory motor experiences that will allow them to construct concepts, that will translate into ideas and will develop his thinking and reasoning capacity [12].

This association is evidenced in the child early stages when their cognitive processes are produced by his motor activity, at the manipulation and moving of the objects around him, to create significance as a result of the learning construction by its context, generating that the child stimulate their motor

ISBN: 978-1-61804-238-5

processes and motor abilities. This interrelation must be strengthen by the combination of teaching (mental learning) with motor activities such as the use of virtual reality games (motor learning).

Motor learning, and in that way significant learning, can be influenced by virtual reality games through its influence in the premotor cortex. This cortex has direct connections with the primary motor area and contributes with the 30% of the axons that form the corticospinal and corticobulbar track. The premotor cortex is constituted by two components: lateral and medial. The lateral component facilitates the development of conditional tasks with visual indication and the medial component participates in the selection and initiation of movements by more internal than external signals [13]. Virtual reality games can influence directly in motor learning processes providing visual indications and impacting directly in motivation.

LOCOMOTOR PATTERNS

Children develop skills in movements in a progressive way, from first involuntary movements to highly complex abilities. Early childhood period (2 to 7 years) is critic for the development of elementary motor patterns. Children who do not develop during this period mature motor patterns, often present dificulties in the performance of motor abilities more complex such as sporting gestures.

Locomotor patterns are those movements that allow children the exploration of space. Such as walking, running, high and extension jumping, leaping, galloping and climbing. These essential movements are behavior observable patterns which can be divided fundamentally in three stages [14]:

- Initial Stage: This stage represents the first oriented goal that the child tries to execute, their movements are characterized by an inappropiate sequence, restricted use of the body, and a poor rhythmic coordination. There is almost none spatial and temporary integration; movements of locomotion, manipulation and balance of 2 years old child are typical of this stage.
- Elemental Stage: There is a higher control, better rhythmic coordination of fundamental movements. Temporary and spatial elements are more coordinated, however, the pattern is still exaggerated or restricted. Children between 3 and 4 years present a large variety of movements in the elemental stage.
- Mature Stage: Is characterized by mechanical efficiency, coordination and controlled performance. Children between 5 and 7 years can and must be in this mature stage.

METHODOLOGY

This research was developed through a quasi-experimental investigation with a pre-test design, post-test and a control group, the investigation was approved by the Ethics Committee of the University Manuela Beltrán. The intervention group was exposed to two sessions per week of virtual reality games during one month, each session was developed in three phases: a first warming phase, later 15 minutes of interaction with virtual racing game and finally, streching principal groups of muscles of the lower limbs was done.

The research population fulfilled the following inclusion criteria: 5 years old children who belong to Educational Institutions located in Bogotá city, who have not practiced virtual reality sporting games, and that have all their physical and mental capacities, which locomotor jumping pattern is on initial stage, assent signature and informed consent.

Later, the control and intervention group post-test data were compared, identifying if there was any videogames influence on the locomotor jumping pattern in 5 years old children.

RESULTS

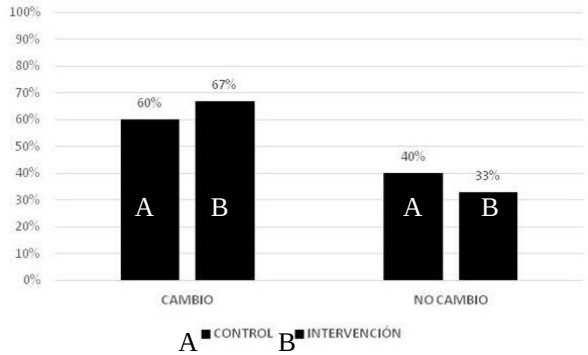
The total research population was 30 children, from which 15 belong to the control group and 15 children to the intervention group.The anthropometric characteristics of the studied population and the intervention population are presented in Table I. From this data (weight and size) were obtained the body mass index (BMI).

Table I

	Weight	Size	BMI
Control	19.8 ± 2.39	108.8 ± 7.14	16.7 ± 1.90
Intervention	18,0 ± 2.86	107.8 ± 6.41	15.5 + 1.88

In fig. 1 is described the changing in the locomotor jumping pattern stage in the control group and the intervention group, ergo, children who were in the elemental stage and passed to the initial stage, or were in the initial stage and passed to the mature stage.

Fig. 1. Percentage of changing in locomotor jumping patterns stage in the control and intervention group.



Although the are no researchs about the effect of virtual reality games in the development of locomotor patterns, this research is in concordance with those investigations that find positive effects of this types of games in learning of motor activities in patients with neurological damage, such as: strokes, medullary injury, multiple sclerosis, Parkinson's

disease and brain damage by trauma [15]. The mentioned effect might be attributed to three key elements: repetition, sensory feedback and motivation that these games provide due to the interaction and inmmersion in the videogame.

There is controversy about quality of motor activities that are learnt. Several investigations have considered that movements are similar or equivalents, because of this they are recommended for learning of motor tasks [16], nonetheless, due to difference in perception it has been observed less precision in the movements [17], [18], [19].

Another point of debate is the applicability of motor activities in reality, however, some investigations have found that virtual reality games provide a motor learning in the three space dimensions, corresponding to the movement that is performed in real world [20].

Finally, is such the relation of motor learning with intellectual learning that virtual reality systems are used for entertainment in non medical practices such as aviation, nuclear and industrial systems, and in medical practices such as training for endoscopic surgery, general surgery, vascular, orthopedics and neurorehabilitation

CONCLUSION

In this research was found a slight increase in the number of children that passed to a superior stage in the jumping pattern in the group that performed 2 weekly sessions of virtual reality games during one month (intervention group) compared to the control group. This research initiates a path in which investigations that include wider samples can be done, with more objective testing for the evaluation of locomotor pattern, increment in the quantity of sessions of videogames and statistics tests to determine the effects of virtual reality games on the development of motor patterns in children.

ACKNOWLEDGMENT

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IT Initiative for Creative Interactive Teaching Presentation based on IT Blueprint Framework

Maria Seraphina Astriani, Satrio Pradono, and Jurike V. Moniaga

***Abstract*—** The world is evolving, the way of live is shifting into digital age and people are evolving in terms of knowledge because of the present of technology. Traditional teaching methods like we used to have, while we were in school, are now longer accepted by today's learners. We live in digital era, where everyone wants something efficient, effective, dynamic, fast and interactive. Traditional teaching method where the teacher is delivering the materials to students by using presentation slides is no longer interest the students. They demand something more advanced, more interactive and more attractive to gain their attention to learn better. Teacher and school will need to make something interesting by using information technology, like interactive presentation.

***Keywords*—**interactive presentation, interactive teaching, IT Blueprint framework, IT Initiative.

I. Introduction

BECOMING a teacher is not as easy as it used to be. Before, there are no options for the students other than to accept any materials from the teacher whether the teaching style is boring and make the subject is unattractive than it already is. Before, both teacher and students have no references of how to make a better teaching and learning process. Now, since the internet is becoming an integral part of our life as we are depending on it every day, students can see other teaching styles from around the world that they believe it will gain more interest for them. With this condition, teacher needs to improve their teaching style or presentation to be more interactive and creative to gain student's attention.

As the internet playing an important role in our daily live, we cannot avoid our dependency of IT is increasing aggressively. Not only in the education world but people are now realize that to achieved all those things they need is to implement IT system, because IT has a significant impact in our daily life. The main involvements of IT in the company or school are to increase the efficiency, effectiveness, and competitiveness [1] and same approach are used in education world. Comparing with the previous generations of students, the digitally-native students tend to be more active experimental learners, more proficient in multitasking, and strongly dependent on communication technologies for accessing information and for interacting with others. In order to reach the generation's potentials, the previous research has proved that an interactive learning tool is more favorable in order to create enjoyable and interesting interaction to boost student motivation [2].

Since today's students are demanding something more interactive and creative from the teacher because they believe that they will learn much better. Today, most of the education institutions are not supported with a decent Information and Communication Technology or ICT system that can support both the business aspect of the institution as well as the teaching and learning aspect [3]. They still use the old traditional method of teaching where the teaching and learning process is dominated with one-way communication mode. In this mode, the lecturer explains the teaching materials meanwhile the students take the notes and try to comprehend what the teacher has explained and the interaction between teacher and students is missing. The above teaching and learning method is often ineffective and resulting on a condition where the teaching process becomes ineffective and demotivating the student learning [2]. These problems are initiated from the fact that the traditional method is less interactive between the both parties. The current teaching and learning method should be revised to align with the current young people adeptness of technology. Therefore, the problem lies ahead is that there is an urgent need to change the teaching and learning delivering method [4].

II. Method

Student interactivity is defined as the student's ability to response continually [3]. According to Hsu [2], interactivity has long been identified to contribute to successful teaching and learning. Because of that reason to solve the problem, we need interactivity in teaching and learning to create better environment to be more active and dynamic. Below is the method to create interactive learning environment.

Although IT Blueprint based on best practice, making IT Blueprint requires basic methodology that also includes the 5 aspects [3][5][6].

These steps are: (1) what is the vision? Define the vision to know what the goal is; (2) where are we now? Make a self-assessment to get a picture where is our current position for in terms of technology environment; (3) Where are we going to be? This step is to define are there any potential technologies

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that possible to be used in education to reach the vision. (4) How do we get there? To create Creative Interactive Teaching Presentation, we need to analyze: (a) Requirement gathering, (b) List of features, (c) Implementation plan; (5) how will you know when you get where you want to be? To know where our current position is, we need to make a tool to monitor our steps and time frame.

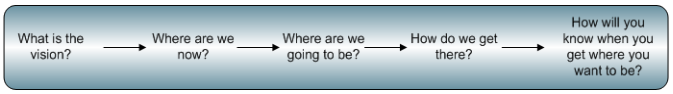

Fig. 1 basic methodology overview

Combining the basic methodology as well as the 5 pillars [7][8][9] as the basis for IT project to translate from the company or school's business processes, IT Blueprint Framework is formed by the following figure:

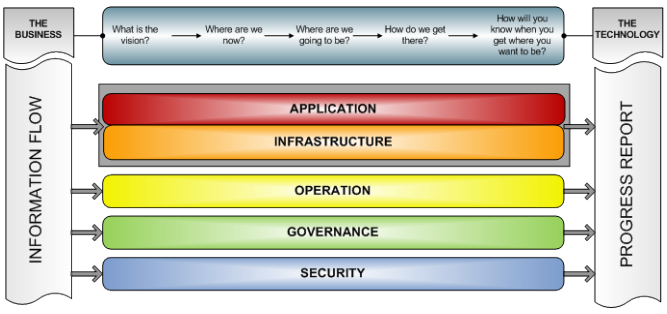

Fig. 2 IT Blueprint framework

IT Blueprint Framework of the above can be seen in the form of input called Information Flow (The Business) and its output is called Progress Report (The Technology). To obtain the Information Flow diagram it is necessary to analyze the company or school's business processes. This diagram will used to support the application and the infrastructure pillar. To see all the changes that occur with the implementation of IT Blueprint, we need Transition Matrix, which will show us the transformation of the IT system from IT project in a specific period of time. In this study, has been compared by researcher [3][5][10], Transition Matrix will have a transitions on the Where are We Going To Be? - Define Future so from the beginning of the IT project we will have a clear picture of the targets that should be done.

IT Blueprint does not require companies to use the most advanced or sophisticated and the most expensive technology to improve efficiency and effectiveness, but more likely to see which one is the most suitable technology and in accordance with the vision and mission of the company or school. In addition, the IT Blueprint also need to know the existing business processes within the company or school [5].

III. IT Blueprint

Approximately 50-80 % of IT projects fail because the project is over budget, needs that are not accommodated and there is no user acceptance. The implementation of technology in IT projects is in the gray area, there are no exact theories that explain this methodology clearly on how the implementation of IT projects in the real world should be done. Insufficient time or funds, unacceptable requirement, technology, governance, testing, and poor project management are always be the scapegoat in project failure. Why project failures are keep happening? Because operate without a full and clear Blueprint [11]. The fundamental difference between IT with other engineering disciplines is the lack Blueprint [11].

Traditional development is characterized by the following [3]:

- Requirements continuously change, adding time and cost
- Multiple versions, are required to deliver all requirements, taking years to deliver the final product
- The user interface inevitably does not work as people work, requiring constant tweaks and enhancements to get it right
- The business is forced to change its business practices to suit the technology, not the other way around.

The IT Blueprint fits into traditional development lifecycles and methodologies and also works equally well with new and existing applications. IT Blueprint can deliver [11]:

- Communication of functional and non-functional requirements
- A clear line of sight between strategy and application behavior
- Choice of the right technology solution
- Vendor accountability to the IT Blueprint
- Certainty of outcome
- On budget, on time and usable technology
- The application works properly on the first time

Referring to the previous research on the benefits of manufacturing and IT Blueprint [3][5][12], the IT Blueprint will continue to play as a leading role in implementing IT projects. This study will focus on ways of making IT Blueprint in general as a foundation to build IT projects within different company or school and it will produce a different IT Blueprint and by having and implementing this, the company or school will have a strategic solution as their IT project.

To start developing the IT Blueprint, organization’s vision is needed as the base of IT Blueprint methodology.

Business process will be translated into information flow in the system. In future, the information can be obtained more quickly with centralized data [3].

Comparison of the figure below will give clearer picture for what we don’t have now and what will we have in the future.

To conclude all the future targets, transition matrix is created to let the organization know on which way they transform.

Consolidate			Integrate System
System		Interactive Presentation	
Requirement	Data & Environment Preparation		
	Period I	Period II	Period III

Fig. 3 Transition Matrix

IV. Implementation

Based on IT Blueprint framework, as a starting point, vision is required to set our target. Vision is the key to deciding the "where are we going to be" [5].

After the vision is determined: "Creative Interactive Teaching Presentation", the next step is defining current IT conditions. The things to do on this step are list all the IT devices and understand-analyze current IT situation. SWOT, SWOT matrix (IFAS, EFAS), and CFS can be used as a tools to help defining current conditions [12]. This is the example of the IT current conditions: each class room has 1 computer (LCD monitor, keyboard, mouse, RAM, hard disk, graphic card, HDMI port, etc.) and 1 projector.

Based on the current IT situation, future will clearly defined as listed below

Before	After
Presentation slides	Interactive presentation
Navigate using tools: mouse, keyboard, or presentation remote	Navigate using motion gesture
Can not move freely (because need to use the tool(s))	Can move freely
Less enjoyable	Enjoyable
Less interesting	Interesting

Fig. 4 comparison

Analyze from figure 4 and current IT situation, it will give clearer picture of what we don't have now and what will we have in the future.

Infrastructure	
Needs / Target	Solution
Device for detect motion gesture	Motion capture device
Network	Connect computer with motion capture device
Platform environment	Computer with required specification of motion capture device
Applications	
Needs / Target	Solution
Create interactive presentation	Interactive presentation software that can detect motion gesture
Software Development Kit	Computer with motion capture device SDK

Fig. 5 needs and targets example

Information flow diagram created after define the business process. It joint the future needs (application) and business process to represent the flow of information for future application [12]. This is the example feature of information flow diagram: Hand gesture: shove left, then call next_slideshow() function. To help define the tasks, Hierarchical Task Analysis (HTA) can decompose tasks to subtask / subgoal [13]. Following is the example of HTA:

0. Navigate Interactive Presentation Slide
1. Check the system
    - 1.1. Check display
    - 1.2. Check device indicator
2. Stand approximately 1 meter towards device
3. Navigate and operate slides
    - 3.1. Choose presentation slides
    - 3.2. Navigate the slides
        - 3.2.1. Shove left
        - 3.2.2. Shove right
        - 3.2.3. Shove up
        - 3.2.4. Shove down
    - 3.3. Choose
        - 3.3.1. Pinch
        - 3.3.2. Close palm
        - 3.3.3. Open palm

IT Initiative will help the way to achieve targets. IT initiatives is a roadmap of what should education institutions implement for meet the future IT. The Each IT initiatives are sort based on urgency, important, cost, and time, and categorized by people, process, and tools. This is the final result for IT Blueprint. Based on this IT Blueprint, they will know which one they should implement first, if they have the budget [12].

These are the example of IT Initiative based on Transition Matrix:

	!	^	$	~
Motion capture device	!!!	^^^	$$	~
Network - cable	!!	^	$	~
Complete the computer specifications	!!	^^	$$$	~~

Fig. 6 IT Initiative - Infrastructure

	!	^	$	~
Interactive presentation software	!!!	^^^	$$$	~~~
SDK	!!!	^^^	$	~

Fig. 7 IT Initiative - Application

	!	^	$	~
Installation	!!	^^^	$	~
Software training	!!	^^	$	~

Fig. 8 IT Initiative - Operation

	!	^	$	~
Disclaimer	!	^	$	~~

Fig. 9 IT Initiative - Governance

	!	^	$	~
Real-time PC protection	!	^	$	~~

Fig. 10 IT Initiative - Security

ISBN: 978-1-61804-238-5

!	^	$	~
! = Less Important	^ = Not to Urgent	$ = < $99	~ = Less than 1 week
!! = Important	^^ = Urgent	$$ = $100 - $499	~~ = 1 week – 1 month
!!! = Very Important	^^^ = Highly Urgent	$$$ = > $500	~~~ = more than 1 month

Fig. 11 legend of IT Initiative

To create the interactive presentation software, researcher using Microsoft Kinect device and Kinect for Windows SDK to implement motion gesture to navigate the slides. Minimum specifications of computer (infrastructure) to runs this interactive presentation are Dual Core 2.55GHz Processor, Dedicated USB 2.0, and 2GB RAM. And the minimum requirements of the software (application) are Windows 7 (32 or 64 bit), .NET 4.0 Framework, Kinect SDK Beta, and Microsoft DirectX SDK.

Figure 12 illustrate the application environment of interactive presentation.

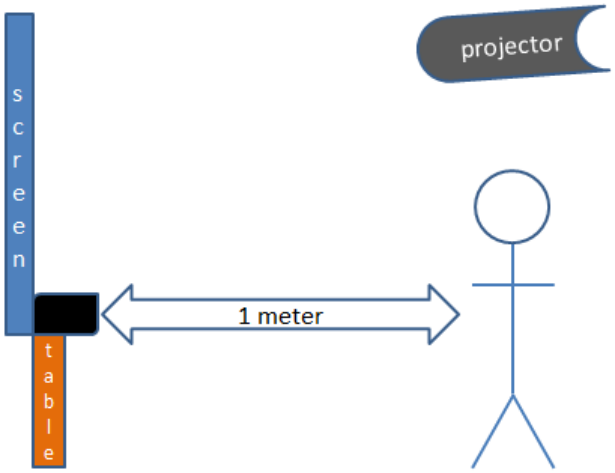

Fig. 12 application environment

V. Conclusion

Teacher needs interactivity in teaching and learning to create better environment to be more active and dynamic. By using creative interactive teaching presentation, teacher can improve their teaching style or presentation to be more interactive and creative to gain student's attention.

To develop a success interactive presentation application, the implementation of IT Initiative in IT Blueprint framework is needed to reduce the failure the IT project.

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Serious Games in Education Towards the standardization of the teaching-learning process

Nabila HAMDAOUI, Mohammed KHALIDI IDRISSI, Samir BENNANI

***Abstract*—** Gaming has pleasantly and inevitably accompanied human life throughout history. Due to their intrinsic ludic and motivational values and with the advent of digital technologies and globalization, games have begun to invade serious domains such as education, hence the label 'serious games'. But, while addressing areas like education, game designers hit at various obstacles because they have to create memorable and ludic experiences without neglecting the learning objectives. The aim of this paper is to evaluate the educational effectiveness of serious games and to standardize the learning process to create effective serious games. We will describe the use, and the integration of IMS learning design specification in the design process of serious games to facilitate the communication between educators and game designers and to create adaptive learning experiences.

***Keywords*—** Serious Games, IMS-LD, Video Games design, Standardization, Adaptive learning.

I. Introduction

Towards the end of the past century, video games became a worldwide phenomenon and are still taking an important place in various cultures. They have become part of daily routines of many people regardless of their age, status or interest. In fact, video games have become one of the biggest entertainment industries beating out the movie, music, and DVD industries combined, so far as sales are concerned [1]. Video games provide their users with clear goals, interaction with other players, and an experience which they cannot realistically achieve in real life. Moreover, video games are considered as an excellent way to deal with motivational enhancements. According to Yee's studies [2] gamers play for three main reasons: relationships (deriving pleasure in interacting with other gamers), immersion (identifying with game characters and living in the fantasy world of the game), and achievement (overcoming challenges and becoming powerful). No other field has experienced the same explosive growth as the computer and video game industry; which has aroused its interest in different areas other than entertainment.

Recently, we have witnessed the appearance of serious games which do not target merely the unique purpose of entertainment. Most significantly, they can be used for serious goals such as training, learning, communication or even physical or mental exercises. They have become a new trend in different areas including education. Today's students represent the generation that grow up surrounded by an amalgam of contexts and learning situations using video games. In this regard, serious games are recognizably considered as a promising and an effective learning medium or tool. Serious games can be used for different types of learning. The nearest at hand are problem solving activities during which the player/learner is given an amount of information and a situation where s/he is involved in a game to solve particular pre-targeted problems. Similarly, s/he uses them to identify with a character so that the player/learner knows the use of the playing context in real life, by gaining skills of practice in what s/he is learning and in specific kinds of situations s/he will need to confront. Serious games also help in adapting the teaching process according to the learner's profile. Good video games give us a glimpse about what learning might look like in the future; and if or when we decide to give up the old approaches and methods of traditional schooling [3].

Serious games, as learning technologies, must appropriately integrate pedagogical and learning objectives. Beyond elements that are inherent in every game (mechanics, game-play, rules and so on), various learning aspects need to be included; which makes the design of serious games a mind-boggling and challenging task. In this paper we will see how serious games design can benefit from existing e-learning standards. In section 2 we will briefly define serious games and discuss their effectiveness in the educational area. In section 3 we will introduce video games design, outline some standards in e-learning design before proposing an integration of serious games and IMS-LD. Finally, we conclude this article by mentioning our future work.

II. Serious Games in Education

Today's digital students have tremendously benefitted from ICT in their schooling. Yet, the traditional basic components or constituents of school systems are still holding sway. Governments still base their school systems on pre-established curricula; and under the umbrella term 'curricula' are inherent syllabi which, in their turn, are founded on pre-established goals, standards, benchmarks and objectives. For a serious game to be successful in pedagogical terms, it has to fit within pre-established paradigms and at the same time go beyond them; which is very hard to bite on for a game designer and

not easy to guarantee in all circumstances. Playing serious video games is susceptible of generating not just entertainment but learning. It can even give immediate feedback to the learner and to the overall system by allowing the player to progress at his/her own pace, by giving him/her the opportunity to explore, by trying new things and taking risks, in a safe place without being judged or ranked [4].

A. The concept of Serious Games

Serious games usually refer to games that are used for other purposes than pure entertainment such as education, military training, health care, and other sectors of society. The term "Serious Games" has been used for the first time by Clark Abt in 1970 before the appearance of computer games. Clark provides the following description of serious games: "*Games may be played seriously or casually. We are concerned with serious games in the sense that these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement. This does not mean that serious games are not, or should not be, entertaining*" [5]. This description is considered valid for the computer based serious games. Later, Mike Zyda who participated in the development of Americas Army defines a serious game as, "*A mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives*" [6].

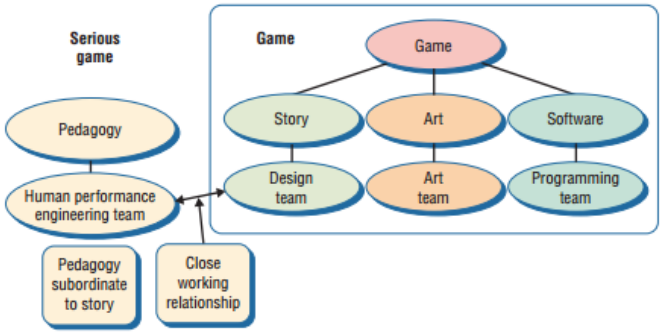

Fig. 1 Serious Games according to M. Zyda

Zyda maintains that serious games have more than just story, art, and software. As Figure1 shows, they include pedagogy (activities that educate or instruct, thereby imparting knowledge or skill). However, he claims that pedagogy must be subordinate to story and that the entertainment component comes first [6].

In literature, there are some terms similar and related to "Serious Games" such as "Game Based Learning", "Digital Game Based Learning", "Educational Games", "Simulation Game" and "Edutainment". Furthermore, "Serious games" does not necessary signify video games; it can also mean regular games (board games, card games and so on). In our paper we will limit the scope of serious games to video games.

B. Serious Games effectiveness in education

Serious games must combine the educational dimension which defines the learning goals and the ludic dimension which creates the engaging and the fun part of the game, while taking into consideration the pedagogical integration of both dimensions.

Criticisms are repeatedly leveled against traditional schooling. It is often said to be based on the transmission of knowledge in a full-frontal way and in settings where learners are looked down on as empty vessels to be filled in with ideas regardless of their needs, likes, age and interests. In contrast with traditional schooling and with the challenges of globalization, 'Blended Learning' has become a necessity and an undeniable fact. The use of electronic media, contents and channels has become an irreversible novelty. Learning by doing, also called 'Experiential Learning', has become more than ever an urgent necessity. This shift from content-based instruction to 'Blended Learning' makes the use of 'serious games' something not just worth venturing on but a pre-requisite for school systems worldwide.

Many decades ago, Benjamin Bloom, an educational psychologist, developed a prominent taxonomy of educational objectives. Although Bloom's taxonomy focuses basically on cognitive sides of learning, the tasks inserted in his taxonomy touch upon affective and psychomotor sides of learning. The cognitive domain involves knowledge and the development of intellectual skills [7]. This embeds skills such as recalling or recognizing specific facts, procedural patterns, and concepts linked to the development of intellectual abilities and skills. The affective domain seeks to define the manner we handle things emotionally. It has to do with feelings, attitudes, motivations, values, and enthusiasms. The psychomotor domain includes physical movement and activities, actions, coordination, and use of the motor-skill areas. Within the cognitive domain, Bloom identified six levels (See table 1). The levels move increasingly from simple to complex and are designed to measure student's degree of learning. Bloom's taxonomy is useful in conceptualizing instructional lessons and skills which the learner should go through from simple to complex. This can also be applicable to serious games, where game developers organize information / input in terms of game levels or sequences.

Levels of learning, sometimes called 'Benchmarks', include tasks which would go under the label of "application", tasks such as building, making, constructing, modeling, predicting and preparing. Later, Raoul A. Arreola formulated a table of learning objectives in accordance with Bloom's taxonomy [8]. He put forward more exhaustive tasks and skills to develop in students. He kept Bloom's six main categories/levels of learning objectives: knowledge, comprehension, application, analysis, synthesis and evaluation. But under every main categorization he derived detailed tasks which lend themselves to serious games in their learning /education dimensions. Bloom's taxonomy included thirty four objectives. Arreola extended on it and made it include sixty learning objectives. A brief glance at Arreola's taxonomy reveals that the main six categories of learning objectives all lend themselves to serious games in one phase or another.

ISBN: 978-1-61804-238-5

TABLE I. BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES

Bloom's Taxonomy of Educational Objectives (Traditional) Skill	Definition	Key words
Knowledge	Recall information	Identify, describe, name, label, recognize, reproduce, follow.
Comprehension	Understand the meaning, paraphrase a concept.	Summarize, convert, defend, paraphrase, interpret, give examples.
Application	Use the information or concept in a new situation	Build, make, construct, model, predict, prepare.
Analysis	Break information or concepts into parts to understand it more fully	Compare/contrast, break down, distinguish, select, separate.
Synthesis	Put ideas together to form something new.	Categorize, generalize, reconstruct.
Evaluation	Make judgments about value.	Appraise, critique, judge, justify, argue, support.

How effective can a serious game be in a particular learning domain? That's a question which generates more than one answer. James Paul Gee, one of the researchers who has studied the learning potential in computer games, has established thirteen principles/criteria that can be used to evaluate the effectiveness of video games in education [9]. These principles/criteria take into consideration the degree of motivation. That is to say how a particular game can be used to motivate and engage learners/players in learning experiences. Gee organized these principles into three categories. The first category deals with empowering learners, the second one touches upon forms of problem based learning and the third one tackles how games create a deep understanding in the learner.

- **Empowered learners**

In this category Gee introduces four principles; The 'co-design principle', where the learner is considered as an active agent and not just a consumer; the 'customization principle' according to which the learner must be able to customize his/her learning experience to his/her own learning style and be able to try new styles at the same time; the 'identity principle' which stands for the fact that deep learning calls for an 'extended commitment' and such a commitment is strongly optimized when people take on a new identity they value and in which they invest themselves heavily [9];and the 'manipulation principle' which aims at empowering the learner by engaging the body and the mind in the learning process.

- **Problem based learning**

In this section Gee defined seven principles. Among them, the 'pleasantly frustrating principle' according to which learners feel and get evidence that their effort is paying off in the sense that they can see, even when they fail, how and if they are making progress [9]. The cycle of expertise principle: Each level exposes the players to new challenges and allows them to get good at solving them until they become expert and the process starts again in the next level. And the information 'On Demand' and 'Just in Time' principle where the information is given "just in time" in situations where the learner can use that information and "on demand" when the learner needs it.

- **Deep understanding**

Gee highlighted two principles in this category. The first one is about 'system thinking'; hard problems have to do with complex systems. To be able to solve these problems the learner needs to know how to do systems thinking. The second one is about meaning as action and image: Instead of getting meaning by other words/equivalents, which is often the case in standard schooling, games give meaning with images, actions and experiences. Meaning is visualized and contextualized.
Searching in the literature, we found many frameworks that help in evaluating serious games effectiveness. Among them we could cite de Frietas and Olivier (2006) who introduced a Four Dimensional Framework for evaluating games based learning. This framework helps in evaluating the potential of using games and simulation based learning in educational practice, and in providing more critical approaches to those games and simulations [10].

When tutors decide to include games in their teaching activities they have to face many decision-making questions. Which game to use for supporting a specific learning context? Which pedagogic approaches to fit within the learning activities? Or, what is the effectiveness of using that specific game?

The Four Dimensional Framework takes into consideration four dimensions. The first one is the "Context" where the learning/playing is taking place. The second dimension is about the "Learner" and focuses on the learner preferences and attributes that can influence the learning effectiveness such as the learner's age, level, background and style. The third one concentrates on "Mode of representation" that applies to the interactivity, the levels of immersion and fidelity used in the game or simulation. This dimension serves also as a method for briefing and debriefing before and after a serious game, which increases and fortifies the learning experience. The last dimension is "Pedagogy" that advocates the participants view

upon methods, theories, models and frameworks used to enhance learning practices.

The four dimensions should not be considered as separate entities but are interwoven; they rather reveal the significance of how each dimension relates and maps to each other to produce, support or inhibit the particular learner or learner group's experience [10].

III. Standardization of Serious Games design

The design of good educational serious games calls for educational effectiveness which must be set up as a goal to be duly integrated in the design process. However, this isn't sufficient; the process of serious games design must be standardized to ensure a good communication and a common understanding of both parts (educators and game designers). Serious games can benefit from standards in e-learning to unify the jargon of game design and to standardize the teaching-learning process.

In this section, we will propose a standardization of the teaching-learning process using IMS-LD and we will explain how both of IMS-LD and video games can be combined to create adaptive learning experiences.

A. Video games design

Salen and Zimmerman defined game design as the process by which a designer creates a context to be encountered by a player, from which meaning play emerges [11]. They consider the role of a game designer as threefold: 'designing game play', 'conceiving' and 'designing rules and structures' susceptible of resulting in an experience for players. They propose schemas to understand the game design. These schemas are Rules, Play and Culture. They defined games design fundamentals that include the powerful connection between the rules of a game and the play that the rules engender, the pleasures games invoke, the meanings they construct, the ideologies they embody, and the stories they tell.

Doug Church a game designer announces this, "The design is the game; without it you would have a CD full of data, but no experience." [12]

Jesse Schell has established in his book "The art of Game Design" a map of elements which are important to take into consideration when designing a game and the relationship between them (see figure 2). He defines video games design as follows: "Game design is the act of deciding what a game should be" [13]. He considers as the main objective of game design creating an experience that starts with an idea and concerns a player. In fact, games create all kinds of wonderful, amazing and unforgettable experiences. Games consist of elements: mechanics, story, technology and aesthetics each of these elements is important and they are related closely to the player's experience. The experience that the game offers takes place in a world, the imaginary place that exists in the imagination of the player. While playing a game, the player must feel free and must feel that s/he controls the game in his/her own way which makes it easy for him/her to project his/her imagination in the world of the game and thus to be immersive in it. For this purpose the designer must ensure that the players do things of their own free will.

The experience that a game offers is primary to the design process, without it the game is meaningless. This experience is not unique to games; we can find it in books or movies. The difference is that these experiences are linear whereas the experiences of games are more interactive. The game designer has to give to the player the control over the events that the experience gives. In this stage of games design, other fields are consulted like psychology or anthropology to try to figure out the player's heart and mind, affect and cognition. While designing this experience the game designer must take into consideration some factors like surprise, fun and curiosity.

Video games are made for a player and exactly for a specific audience. To design a game for this audience, the game designer must think as they do, try to feel what they feel and understand what they want in a game. He must project himself/herself in the mind of the player. The best way to do that is to spend as much time as possible with the target audience and to watch them playing to figure out what they enjoy in a game. This is the strategy of pre-design immersion.

A game consists of mechanics, the rules of the game. They constitute the goals of the game, how players can or cannot achieve those goals and what happens as they try to achieve them [13]. According to Jesse Schell mechanics should be in balance (adjusting the elements of the game until they offer the adequate experience) and must support puzzles to make the player stop and think of the right decision to make [13].

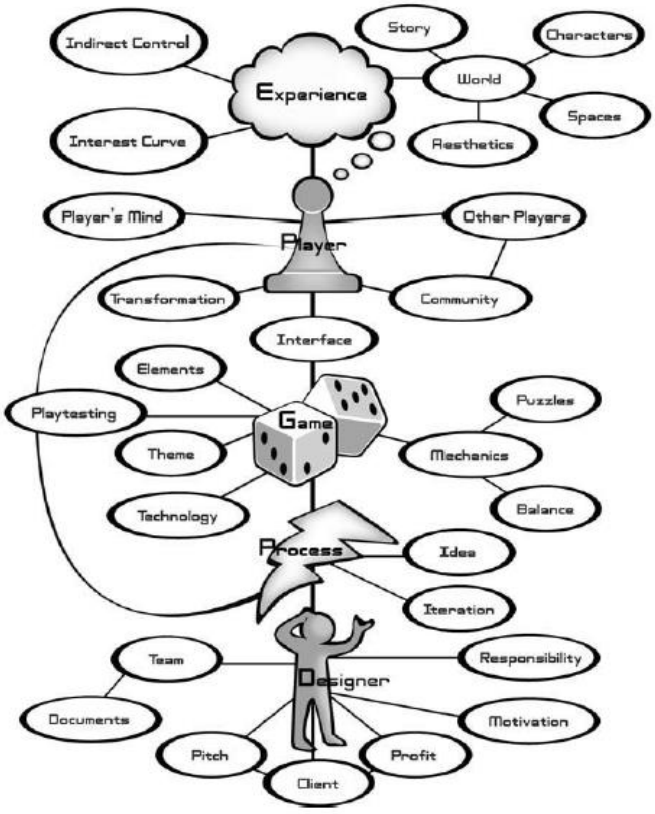

Fig. 2 Game design map (from the Art of Game Design [13])

To create experiences, games must embed stories. These stories happen in a world, the imaginary place where a game takes place. This world contains spaces and characters called also avatars which the player controls in the game and which s/he identifies with. These characters help to create a powerful experience.

The look and feel of this world is defined by its aesthetics, if the game has beautiful artwork it makes the world of the game look real; which makes the experience more effective. Technology is what makes the game possible; it constitutes the physical objects that allow the realization of the game. Technology is the essential medium in which the aesthetics take place, in which the mechanics will happen, and through which the story will be told.

To design a good video game all the elements that have been cited before in addition to the ones that are shown in figure 2 must be taken into consideration.

Educational Games design draws on the elements dwelt on above and bears a great affinity with commercialized video games. But, it needs the pedagogical integration of the learning content.

B. E-learning standards

The standardization of the learning process permits 'interoperability', 're-usability', 'durability' and 'accessibility'. In this section we will shortly revisit the literature on existing e-learning standards to determine the one which will form the basis of our work.

1.IEEE LOM

IEEE LOM is an e-learning standard developed by IEEE (Institute of Electrical and Electronics Engineers). The standard specifies the syntax and semantics of Learning Object Metadata, defined as the attributes required to fully and adequately describe a learning object [14]. It includes pedagogical attributes such as; teaching or interaction style, grade level, mastery level, and so forth. In addition, LOM encapsulates the Dublin Core [15] elements. The Dublin Core metadata standard describes a wide range of networked resources [16]. The Dublin Core standard includes two levels: Simple and Qualified. Simple Dublin Core consists of fifteen elements (the title and the subject of the resource, the description of its content and so on); Qualified Dublin Core includes three additional elements (Audience, Provenance and Rights Holder), as well as a group of element refinements [16].

2.SCORM

The Shareable Content Object Reference Model (SCORM) [17], published by the Advanced Distributed Learning (ADL) project, is a standard for e-learning content. The SCORM specification is a collection of specifications profiles based on various other standards and specifications. It determines how online learning content and Learning Management Systems (LMS) communicate with each other. SCORM defines how to create "sharable content objects" or "SCOs" that can be reused in different systems and contexts.

SCORM specifies how to package learning objects as SCOs so that they can be aggregated, stored, copied, moved, archived, uploaded and eventually delivered to a user. SCORM package its content using IMS Content Packaging [18]. SCORM consists of sub-specifications:

- *Content Aggregation Model:*

The Content Aggregation Model defines how the course content, which will include one or more SCOs, should be packaged, deployed to, and delivered via any SCORM conformant learning management system (LMS).

- *Run-time Environment:*

The SCORM run-time specification controls how the LMS launches content and how the sharable content objects communicates with the LMS.

- *Sequencing and Navigation:*

SCORM Sequencing and Navigation define the ability of a learner to navigate from one learning object to another and the sequence in which learning objects may be experienced by a learner. Sequencing determines what navigational controls and options are available to the learner.

3.IMS Learning Design

IMS Learning Design (IMS-LD) [19] was developed by the Open University of the Netherlands. IMS-LD is a meta language that is based on the Educational Modeling Language (EML).

The IMS Learning Design specification supports the use of a wide variety of pedagogies in online learning. Rather than trying to apprehend the specifics of each pedagogy it provides a generic and flexible language. This language is designed to enable many different pedagogies to be expressed [19].

Learning Design specifies three levels of implementation and compliance (see figure 3). Level A contains all the vocabulary needed to support pedagogical diversity. Level B adds properties conditions, monitoring services and global elements to Level A, which enables personalization, adaptation, sequencing and feedback. It can be used to direct the learning activities as well as record outcomes. Level C adds Notification to level B which is triggered by an outcome and can make a new activity available for a role to perform.

Fig. 3 Three levels specification of IMS Learning design

In comparison with SCORM and IEE LOM, IMS Learning design is very effective in the support of adaptive learning experiences and it can easily be understood by both educators and video games designers, that's why we have based our work on it.

C. Integration of IMS-LD and serious games

The top priority aim of this paper is to use IMS-LD during the design process of serious games so that the game designer team and educators/pedagogues find an appropriate field of collaboration in making an effective educational serious game.

IMS-LD level A features and video game design elements bear a lot in common. In IMS-LD level A we find pre-requisite components such as roles, activities, environment, resources and acts while in video games we find players, characters, mechanics world of the game and stories. The affinity between the two can help in facilitating the communication between educators, pedagogues and the serious games designer team. IMS-LD can be considered as a unified jargon between the two parts. However, the learning process is always dynamic and in a state of flux. A mere common labeling and determining of entities and components is not enough. This is basically the reason why IMS-LD should be continuously integrated in an on-going process of design and adaptation of learning experiences in serious games.

IMS learning design draws on a wide range of modern pedagogical approaches that are used today, active learning, collaborative learning, adaptive learning, personalization, dynamic feedback, runtime tracking, ePortfolios and alternative assessment [20]. In fact with IMS-LD the author of the teaching material can specify detailed learning design components. In other terms s/he can specify the desired type of learning activities and their sequences (including adaptation and personalization aspects), interaction between different persons in different roles and the interaction between these roles and learning activities/tasks and learning services/outcomes [21].

More detailedly, IMS-LD is able to achieve six main types of adaptation [22]: 'learning flow based', 'content based', 'interactive problem solving support', 'adaptive user grouping', 'adaptive evaluation' and 'changes in run-time'. In addition the basic and crucial structure provided by Level A, the elements of Level B can serve as the real key for adaptation. These elements combine properties with conditions and other features encouraging flexible content and a learning flow. The elements in Level B which provide more straightforward support to adaptation in Units of Learning are properties, conditions, global elements, calculations and monitoring services.

- **Properties**

Properties are taken as variables to store values. There are many types of properties: local, global, personal and role. When several properties are defined around a category they can be grouped in the property-group property.

- **Conditions**

IMS-LD is able to define 'if-then-else' rules to change the value of a property or to show and hide one element. It refines the visibility of activities and environment entities for persons and roles.

- **Global elements**

Global elements provide a communication flow between the 'imsmanifest.xml', where the different levels of IMS-LD are set-up, and other XML files. Mainly, they can get an input from the user and they can show a value of a property. Furthermore, they can manage DIV layers in XHTML, for instance to show and hide specific content.

- **Calculations**

IMS-LD is able to make some basic calculations (sum, subtraction, multiplication and division) and some combination of a number of them in a row, to get a more complex formula, like a simple average, for instance.

- **Monitoring services**

The specification allows monitoring any kind of property assigned to a user or a role, for instance. In order to start this action, firstly the component monitor must be set-up inside an environment and later the property can also be traced.

Through a combination of 'properties', 'calculations', 'conditions', 'global elements 'and 'a monitoring service', a range of adaptive methods can be modeled; for instance, properties allow making user's 'features', 'group features', and adaptation to 'stereotypes [23].

We notice in commercialized video games that they are very adaptive. Good video games offer adaptive experiences for each type of players. They offer different skills and different methods to achieve goals and solve problems. Furthermore, they adjust the difficulty depending on the player progress in the game. During the design process of a video game the level designer designs the different levels of the game. In each level s/he predetermines the right level of challenge, the accurate amount of reward, the right amount of meaningful choice, and all the other ingredients that make a good game [13].

There are many works that define the adaptive side of video games in educational contexts, one of them is the customization principal [9] put forward by James Paul Gee who states that the learning experience offered by an educational game is customizable depending on the learner's profile.

Video games can match the player/learner decisions. For instance, it can be detected noticeably if the user is stuck trying to solve a puzzle, and this serves as a clue in lessening the difficulty of the task slightly. [24]

The integration of IMS-LD during the design of educational serious games can facilitate the design process and enhance the learning objectives. This integration helps also the adaptation of the educational content to the profile of the player/learner.

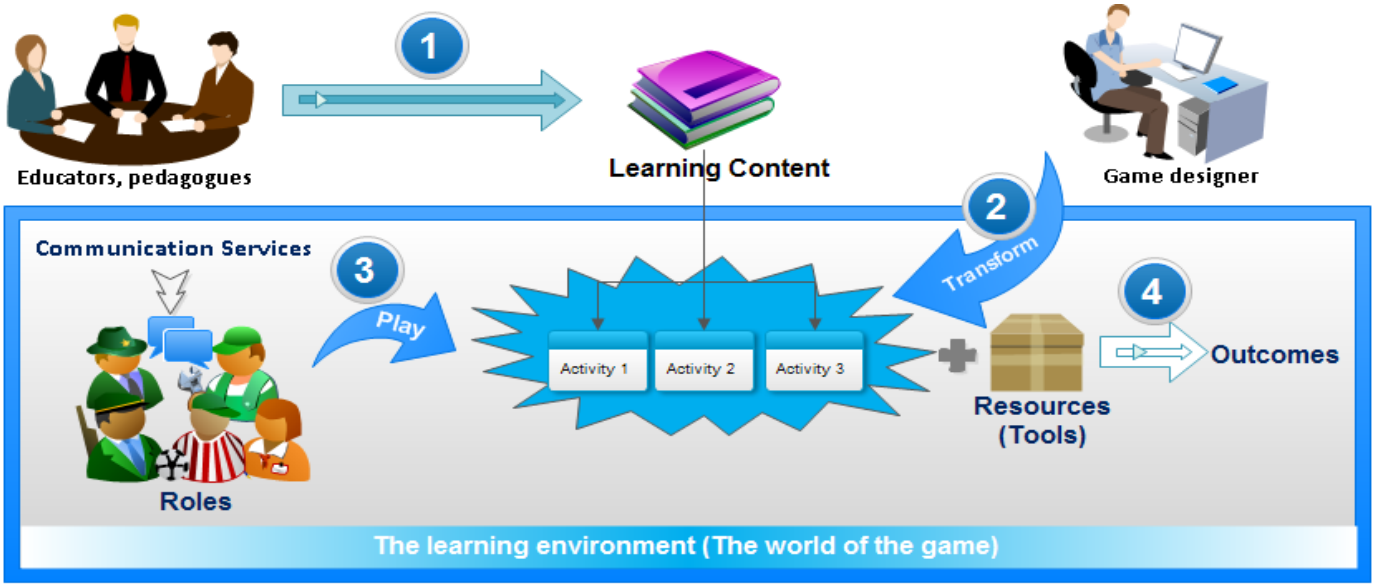

Fig 4. Using IMS-LD specifications during Serious Games design

The integration of IMS-LD is illustrated and visualized in figure 4. The educators/pedagogues create the learning content/scenarios that are organized later in a set of activities.

These activities are carried out in a specific order and are transformed by the game designers to add the fun part, for example to transmit information to the learner/player the game designer will transform it to 'hints collection', to make the learner/player practice this information the game designer can bring situations/contexts (depending on the type of the game) where the learner/player is supposed to act/play to solve problems. And for the evaluation part the game, the designer can come up with a final situation like the so-called "Beat the boss" situation where the learner/player will use all the skills that s/he has developed so far to beat the boss. To achieve these activities the game designer makes available for the player/learner a set of tools.

The 'roles' of the game are the player/learner himself/herself, 'acolytes' that will help and guide the player/learner to achieve the goals of the game and other characters like enemies. To permit conversations/interactions between the different roles, the game designer can consider a communication mechanism like a chat system, forums or wikis. These roles perform predetermined activities in the environment of the game using available resources. The aspects that characterize each role are also predetermined by the game design team.

The game records the outcome of the different activities. The reached outcome can serve in further adaptation and adjustment of the learning content. In fact it can be used to set properties values. These properties represent the learner's progression in the game (the completed activities), the results of evaluations, the learning style of the player/learner and so forth.

The adaptive mechanism will use these properties in the conditions established and agreed upon by both the pedagogues and the game design team to continue adapting the levels/content of the game (see figure 5). It's an on-going process. Conditions which would go under the form of 'If-Then-Else' rules will use Boolean expressions on properties to personalize the learner/player experience and refine his path of learning. For example, depending on the outcomes of one level the game will adjust the next one; and instead of letting the player/learner perform all the activities of the level, only the basic activities will be implemented in the game until the player masters them all.

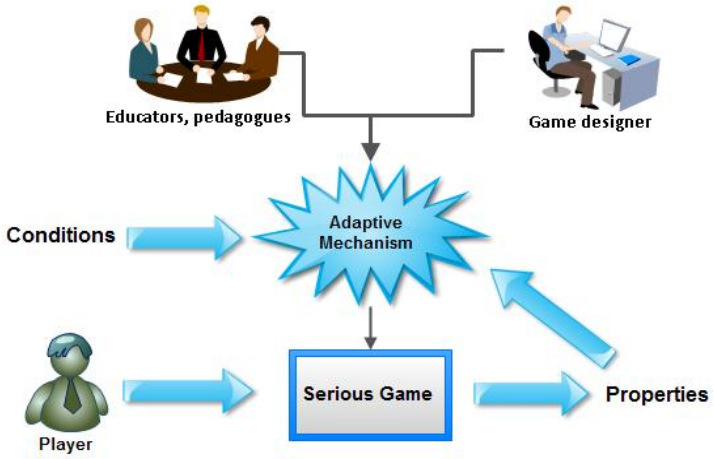

Fig. 5 The adaptive mechanism for serious games

In the same perspective e-ucm [25] made some researchers to integrate IMS-LD with <e-adventure> project [26] to create adaptive learning experiences in educational video games. They create a communication between <e-adventure> and IMS-LD which is regulated using adaptation and assessment rules and which enables a mutual influence of the adaptive learning experience. They took as a case study the game "Paniel and the Chocolate-based Sauce Adventure" where the player/learner learns about the world of chocolate from a practical side.

IV. Conclusion and Future Work

A lot of ink has been spawn on serious games in the last decades in areas such as education. In fact, educational serious games may be considered as one of the cornerstones of 21st century education. To be effective, these serious games must combine both the ludic part and the learning content while taking into consideration some pedagogical aspects during this combination. The integration of both the fun dimension and the educational dimension requires a close collaboration between the game design team and educators. To facilitate their communication and their collaboration the serious games design process must be standardized. In this perspective, we have tried in our paper to standardize some aspects of this process. To do so, we have firstly studied the game design process to understand the important components that constitute video games. We have revisited the literature on existing e-learning standards to choose the adequate one that can be used during the process of serious games design.

We opted for IMS Learning Design specification since 'IMS-LD level A' features and video game design have a lot in common. In this sense, we can use IMS-LD as a common language that can be understood by both educators and video game designers. IMS-LD is considered as a powerful tool when it comes to modeling adaptive learning experiences using the elements of level B; videogames are also considered as ideal tools to adapt the content. In this paper we propose to conceive a standardized adaptive mechanism which will be made by both educators and game designers and that will be based on the adaptive aspects of both IMS-LD and video games. This mechanism will take 'properties' as an input. These properties contain the outcome of the activities of the game and they represent the learner's progression in the game or the results of evaluations reflecting the learning style of the player/learner. The same properties will also be used by conditions/pre-requisites established by both the pedagogues and the game design team to constantly adapt the levels of the game.

Our future work will consist of the establishment of this adaptive mechanism. To do so, we will need firstly to determine the different components and features of this mechanism and to fix its outcome (properties, conditions). We also expect to make a prototype to apply this mechanism to a special type of game for a specific audience before its generalization.

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An Empirical Study about the Influence of Moodle on the Teaching – Learning Process at Higher Institutions

Said T. EL Hajjar

Abstract—An important issue in higher education institutions is to involve the interest of students in digital technology at the teaching /learning process. This study describes the effectiveness of using Moodle to teach students in all university levels. In this paper, we conduct a questionnaire survey at Ahlia University in the Kingdom of Bahrain regarding interest in how Moodle can be used to support, improve and develop student learning. Conversations with teachers and students and feedback responses from three faculty (full response) and forty-five students (partial response) are drawn upon and form the basis of this paper. The purpose of the survey is to gather evidence of the relationships between university faculty and the Moodle system, from which future practice could be informed. The findings confirmed that this system enabled the members to promote understanding and greater respect for digital technology. Although a limited number of respondents indicate that academics were still in a period of transition from trivial systems observance to deep pedagogical change, a majority of respondents reported some degree of integration of Moodle with their teaching, along with a long-term commitment to Moodle utilization and improvement over time.

***Keywords*—** Course design, Moodle, educational effect, course content, student learning, teaching.

I. Introduction

Recently in developing countries, disinterest in technology of students at higher institutions has become an issue. In this study, we held a Moodle system enlightenment experience targeting undergraduate students at different levels as the participants' performance would become good evidence for the positive influence of Moodle system in the teaching/learning process at Ahlia University.

Recently, scientists have clarified that communication technology would be used to sustain the teaching/learning process in the classroom and across all subjects of the curriculum [1]. To maintain this, a balanced approach to incorporating technology, pedagogy and content should be established in order to supply a significant learning environment for students [2].

In the past, we participated in various educational software and have analyzed a number of questionnaire surveys regarding the awareness contents conducted to the awareness participants. The analysis results have confirmed that to improve the awareness of the participants for using technology and they have assured that students need opportunities to deal with technology so they may gain the skills and confidence they require to, not only to support their learning, but also to provide them with the skills they need for their future work. It is important for the faculty to prepare a wide variety of attractions, and to give easy-to-understand explanations and descriptions. To achieve this, it requires from faculty to have enough idea of how information and communication technologies (ICTs) can be used and the skills to be able to integrate it into the teaching/learning process [3]. Teachers who have a strong combination of ICT skills and pedagogical knowledge will be better prepared to "effectively use today's technologies in the classroom as well as continue to develop and adapt to new technologies that emerge in the future" [4]. Moreover, this generation is eager to spend hours and hours on digital instruments while he quickly is fed up in facing a traditional lecture of learning. It is normal since this generation is somehow considered as a digital generation behaving like robotic. Moodle is a supportive tool to initiate an organized system for teaching and learning that is used in many universities around the world. Ahlia University is one of these universities that use this technology and the results of our survey have proven the significance of this system on student's performance.

II. Background

Students who plan to get an education diploma or equivalent diploma to it should have the opportunity not only to gain theoretical knowledge, but also to develop and support this knowledge with technology tools. Flinders University has implemented a PE Program (Professional Experience) as a practicum course [5]. So it is preferable in these practicum courses to give a space for the use of technology such as Moodle. Mark has proven Moodle in the classroom can be used to support, enhance, and extend student teaching [6]. Kennedy has stated that the pre-service teacher is using Moodle to supply pupils with practical technology in order to encourage them to actively involve with the content-based learning materials, interactive activities and their peer learners [7]. The development of e-learning has become an important aspect of teaching and learning [8]. In 2009, one Australasian university embarked on an ambitious three-year digitalization and curriculum renewal project. The key initiative was replacement of WebCT with Moodle. In fact, Moodle is an

opportunity for the University to transform the traditional boring model of teaching to a more modernized independent and activated system. On the other hand, some faculty prefer to mix e-learning into traditional as a way of enhancing teaching and learning.

The Moodle site had to be easy to use otherwise students would be discouraged to use it [9] . Therefore, the Moodle site required to be visually interesting, simple to navigate, and contained information that was relevant and up-to-date. Unfortunately, the feedback from teachers and students about how it looks and how they feel towards Moodle exposed that this was not the case and a sense of frustration at how difficult it was to find things was a re-occurring theme. A Moodle front page that included the whole structure of the Moodle site (learning areas were added as a category, year levels as a sub-category and then subjects as a course) proved to be unusable. In addition, what was mixing the confusion was the fact that a course was visible to teachers and students when it did not have to be, because the course had already been completed or was a course they did not need to undertake. Arteaga said that this highlighted the need to have a Moodle site that helped the teacher and was student focused which meant it needed to be personalized and tailored to the specific needs of each person.
Faculty has found that Moodle is a great way to organize and deliver course materials [10]. Arteaga said that using Moodle to create a student-focused environment will enable students to increase their understanding based on their knowledge and skills. The feedback, particularly from students revealed the importance of getting the course design right. The Faculty has designed each course so it was clear, not too text heavy, included lots of white space and specific icons to indicate key things (e.g. tasks to do, assessment tasks) to make it easy to navigate. Other studies have shown that one of the key factors of student satisfaction is that interactivity and autonomous learning modes can also have an influence [11].

According to some scientists, online teaching has approximately nothing to do with computers and everything to do with time, motivation knowledge and the new agency of cyber-experience, as well as good appropriate teaching [12]. To investigate this further, the aim of this study is to gather evidence of the relationships between Faculty and students and the online environment using Ahlia University as a case study. The intention is to determine the significance use of Moodle, to understand staff and students perceptions of the use of Moodle, and to assess the types of supports needed for the effective digital delivery of learning resources. As the faculty and students had a strong background in information and communication technologies and expertise in e-learning, the opportunity is used to determine the extent to which Moodle could be used in the teaching/learning process to enhance and extend student learning.

III. RESEARCH DESIGN

In the Kingdom of Bahrain, Ahlia University made a decision to provide each college with an online learning environment created in Moodle and this is what was used for this case study. This research involved a survey that collected responses from faculty and students through a questionnaire. The study took place in November 2013 in the Mathematical Sciences Department. The sample included two academics in this Department, of which 100% responded, and 84 students, of which 67 (approximately 80%) responded. The survey included 30 questions that required responses against a Likert-scale. Table I provides a summary of the number of responses received.

Table I: Feedback survey

Faculty	Two teachers completed the survey (100%)
Students	67 out of the 84 students completed the survey (80%)

Faculty in this department were supposed to input all course requirements on Moodle, such as course syllabus and outline, slides, assignment, handouts, online exercises, quizzes , tests ,… Students from their sides had to have access to these requirements through Moodle. Faculty were using a local network drive as a depository for the content students needed to access and were receiving submitted work from students as a hardcopy, email or USB drive they were using an Excel spreadsheet to maintain student completion and grades. Students and faculty express a negative impression on the use of Moodle at the beginning due to technical problems and due to both Faculty and students had a very basic understanding of Moodle. However, they reported that after two semesters they have started two realize the benefit of this system.

IV. FINDINGS

Results revealed that the two Faculty have had an essential Knowledge of Moodle, and most of the students' respondents (90%) had a fundamental knowledge of Moodle (FK&FA). Both Faculty members had made an effort to fully integrate it into their teaching or paper(s), and 88% of students had made an effort to fully integrate it into their learning (FI&FA). Both faculty expressed confidence in their ability to use Moodle, and the majority of students (75%) expressed confidence in their ability to use Moodle (CA). In terms of long-term adoption, the almost all students' respondents (93%) intended to make further use of Moodle while one Faculty (50%) intended to make further use of Moodle (UOM). Conceivably expecting given that Ahlia University had clearly stated its commitment to widespread adoption of Moodle in all papers and programmes. Fig. 1 provides a summary of Faculty and students' responses to questions relating to their adoption of Moodle.

ISBN: 978-1-61804-238-5

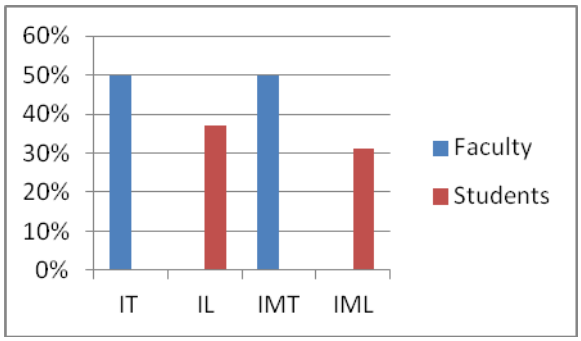

Fig. 1 Adoption of Moodle
FK&FA, FI&FA, CA and UOM are the constraints that describe the adoption of Faculty and students for Moodle

50% of faculty agreed that Moodle had helped them improve their teaching (IT); while 50% agreed that implementing Moodle in the teaching process had helped them think more profoundly about teaching (IMT). On the other hand, a limit number of students' respondents (37%) agreed that Moodle had helped them improve their learning (IL); while 30% agreed that implementing Moodle in the learning process had helped them think more profoundly about learning (IML). In perception, the last item did not allow respondents to qualify whether they are not thinking more profoundly because they consciously decided not to take the implementation of Moodle as an opportunity to reflect or they consider themselves reflective thinkers on a continuous basis. Fig. 2 provides a summary of Faculty and students' responses to questions relating to their teaching and learning practice.

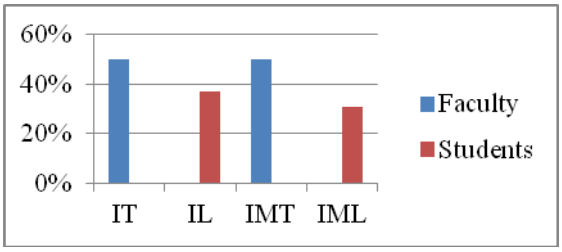

Fig. 2 Teaching and Learning practice
IT, IMT, IL, and IML are the constraints that describe the teaching and learning practice of Faculty and students for Moodle

Faculty and students believed that the use of Moodle has improved the level of faculty-student interaction. Both Faculty agreed that the use of Moodle has improved the Faculty-student interaction in faculty's papers (FSI) while 87% of the students believed in it. Moreover, Faculty and students insisted that Moodle has increased their connections and communications (CC) [Faculty (100%) and students (88%)]. Also there was an agreement among Faculty and students that Moodle helped them with their distance learning (DL) [Faculty (100%) and students (84%)]. Fig. 3 provides a summary of Faculty and students' responses to questions relating to their interactions.

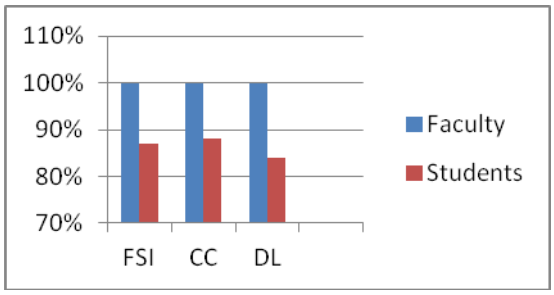

Fig. 3 Faculty-Students Interaction
FSI, CC, and DLare the constraints that describe the interaction process between Faculty and students through Moodle

Faculty and students believed that there are many benefits of Moodle. They believed that Moodle makes content available for study and revision [Faculty (100%), students (83%)]; reduces the cost of producing student handouts [Faculty (100%), students (100%)]; offers more variety of content [Faculty (100%), students (85%)]; helps to keep the course up-to-date [Faculty (100%), students (82%)]; offers students more flexibility over their learning [Faculty (50%), students (76%)]These are aligned with Moodle's passive' features and primarily the ability to post lecture notes online. On the other hand, Moodles' interactive' benefits gained positive votes by almost half of respondents: Increases staff-student interaction [Faculty (50%), students (48%)] and increases student-student interaction [Faculty (50%), students (52%)]. The item relating to teaching or learning practice was considered among the weakest benefits: Increases the effectiveness of my teaching or learning [Faculty (50%), students (32%)]. This result indicates that most of respondents feel neutral about the pedagogical benefits of Moodle. A possible clarification was related to respondents' responses to the item "Helps to save the teacher time." While only few respondents responded positively [Faculty (50%), students (31%)], it was the only item to generate a negative response by more than 50% of respondents.

The lowest ranking benefit related to learning" Helps to keep students motivated and on track [Faculty (50%), students (22%)] ; which was closely accompanied by Promotes more active learning'[Faculty (50%), students (26%)] and increases student interaction with content'[Faculty (100%), students (41%)] . It is unknown whether these results represent respondents' perceptions of Moodle's potential benefits for learning or whether responses were given in the context of current limitations facing effective teaching via Moodle. However, one Faculty respondent's perception was that Moodle has been seen to promote passive learning: Students are provided with more material, given better access to academic staff and this can lead to individual learning, and accessing databases and locating articles is part of the learning process for academia.

ISBN: 978-1-61804-238-5

V. Conclusion

This case study on Faculty and students' perspective of using Moodle has shown that it can be used effectively to support, enhance and extend student learning. The findings describe a successful implementation of Moodle at a system's compliance level, which was considered an outstanding achievement considering that implementation was above and beyond the existing pressure of teaching and research. Moreover, creating a digital environment can motivate students and generate an engaging and enriching learning experience that students will enjoy providing they find it easy to use. With these advances, it was widely appreciated that Moodle had begun to offer students more flexibility over their learning. To achieve this, Moodle courses need to be well designed, easy to navigate, tailored, populated with activities and resources that students can access at any time and from anywhere. It is important that Faculty need to develop their course use Moodle in the classroom as students may prospectively lose interest, and find it delay their learning. Although students are able to quickly familiarize themselves with Moodle, the use of some course formats, conditional activities and completion status to tailor student learning can also affect negatively on the student's experience. When Moodle is using well, students will be provided with a "one stop shop" they can access at any time and teachers can track student progress, identify at risk students more easily and spend more time in the classroom interacting with students. However, the current survey exposed significant scope for Moodle to manipulate teaching and curriculum design at a deep level. This would involve a shift in attitudes away from seeing Moodle as a dried tool, towards becoming the border of innovation in teaching and learning. However, consistent with the literature surrounding the uptake of e-learning (Salmon, 2005; Stein, 2011), respondents of the current survey reported that their dedication to Moodle was seriously limited by their lack of time. Faculty respondents expressed that they were under pressure not only to teach but to post files and, as long as this was the case, their capacity for Moodle as a transformational teaching tool would remain limited. This tension suggests both academics and traditional distance education providers are in a transition period as they struggle to find the most appropriate combination of predictable and digital learning resources.

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Legal Education - A Purposeful Process of Formation of Legal Culture of Preparing Students for Public Participation

I. G. DOLININA, E.A. SHAKIROVA

Abstract – Legal enlightenment, in modern conditions, is an important component of the formation of legal culture and legal consciousness of students. High results in legal enlightenment students can be achieved through a program of legal enlightenment. The correct choice of methods and forms of influence in shaping the worldview of students, makes the process of legal enlightenment more effective.
Keywords – legal enlightenment, program of legal enlightenment, forms and methods legal enlightenment.

The present stage of development of Russia is characterized by significant changes in all spheres of society. Development of rule of law, development of civil society and the strengthening of national implementation of the task require the consent of the Russian high legal culture. Recognition of the rule of law, priority rights and freedoms, to ensure reliable protection of the public interest, awareness of legal liability is not possible without the formation of a high level of legal citizens. Update educational system dictated changes brought Russia's entry into the international community, the formation of civil society and rule of law set new requirements for legal education. The priorities are: humanization, human life and health, rights and freedoms of the individual, mutual education, hard work, citizenship, patriotism, responsibility, legal culture.

Legal education in its purest form does not provide a solution to the objectives and tasks of the modern education system. In the modernization of education laid the social order to enhance the role of education, based on spiritual – moral development of the individual. The need for spiritual – moral development gives us grounds to appeal to the notion of legal education.

Legal education is "broadcasting and retransmission of legal knowledge, continuity and interference of universal moral values, legal ideas, introduction to human historical and cultural heritage predecessors." Develop a theoretical framework of legal education, taking into account the current conditions, the education system provides new conceptual approaches will provide the educational process new forms, methods and means. Through legal education can be solved such problems as: attracting public resources to educational institutions, the formation of open educational space, avoiding the authoritarian education system, education system new forms and methods of legal education and as a result, interest in the development of legal knowledge and improving the socio - legal activity of students. Implementation of the developed science-based approaches to legal education of students, will allow solving strategic problems of educational policy, laying the foundations consciously – lawful behavior of entities.

Need methodological basis of legal education is determined by:
– The social order of society, aimed at enhancing the role of the educational component in education and existing practice traditionally approach;
– Society's need for citizens with a high level of legal culture and legal consciousness, and identified low levels of these qualities among the students;
– Society's need for enhancing the role of public resources, their involvement in the educational space, through the creation of structures to ensure the openness of educational institutions for public participation, and the lack of such structures in the current education system;
– The need the structure and content of education in Russia, taking into account the global trends and the needs of Russian society enshrined in legal acts involving the strengthening of education of students, and the absence, to date, sound theories and programs.

The need for legal education is reflected in international instruments "Universal Declaration of Human Rights" (adopted by the UN General Assembly 10.12.1948), "Convention on the Rights of the Child" (Adopted 20.11.1989 Resolution 44/25 of the UN General Assembly) in the normative legal acts of the Russian Federation Federal Law

from 21.11.2011 N 324 -FL "on free legal aid in the Russian Federation" "Principles of State Policy of the Russian Federation in the sphere of legal literacy and legal awareness of citizens" (approved by the President of the Russian Federation of 28.04.2011 N Pr -1168).

The documents substantiated the importance of legal education, their implementation will remedy the lack of knowledge of students on legal issues, moral and ethical issues strengthen the educational focus of education.

The aims and objectives of legal education will be successful if it is developed and implemented a program of legal education and identified effective forms and methods of legal education.

Legal education – integrative process to understand interdependence of activities: educational activities and training in the field of law, aimed at solving problems as a result of which students acquire knowledge, skills and substantive work to develop their personal quality, the ability to self-learning. Legal education – a purposeful process of forming a legal culture based on freedom of choice of information that is implemented through a system of state and public organizations providing legal consciousness and behavior students. Priority in the system of legal education is the educational function.

The purpose of the program right education:

citizen education for life in a democratic state, civil society;

implementation of one of the most important directions of the state policy in the field of education of the Russian Federation – the legal education and training;

provide the necessary scientific-methodological conditions for the development of information systems education and training at an educational institution;

create conditions for the realization of creative capabilities of trainees in various activities;

Develop a program of legal education and education in the field of human rights and freedoms, prioritizing forms and methods of its implementation are not specialized task only experts in the field of legal education and the aims of the state and national issues – education citizen in a democratic society. Availability Program claimed today at the regional and municipal levels, the educational establishments. Experience in implementing the legal education at over institution allowed to bring the system of legal education and training to a new level, to create conditions for the legal education of students with the help of community resources.

Among the most important activities are the following:

legal lectures , contests, creative works of students, the radio range, discussions, contests legal knowledge forums;

weeks legal education of students, during which invited representatives of executive and legislative power to talk with the students, by the distribution of visual material: brochures, leaflets, posters;

participation in the federal program "I am a citizen of Russia", which aims to develop knowledge about spiritual – moral values, national traditions, civil rights and obligations, confidence in the society, the state, business, youth development consolidation, its tolerance and countering extremism in the present situation.

Legal education program provides the conditions for the system and the whole process of training and education.

The most effective forms and methods of legal education must be recognized:

Educating the media: newspapers, magazines, TV, INTERNET,

And Information – legal system: "Code", "Consultant".

Publication of specialized literature on legal issues: Reference, information brochures, collections of questions and answers, comments laws and legal practices.

Legal education in oral lectures, lectures, talks, discussions (roundtables, forums, symposiums, debates and disputes, etc.), the evening of questions and answers, legal clinics, counseling, art troupe, messages, clarification, suggestion, request, exhortation.

Obvious disclaimer: posters, photos offender’s stands, wall newspapers, public service announcements, "combat" leaflets, brochures, flyers, leaflets, flyers.

Creative and design activities: competitions, contests, and flash - mobs projects.

Works literature, art and film: movies, theater, novels and stories of Russian and foreign writers, works of art and exhibitions.

Thus, the essence of legal education is determined by the provisions of the original regulations and the needs of a modern society in improving the legal culture and justice. Efficiency of legal education becomes distinct features and scientifically-based impact on personality development programs in the

presence of legal education. Forms and methods of legal education ensure effectiveness of the educational process, which consists in the fact that the trainees had the opportunity to update and expand legal knowledge among students, a system of legal thinking and a willingness to be the subject of public relations, and the need for developing the ability to participate in social activities needed.

Experimental work carried out on the basis of SEI ACT "Perm College of Industry and Information Technology", its purpose was evaluation of the effectiveness of the proposed model of legal education of students. Experiment results were monitored for three years. During this period in the study involved six training groups. Each group participated in the experiment for two years (the first and second year). Total number of students involved in the diagnosis was 186 (92 – Control group; 94 – experimental group) people.

Table 1.

Criteria and indicators tiered legal education

High Conscious legal	**Average Formal – legal low**	**Unconsciously , household**
CRITERIA: Legal literacy		
Measured didactic units: ACTUAL legal knowledge and experience: knowledge of the law, possession of legal concepts, understanding the structure of authorities and their powers, awareness, the ability to protect the rights, critical to legal information.		
evaluation of the criteria		
Perceived knowledge, System, deep, personal correlated. The need for legal information. Perception of critical information.	Knowledge superficial, haphazard and not always correlated personality. Perception of information is not important.	At the level of knowledge representation. Negligence within the meaning of information. Lack of interest to the right information.
CRITERIA: The legal position		
Measured didactic units: value Pleadings: understanding of the importance of law and order, the positive legal position , the desire to comply with the rule of law , responsibility for actions and deeds .		
evaluation of the criteria		
Pronounced positive attitude.	Positive legal position is weak.	The legal position is negative.
CRITERIA: Legal action		
Measured didactic units: moral – Good behavior: legal compliance, and skills application of the law, active legal activities.		
evaluation of the criteria		
Social – significant behavior. Positive good behavior. Productive, creative activity. Initiative.	Conformist behavior. Maybe an occasional violation of the law. Reproductive activities.	Marginal behavior. Performing formally separate actions. Lack of initiative.

For the purity of the experiment as the control and experimental groups were chosen parallel to one specialty group. Such a choice is substantiated by the need to provide the most

objective conditions of an experimental study. With this choice of the general conditions were: one training standards and programs taught by the same teachers, the availability of combined items "Fundamentals of Advertising," "Principles of Management", the division into groups after a common set on a specialty subject to equal the average of the results of the certificate incomplete secondary education.

The main way to solve the problem is to implement the pedagogical conditions of legal education.

The first condition – the development and implementation of a program of legal education. We have developed and implemented a program of legal education of students. Program were identified goals and objectives of legal education, a set of activities in three areas: legal literacy, forming the legal position, the right activity and activation of delinquency prevention. The program included: messages on the theme" It's fun ... "; thematic lessons rights "legal consciousness as a way to combat crime ," "Oh married unbearable " and others; lecture on " What to do if you stopped law enforcement representative ? . ", "Do not forget the rules of the road", etc.; seminars on "How to avoid becoming unemployed ? "; conversation " is immoral misconduct ... "lecture " Do I know the law? " discussion "I have the right ?". One of the activities on legal education is the dissemination of visual information: brochures, information leaflets; attracting students to participate in extracurricular activities: forums, competitions, contests, projects; invitation to the lessons and extra-curricular activities for representatives of the executive branch: juvenile inspectors, traffic police inspector, a representative of the registrar. The program includes: elective "Legal education personality" elective course "Legal education consumers," competition" Constitution Day," the debate on the topic: "I have the right to "lecture on the right, the project "The world we build ourselves," competition "Teen bad habits in the world, "drawing contest "Me and my rights", the development reminders for parents, lectures on radio lyceum" Legal Orientation meeting, "competition" know "Consultant " – know their rights, "Competition in law for students of first and second courses , ten-day-forum" Legal Culture – new generation." Objectives of the program expansion of legal knowledge, the formation of positive legal position, the involvement of students into social activities, prevention of crime.

The second pedagogical condition – the capacity utilization of public resources – required alignment of interaction with the legislative and executive authorities of Perm region, non-governmental organizations and inter-regional and regional levels of education and educational organizations of Perm. On a positive experience should be named co-operation with the Commissioner for Human Rights, Perm region, the Committee on Youth Policy of Perm region, Inspectorate juvenile Sverdlovsk district of Perm. Cooperation with the Interregional Association "for civic education" – the head doctor of pedagogical sciences, professor I.G. Dolinina, participation in the Public Council for Civic Education Perm Region (Ministry of Education), interaction with RIP "TelecomPlus" – the largest in the center of Perm region national network spread legal reference information "Consultant", participation in the project "I am a citizen of Russia" FDC "Change" to Moscow, Anapa, Krasnodar region, cooperation with HPE "Perm State University. "Studying experimental groups were involved in the activities organized in conjunction with the above organizations, as demonstrated by the observation that contributed to increased social participation of students, helped attract additional information and funds.

Third pedagogical condition – included activities on the choice of optimal forms and legal education.

Increase the level of literacy in the right experimental groups was promoted through: lectures, lectures, watching movies, distribution of booklets and leaflets, and others. Formation of active legal behavior of students in the experimental groups was carried out through participation in competitions, contests, forums, projects. Students participated in a civil forum "Youth, elections and politics," projects "I am a citizen of Russia ", " Advertising Law: Present and Future ", "Am I right ?" Creating a positive and others carried out the legal position when writing an essay "Students look at the problems of Russia ", "The Constitution of the Russian – my Constitution" and other works – the arguments for participation in discussions and conversations, discussions of legal situations and actions.

Implementing structural – dynamic model of legal education in secondary vocational education will raise legal awareness. This experimental results prove the experimental work carried out over three years.

ISBN: 978-1-61804-238-5

Sources of data collection and calculation tools for performance monitoring of the right education students were: teachers information, questionnaires, expert interviews, testing, observation, and self-esteem.

Quantitative evaluation of experimental results – experimental study was carried out by the percentage of students who are at a particular level of legal education at the beginning and end of the experiment. Found that by providing purposeful pedagogical conditions all components of the legal criteria developed enlightenment. Comparative analysis of the examiner and the formative stages of development – experimental work clearly demonstrates the stability of positive results and successful dynamics of legal literacy, legal position and legal activity (Table 2).

Each criterion in the experimental groups by the end of the experiment can be stated that in the process of studying legal education closer to the "middle" level, whereas at the beginning of the experiment most of the students showed "low" level. An increasing number of students, by the end of the experiment are on the "high" level of development of legal education: legal literacy has increased by more than two times the legal position changed to 30.9%, increased legal activity is not the number of students participating in legal activities decreased by 59,6 %. It should be noted that the change in legal education in the control group also noted, but the difference in performance at the end of the experiment, from the beginning, was negligible .

Table 2

Dynamics of formation of legal education outcomes of students in the experimental - experimental work (IER)

criteria	levels	EG = 94 people				CG = 92 people			
		Starting IER		end of IER		Starting IER		end of IER	
		Кол-во	%	Кол-во	%	Кол-во	%	Кол-во	%
Legal literacy	high	6	6,4	18	19,1	7	7,6	9	9,8
	average	34	36,1	61	64,9	31	33,7	34	36,9
	low	54	57,5	15	16	54	58,7	49	53,3
Pleadings	high	8	8,5	23	24,5	8	8,7	9	9,8
	average	34	36,2	58	61,7	32	34,8	39	42,4
	low	52	55,3	13	13,8	52	56,5	44	47,8
Legal action	high	5	5,3	36	38,3	5	5,5	7	7,6
	average	21	22,4	46	49	21	22,8	41	44,6
	low	68	72,3	12	12,7	66	71,7	44	47,8

Statistical treatment received during the experimental work and data generalization of the results led to the conclusion that the implementation of the model of legal education, while ensuring the identified conditions to increase legal literacy and legal position of the formation of positive and lawful behavior (Fig. 2, 3,4).

Positive trends in all indicators gives reason to conclude that the purpose of the study achieved hypothesis proved tasks solved.

Conclusion

Legal education – integrative process interdependence of activities – educational and outreach, based education and training in the field of law, solving problems, as a result of which students acquire knowledge and skills of the subject and social activities.

Legal education – a purposeful process of forming a legal culture based on knowledge of the laws, human and civil rights, freedom of choice of legal information that is implemented through a system of state and public organizations, and ensuring the development of the legal consciousness of right conduct of students.

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A Development of online lessons of Suansunandha local wisdom, Preparing Readiness for ASEAN

Chaiwat Waree

***Abstract*—** The objectives of this research are: to develop and discover efficiency of online lessons of Suansunandha local wisdom for preparing readiness for ASEAN to meet with criteria at 80/80 and to study satisfaction level of students by using online lessons of Suansunandha local wisdom for preparing readiness for ASEAN. The target group herein was 40 students who studied in Academic year of 2013 and interested in online registration. Target group was determined by using purposive sampling. Tools used in this research were 20 items of post-test contained in online lesion, student's satisfaction evaluation form towards online lessons usage. Data analysis was conducted to find efficiency of online lessons as defined by criteria at 86.00 / 87.50 and student's satisfaction level towards online lesion usage of 40 students. The obtained mean was 4.46 and standard deviation was 0.68.

The results showed that the efficiency of online lessons of Suansunandha local wisdom was at 86.00 / 87.50 that was higher than defined criteria at 80/80. In addition, Overall satisfaction of students towards online lessons usage was in the highest level with the mean of 4.46 and standard deviation at 0.68. The obtained results were able to be used as guidelines for further development of learning activities management of other courses.

***Keywords*—** Online Lessons and ASEAN.

I. Introduction

CURRENTLY, general people of ASEAN countries, including Thai people, had no feeling of being "ASEAN citizens". From a report of the survey on their opinions regarding attitudes toward ASEAN perception, it was found that most people or less than 65% felt that they were "ASEAN citizens". As one of members who established ASEAN, Thai government emphasizes on preparing readiness of Thailand for driving development of ASEAN Community within 2015 by focusing more on practices and connection for benefits of regional people as shown in Declaration of Cha Am – Hua Hin regarding Action Plan for ASEAN Community during 2009 – 2015. In this declaration, Thailand and other ASEAN members mutually committed to promote ASEAN people to participate in and gain benefits from this ASEAN assembling as well as process of becoming ASEAN community. Moreover, in the occasion that Thailand held the position of President of ASEAN in 1979, Thai government compelled to realize the ASEAN Chater, revitalize a people-centred ASEAN Community, and reinforce human security for all, etc. These would enable people to achieve becoming ASEAN community before 2015[1].

Thai government emphasized on participating in ASEAN community with the aim to lead Thailand to participate in ASEAN community completely by building readiness and strength on economy, society, culture, politic, and security. These three cores of ASEAN community were important equally and they should be operated continuously and completely. To determine becoming ASEAN community as national agenda, it should cover these three cores in order to become complete ASEAN community with national ASEAN committees as the national mechanism for coordinating and following up over all progress of all cores. In addition, they also had an important function to compel and support government agencies to operate for becoming ASEAN community. Moreover, national action plan for preparing readiness for ASEAN was also made.

Apichai Nutnearng [2] studied on operative documents of University's Courses Establishment and Development and found that utilization of local wisdom and leaning sources of university establishing courses was consistent with local demands in good level at 15.74%, in moderate level at 73.15%, and in low level requiring improvement at 11.11%. Simultaneously, utilization of university, learning sources, and local wisdom was in good level at 13.89%, in moderate level at 71.30, and in low level requiring improvement at 14.81%. University was able to develop and use leaning sources in good level at 19.44%, in moderate level at 70.37%, and in low level requiring improvement at 10.19%. University was able to utilize local wisdom to manage learning in good level at 14.81%, in moderate level at 61.11%, and in low level requiring improvement at 24.08%. From such data, it was found that university remained emphasizing on utilizing local wisdom for managing learning process in low level while local wisdom was necessary for managing instructional process for sustainable development with identity and readiness for exchanging cultures to become ASEAN community proudly

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ISBN: 978-1-61804-238-5

while being able to conserve uniqueness of Thailand.

The Office for National Education Standards and Quality Assessment declared the Third Education Criteria for Performance Excellence (2011-2015) consisted of basic indicator, identity indicator, and indicator of supporting measures in order to make university understood meaning, collected data, and prepared readiness on data for the Third Education Criteria for Performance Excellence. As a result, this study would like to provide additional understanding on such issue as follows:

Identity refers to effects on learners according to philosophy, determination, vision, mission, and objectives of establishing university approved by university's committees and its original affiliation. Identity was an indicator caused by the Second Education Criteria for Performance Excellence that inspected whether it was determined with philosophy, determination, vision, and mission of university only. In practical, all universities shall determined these things since they were established. For the Third Education Criteria for Performance Excellence, it evaluated whether the learners possessed characteristics according to matters defined in philosophy, determination, vision, and mission. For example, if university defined it philosophy as "Knowledge and Morality", students or graduates shall have knowledge and public mind. On the other hand, if vocational training school defined its philosophy as "Durable and Willful towards Working", the graduates shall be durable and willful towards work. This shall be considered as achieving its identity and the obtained results must be considered according to scoring system of each educational level. In collecting data on identity, university must determine a criteria for evaluating identity of university that may be a meeting for listening to opinions of university's community or a survey for gaining opinions from internal personnel toward learner's characteristics whether it reflected defined philosophy, determination, vision, and mission. Subsequently, scoring shall be in accordance with effect level on local communication or external agencies as well as acceptance level of community or external agencies. Results obtained from operation would provide good effect to university for further reviewing, consideration, and operation with explicit goals. For graduate study level, university and faculty shall determine identity in the same way therefore it could be said that "One university is one identity" [5].

Section 12 of Article 4, Educational Management Guidelines, of National Education Act B.E. 2542 stated that educational management for formal education, non-formal education, and informal education must emphasize on knowledge, virtue, learning process, and integration as proper of each educational level. In section 30, it stated that university must develop its instructional methods to be effective and promote its instructors to be able to conduct some researches for developing knowledge to suit with learner in each educational level [3].

Section 65 of National Education Act B.E. 2542 stated to develop personnel on both creators and users of educational technology in order to gain suitable and quality knowledge and abilities on creating and utilizing technology. Section 24 stated to provide learning process in university and related organizations, provide content and activities to be consistent with interest and expertise of learners by considering on individual difference, promoting and supporting instructors to be able to provide environment and instructional media facilitating learners to start learning and gain knowledge as well as able to utilize researches as one part of learning. In addition, instructors and learners may learn together from instructional media and various types of technology sources therefore technology media is currently created for utilizing in instruction of learning groups according to Basic Education Curriculum diversely.

WBI operated on internet system was able to communicate under Multi-user System with borderless. Learners were able to send and receive electronics education data with no limitation on time and place. In addition, learners and instructors were able to communicate to each other and instructors were able to follow-up learner's behaviors and educational record. What made CAI different from WBI was communication because WBI was able to communicate under Multiuser system with borderless. Learners were able to communicate among them, with instructors or experts, and knowledge hub. In addition, they were also able to send and receive electronic education data with no limitation on time and place. There was no border under internet network or it could be called as virtual classroom. It could be said that any activity performed in schools or classrooms was able to be performed in WBI on internet network from starting to graduation of learners [7].

From such reason, the researcher was interested in utilizing innovation and electronic media to convey local wisdom or A Development of online lessons of Suansunandha local wisdom for preparing readiness for ASEAN because it was not only motivating learners to be enthusiastic to learn new things but it was also conveying Suansunandha local wisdom to ASEAN community.

II. Research Objectives

To develop online lessons of Suansunandha local wisdom for preparing readiness for ASEAN to gain efficiency at 80/80 and achieve better level of student's satisfaction.

III. Hypothesis

Online lessons of Suansunandha local wisdom for preparing readiness for ASEAN had efficiency level at 80/80 according to standard criteria and student's satisfaction level towards online lessons of Suansunandha local wisdom for preparing readiness for ASEAN was in high level.

IV. Scope of Research

Populations used in this research were students of Suan Sunandha Rajabhat University in all years.

Target group used in this research on online lessons of

Suansunandha local wisdom for preparing readiness for ASEAN was students of Suan Sunandha Rajabhat University in all years obtained by using purposive volunteer sampling.

V. Expected Benefits

1) Obtain guidelines for learning management in online lessons of Suansunandha local wisdom for preparing readiness for ASEAN;
2) Utilize online lesion for remedial teaching that students were able to learn by themselves;
3) Instructors had online lessons of Suansunandha local wisdom for preparing readiness for ASEAN in learning management process that was able to be used in instructional process;
4) Learners were interested in lessons and gained more achievement on learning management process;
5) Knowledge obtained from this research would be beneficial to instructors or anyone interested in developing online lessons for other contents.

VI. Conceptual Framework

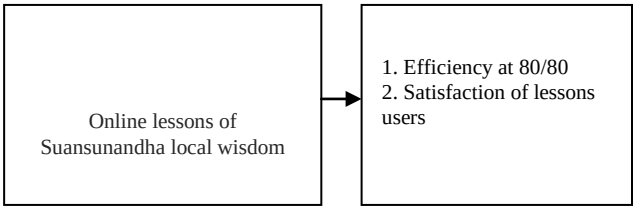

Fig. 1 Conceptual framework

VII. Research Process

1) Studied papers and researches as well as studied from local some philosophers through interview and focus group in order to synthesize Suansunandha local wisdom. Subsequently, the obtained results were classified and arranged systematically in bi-language format (i.e., Thai and English) and created in the form of online lessons.
2) Submit developed online lessons of Suansunandha local wisdom for preparing readiness for ASEAN to experts for inspection and improvement.
3) Tried out improved online lessons of Suansunandha local wisdom for preparing readiness for ASEAN with students who were not target group for further improvement and public relations.
4) Students who were target group studied created online lessons of Suansunandha local wisdom for preparing readiness for ASEAN and took pre and post test. Subsequently, satisfaction of students was evaluated after their usage of online lessons of Suansunandha local wisdom for preparing readiness for ASEAN.Obtain guidelines for learning management in online lessons of Suansunandha local wisdom for preparing readiness for ASEAN;
   - Tested students with test review of 4 online lessonss. The obtained scores were collected as scores of formative evaluation.
   - 15 items of achievement test on online lessonss were tested with students and the obtained scores were collected as scores of post-test.
   - 10 items of satisfaction evaluation form towards online lessonss were commented by students.
5) The results were checked and the obtained scores of pre and post test were analyzed by using statistics in order to find efficiency at 80/80.
6) Student's satisfaction after using online lessons of Suansunandha local wisdom for preparing readiness for ASEAN was analyzed and concluded.

VIII. Conclusion on Development and Utilization of Online Lessons

1) From development and try out of online lessons of Suansunandha local wisdom for preparing readiness for ASEAN, it was found that it was suitable and efficient according to defined criteria calculated to be 86.00 / 87.50 when utilizing with 40 students who were target group that was consisted with defined hypothesis.
2) From try out of online lessons of Suansunandha local wisdom for preparing readiness for ASEAN, it was found that efficiency of process (E1) provided in tests was calculated to be 86.00% and efficiency of results (E2) was calculated to be 87.50%. These online lessons of Suansunandha local wisdom for preparing readiness for ASEAN had higher efficiency than 80/80 as defined therefore it could be concluded that these online lessons had high efficiency as defined by criteria and they were able to be used for classroom instruction efficiently.
3) From the results of student's satisfaction towards learning with online lessons of Suansunandha local wisdom for preparing readiness for ASEAN, it was found that overall student's satisfaction towards instruction using online lessons was in the highest level, i.e., students had overall satisfaction towards online lessons in high level with mean of 4.46 and item 10 was gained the highest satisfaction level of students. Average demand of students on creating online lessons for other subjects was 4.84. For other evaluations, most of them had high level of satisfaction.

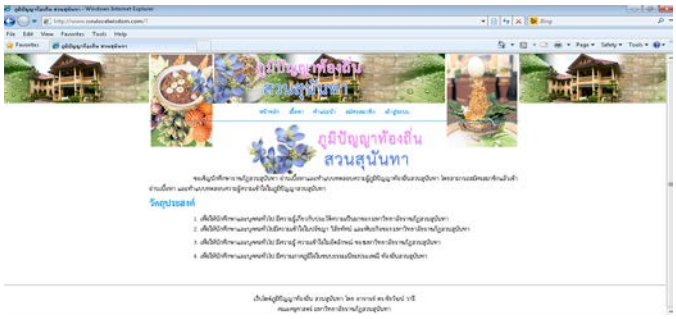

Fig. 2 Online Lessons of Suansunandha Local Wisdom
http://www.ssrulocalwisdom.com

IX. Discussion

A. Discussion on Development and Utilization of Online Lessons

From development and utilization of online lessons of Suansunandha local wisdom for preparing readiness for ASEAN, the results could be discussed as follows:

1) Development and utilization of online lessons was successful and efficient as expected because the research had studied on process of making online lessons from several theories and concepts through studying on related papers and analyzing lesson's content from curriculum, determination of behavioral objective, planning of creation and development. In addition, the researcher was also supported by some content experts and their comments on index of consistency among issues, objectives, learning standard of curriculum, finding on accuracy of tools, and finding of confidence level, were assembled as a tool for creating and developing online lessons of Suansunandha local wisdom for preparing readiness for ASEAN. As a result, such online lessons were able to be created and developed successfully. In addition, they were also able to be used and publicized to other instructors in other universities that was consistent with a research of Sunanta Suntornprasert [4] stated that instruction with online lessons was able to develop students to be more confident with themselves and learn lessons with their potential leading to higher level of achievement. In addition, online lessons also developed students in both cognitive domain and affective domain efficiently because they enabled students to learn and understand contents of lessons through repeated reading. In addition, it was also found that online lessons were able to adjust learner's behavior to seek knowledge, realize, and see value of learning providing good cognitive skills to learners if such online lessons were developed by content expert and expert on online lessons correctly and systematically according to principles.
2) Efficiency of these online lessons was in high level as expected at 86.00 / 87.50 due to creation and development of such online lessons. The researcher studied on basic data and analyzed work, contents, learners who were target group, and behavioral objectives prior planning on creation and development to meet those behavioral objectives under explanation and suggestions of content expert for inspecting accuracy of contents, language correctness, appropriateness of design, instructional methods, and presentation. Subsequently, the obtained lessons were improved, developed, and tried out with a small student group in order to find further faults for additional improvement and development prior performing field tryout with 40 students. The results showed that efficiency of online lessons was 86.00 / 87.50 that was satisfying and met with expected hypothesis.
3) Student's satisfaction towards online lessons of Suansunandha local wisdom for preparing readiness for ASEAN was in high level for all items because the research studied on psychology of learning of learners before planning creation of online lessons. Subsequently, the obtained results were planned for creation and development of complete online lessons that was consistent with work of Supasombun Ingrattanakorn [6] who studied on developing computer program for remedial mathematics teaching on matrix and linear equation of 4th year students of Faculty of Agricultural Technology. The results showed that learners had higher level of achievement than before with good attitude towards mathematics learning by using computer.

B. Discussion on Distinctiveness of online lessons of Suansunandha local wisdom for preparing readiness for ASEAN

Distinctiveness of online lessons of Suansunandha local wisdom for preparing readiness for ASEAN was as follows:

1) Distinctiveness of online lessons of Suansunandha local wisdom for preparing readiness for ASEAN was analyzed on its content prior preparing its tests therefore it was complete according to academic principles. Moreover, the researcher also studied and researched on concepts and theories for creating and developing online lessons from reliable data sources of papers and websites therefore data used in this research was updated and correct upon academic principles completely. For report writing, utilization, and development, it was prepared by the researcher by considering on language principles upon defined contents and curriculum. It was prepared in the same system either system of writing topic title or reference system in bibliography.
2) The researcher prepared the report on the results of development and utilization of online lessons by developing, improving, and correcting under suggestions of experts as well as presented it in 5 chapters of research including introduction, background and significance, related papers, concepts, theories, and researches, research process, and results of development and utilization.
3) For utilizing concepts for creativity, the researcher studied on concepts and theories obtained from learners and comments obtained from specific experts on educational technology. In addition, the research also participated in several trainings in order to collect experiences for gaining new knowledge on applying computer technology to learning of students. As a result, this innovation was created that was considered as the ultimate benefit for educational management. Consequently, after tryout of this innovation, it was admired and accepted by several instructors.
4) Typing, format, and correctness of this report and developed media according to academic principles was also another distinctiveness greatly considered by the researcher because correct, beautiful and orderly typing was an indicator reflecting quality and efficiency of the

researcher. In addition, it also fostered orderliness for passing on and fostering to researcher's students.

5) This instructional media on online lessons of Suansunandha local wisdom for preparing readiness for ASEAN was a contribution developed by the researcher in all procedures from initiating concepts of development and analysis on contents to test design, finding efficiency of created test, writing conceptual framework, considering on theory and psychology of learning before tryout. The obtained results were publicized to other instructors in various places and it was found that most instructors had positive respond to this innovation. They commented that this online lesson was useful for academic advance and able to be used as a model on applying it as electronic innovation in the future.

6) 40 students who used online lessons of Suansunandha local wisdom for preparing readiness for ASEAN had higher grades exhibited that online lessons were efficient and beneficial for learners.

X. SUGGESTION

From conducting this research, the researcher had the following suggestions :

A. General suggestions

1) Before using online lessons of Suansunandha local wisdom for preparing readiness for ASEAN, the instructor should prepare readiness of online suggestions and must urge students on loyalty for doing their tests without opening provided answers. They must completed all items and procedures without skiping in order to gain certain knowledge and understanding in lessons. Consequently, they would be able to utilize obtained knowledge in group discussion and practicing skills of concluding lessons diversely. This also the best method to practice students on conceptual skills as well.
2) While performing group activities for practicing team working, instructor should perform a duty as a consultant providing suggestions and assistance to students when they had any problem in order to enable them to perform all activities contained in lessons smoothly with no boring.

B. Suggestions for further studies

Online lessons should be created with other contents.

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XI. BIOGRAPHY

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Civic education – experience of preparing for public participation

A.A. Botalova
I.G. Dolinina

Abstract – The article presents a system of civic education in the High School Perm Region. Forms and methods of helping to educate students with active citizenship and to prepare them to interact with society and government institutions.
Keywords – civic education, citizenship, participation, teach.

I. INTRODACTION

Civic education – providing training, information dissemination, organization of practical activities to give students the knowledge, skills and understanding of a democratic society and a state of law, as well as form values, attitudes and behavior of them in order to provide the opportunity to sell the rights to take responsibility for behavior in society and to implement an active civic role in life (accordance with the approaches adopted by the Council of Europe).

Under civilian education T.V. Bolotina understands "the transfer of expertise to students, shaping their skills, serving to the assimilation of positive social experience, and development of basic social competencies. It is a complex system of organization of various educational activities, the core of which is the legal, political and moral education and upbringing, as implemented through the educational process and through democratic and legal organization of the school environment "[7].

Civic education is seen as a condition of building a democratic state of law and the factor of increase social stability, its sustainable development.

Teachers of our schools teach students citizenship. Citizenship – this moral quality of a person, whose main elements are harmoniously combined patriotism, international sense, morality, tolerance, focus on human rights, equality before the law, social justice.

Development program "School – the center of intellectual and spiritual development of the village" is basis of the work of our school.

II. THE MAIN DIRECTION AND FORM OF WORK

Civic participation – the principle of citizen participation implies that the interests of all sections of society should be represented in the political process and take into account when making decisions. It is about inclusion of citizens in the discussion and development of political, socio-economic, cultural programs and projects, the impact on decision-making and control over their implementation of self-government at the local level. Public participation – is a continuous process of interaction between the institution (organization) responsible for the decision, and the citizens whose interests may be affected by direct or indirect consequences of the proposed solutions (public concerned), as well as public authorities at different levels of regulating this kind of activity.

Such interaction, at least comprising:

- Measures to promote public understanding of the full decision-making processes and mechanisms responsible authority explore emerging environmental and social issues;
- Full public information on the status and implementation stage of development (implementation of the project, plan or program, policy or assessment of one of the above), as well as opportunities for information, submitting comments, and other ways to participate;
- Active collection of opinions of all concerned citizens, their perception of project goals and objectives, as well as their preferences regarding the use of resources, alternative development strategies and any other information related to the received solutions.

Educational activity on the formation of citizen covers all levels of the educational process is the essence of school civics students, which is carried out by means of extracurricular work and through the content of the training

material in the implementation of educative learning function.

The curriculum of the school is given a significant place optional courses "Citizenship" for students 5 – 7 classes, "My Rights" and "Human Rights" for high school students. For several years in the schools of Perm region Legislative conducted lessons. At our school, they are held for all age groups in a creative way, guys usually take the initiative and activity, guests ask questions, express an opinion about the issues discussed. Lessons are invited officials: repeatedly attended by deputy of the Legislative Assembly of Perm region Elokhov, deputies of the Provincial Assembly and district Nytvensky Sherinskogo settlement.

Tradition in the school was holding a "Civic Week", during which children participate in intellectual games, quizzes, published newspapers, meet interesting people of the village. In the current academic year, a similar week was devoted to the 20th anniversary of the Constitution of the Russian Federation. Their knowledge of the pupils of 5 – 6 classes demonstrated in the game "I. Power. Law", the students, grades 7 – 8 competed in the game "Legal mosaic" and high school students defended their position in the communicative fight on "Do we need in modern Russian youth organization?" Such events not only broaden the mind of students, but also promote the formation of their active life position, indifferent attitude to what is happening around.

Teach civic patriotism – moral principle, social sense, the content of which is the love for the Fatherland and the willingness to subordinate it to the interests of their private interests. Patriotism assumes pride in the achievements and culture of their homeland, the desire to preserve its character and cultural characteristics and identification with other members of the nation. Patriotism – particularly emotional experience of his belonging to over country and their nationality, language and traditions. So, in 2010, high school students defended village improvement projects, development of tourism and sport. Thanks to one of these projects in the school had its own ice rink, skate rental for children and everyone villagers. Help volunteer groups of schoolchildren aged, veterans of labor, care of monuments died during the Civil War and the Great Patriotic War – important things that demonstrate civic position of the younger generation. Guys do not do it at the behest of adults and on their own initiative.

Development and implementation of social projects and actions is another important area of our work. The school has created a group of senior Information, which holds five-minute on important dates in the political life of the country. Topics of presentations: Constitution Day, Election Day, the victims of political repression, etc. It was after one such students interested in the history of the museum of political repressions "Perm – 36" on their own initiative organized a trip to the village of senior Kutchino where this museum. Students were shocked by what they saw and heard about the time of the totalitarian regime in our country. The visit had the idea of a research project. A group of children produced a film about the fellow villagers – the builders of the fish farm, the victims of Stalinist repression, whose descendants live in Shere. Was studied construction documents pond farm life story of the special settlers, received an interesting student work included in the collection of research students in the school.

Student government is the form of participation in self-studying in educational institution, suggesting the involvement of children in addressing the organization of the educational process in conjunction with the teaching staff and administration of the institution. Targets senior Council: planning school activities, better communication between students and administration, reacting with other city agencies and organizations in order to influence decisions regarding the problems of school organization. It is here that the guys are going about school, express their ideas, learn to defend a position and listen to the opinions of others.

Another form of work – annual meetings with senior school graduates who are successful in business and in politics. Our guests were deputies Sherinskogo settlements, entrepreneurs, and this year they met with the Minister of Agriculture of Perm region Ogorodov IP, graduated from high school in 1998. This is a young man with an active civil position, made a fine career. No less interesting and meetings with representatives of the older generation. Thus, a frequent visitor to the school is VS Popov, head of "Sherya" Deputy Provincial Assembly Nytvensky district, permanent sponsor of the school.

III. DIAGNOSIS OF FORMATION OF CIVIC COMPETENCE

To identify personality traits of formation of civilian students were surveyed students grades 10 – 11.

1 Test "Are tolerance we?"

1. All respondents (100%) know that the Russian Constitution provides for equality of all people, regardless of gender, race, nationality.

2. According to all respondents (100%) tolerance is respect for people of other beliefs, nationality, religion.

3. Nationalist is someone who believes representatives of their country better than all others. Since 100% of students responded.

4. Xenophobia is intolerance towards people of other beliefs, nationality, religion. So say 15 people (88%), 2 person (12 %) did not know what xenophobia.

5. Migrants and refugees – people forced for political or economic reasons to leave their permanent residence. Since 100% of students responded.

6. Gypsies – a people with a distinctive ancient culture (41%), the freedom-loving people living in their traditions (59%).

7. To the question "How do you usually feel about the fact that in your home, the village people live a different nationality and religion" 100 % responded that they do not care, because "everyone has the right to live wherever he wants," "all equal ","if only to respect the place where the", "is even more interesting to live, you can get acquainted with different cultures."

8. "To you ever treated worse than other people on any grounds?" To this question 14 people (82 %) responded "never", 3 people (18%) answered "yes", but the signs are not named.

9. "Have you ever shown intolerance to some members of the minority?" 100% responded negatively.

10. "In your opinion, is there in your area intolerant attitude towards people of other beliefs, nationality, religion? " Answers:

"Yes, but is rare and is not a problem" (59%), "No, we are all equally good" (18%), "Yes, and it's a big problem" (12%), "I do not want to think about it" (12%).

11. " You encountered cases of humiliation of human dignity because of his nationality and religion?" Answers:

"Yes, personally observed" (23%), "Yes, I read in the newspaper, seen on TV, heard from friends" (18%), "No, not face" (59%).

12. "Have you met intolerance and what kinds?" Answers:

"No, have not seen" (88%). "Yes, the spread of Nazi symbols in the form of inscriptions" (12%)

13. " Would you like to take part in actions against nationalism and xenophobia?" Answers:

"Yes, I would sometimes help in such activities" (64%). "No, I do not have time and energy to this" (18%). "Difficult to answer" (18%)

Conclusions of testing:

1. All students have an idea of tolerance, tolerance manifest themselves (100%) and are ready to take part in actions against nationalism and xenophobia (64%).

2. 73 % of respondents have not met with intolerance and humiliation of human dignity on national and religious grounds, believe that Nytva area is no such problem.

IV. TEST "I'AM CITIZEN

(interpretation of the socio – political life)"

Dear friend, you specify a value for the socio – political life, apart from points 1 to 5.

1. Define the purpose in life, vocation and purpose in life.

not defined (0) doubt (3 patients, 18 %); set the direction (5 persons, 30 %); defined (4; 24%); fully identified (5 persons, 30 %).

2. I carry out my duties (even in the presence of internal protest).

Do (0); rare (0); sometimes (3 people, 18 %); often (10 persons, 60%); constantly (4 persons , 24%).

3. Interested public and political life.

never (0); rarely (3 people, 18%.) sometimes (5 persons, 30 %.) often (6 persons , 36%) constantly (3 people, 18 %).

4. Can realize their needs and interests in public and political life.

never (3 people, 18 %); rarely (3 people, 18 %) sometimes (7 people, 42 %) often (4 persons, 24%) constant (0).

5. Can influence the social and political processes

never (2 persons , 12 %) rarely (7 people , 42 %) sometimes (4 persons , 24%) often (4 persons , 24%) constant (0).

6. Confident in the possibility of self-realization of the public and political choice

never (0); rare (0); sometimes (0); often (10 persons , 60%); permanently (7 people , 42 %).

7. Can take responsibility for their lives and their loved ones

never (0); rare (0); sometimes (3 people, 18 %.) often (5 persons , 30 %) permanently (9 people , 54 %).

From the questionnaire shows that most of the students grades 10 – 11 realize the importance and significance for themselves socio-political life, interested in it (84%) consider it possible to meet their needs and interests in public and political life (66%) , make your choice and prepared to take responsibility for it (100%).

V. PROFILE

"I'm ready for civic and political participation"

Students were asked to put up signs on the appropriate column "+" sign.

Table 1.

Results
of the study of the preparedness of college students for civic and political participation in the life of society and the state
(in percent of those surveyed)

Criteria and indicators of preparedness for civic and political participation	**No**	**Rather no than yes**	**there is no telling**	**Probably yes, than not**	**yes**
I. I'm Interested in the events in political life (city, country, international relations)					
- Possess knowledge about their political rights, political system, political events;		1;6	4;24	6;36	6;36
- I have my own opinion, based on ownership of information about political leaders, parties and their programs, the political institutions of the state and society;		3;18	4;24	7;42	3;18
- Discuss political issues with friends, at home, etc.	3;18		3;18	8;48	3;18
II. I am willing to participate in political life					
- understand what is required handovers of power and consider myself ready to participate in elections;	5;30		8;48	2;12	2;12
- I can evaluate the activities of the authorities.	5;30		7;42	3;18	2;12
III. I know how to interact with society and the state					
- I have a basic knowledge of the laws and mechanisms of action of government institutions;		3;18	2;12	6;36	6;36
- Know how to negotiate in a difficult situation and is ready for mutual compromise;		3;18	5;30	4;24	2;12
- I respect the opinions of others.	3;18		2;12	6;36	9;54

From the questionnaire follows:

- That have knowledge of their political rights, political system, political events 72% of respondents; difficult to answer this question 24 %.

- Have an opinion, on the basis of ownership of information about political leaders, parties and their programs, the political institutions of the state and society 60% of respondents.

- Discuss political issues with friends, at home 60 % of respondents.

- We are ready to participate in the political life of about 24 % of the respondents, 30 % consider themselves unprepared, 48 % were undecided.

- Know how to interact with society and the state more than 50 % of the respondents, the remaining 50 % either did not know or were undecided.

In general we can say that the kids are ready for civic and political participation, but they lack the knowledge to do so, and therefore requires work pedagogical staff primarily teachers of social sciences in this direction.

VI. CONCLUSION

Civic education gives some results. Graduates of our school – people with active citizenship. They get an education and come back to the village, working in agriculture, institutions, and actively participate in the social life of the settlement. This is largely the result of the work of teachers Sherinskoy school education of active

citizenship among the younger generation. Job done a lot, but civic education has a number of problems.

Problems of civic education:

- not happened to understanding the role and place of civic education;
- civic education activities adult drops out of sight of the authorities and educational institutions and restricted to specific activities;
- shortage of personnel with significant skills in the field of civic education ;
- lack of instability and funding sources;
- officials usually are not adequately trained to interact with citizens, non-profit and other organizations , including in the field of civic education;
- new educational standards include requirements for the formation of civic qualities of students, an essential condition for achieving this target in the standards specified cooperation of educational institutions , educational authorities and non-governmental organizations.

VII. ACKNOWLEDGEMENT

This article was prepared under a grant from the Russian Humanitarian Foundation project “Legal education and the formation of a civil competent youth Perm edge” 14-16-59004.

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Virtual Labs in ELFE – First Steps

VLADISLAV SLAVOV, ASYA SENOVA, KAMELIYA YOTOVSKA

Abstract: - The virtual labs concept is one of the challenges in higher education especially in the engineering education. Being more interactive they allow the students acquiring practical knowledge remotely. The English Language Faculty of Engineering has started a new project of implementation of the virtual laboratory conception in industrial engineering education under the Human Recourses Development program. This paper gives an example of a virtual exercise and shows the first steps of how to create such.

Key-Words: - Virtual Laboratory, Engineering Education, LabVIEW, ELFE, feedback, e-learning

I. Introduction

The English Language Faculty of Engineering (ELFE) in the Technical University of Sofia (TUS) was established in 1992. It started with a bachelor specialty of Industrial engineering and now the students can choose between 4 master specialties as well. Every year between 200 and 250 students start their education in ELFE.

The virtual laboratories are one of the latest developments in the modern education [1]. The implementation of the virtual laboratories concept [2] in the engineering education is not an easy task though. The connection between the laboratory exercises and the theoretical knowledge (lectures) is very important in the engineering disciplines. And as long as we can say that the transfer of theoretical knowledge using contemporary approaches as e-learning and m-learning has improved significantly in the past few years [3,4], the virtual labs' implementation in the higher education (especially in the engineering education) makes small steps.

Under a development project ELFE decided to implement a few virtual labs into the educational process. The expectations are to facilitate the students in accepting the educational material with extra possibilities to execute their laboratory work remotely – from their home computers instead of visiting the "real" labs. This first trial for ELFE of implementation the virtual laboratory concept in the real engineering education is supposed to lead to further "stronger" and stable development of the educational process supplying the students with more options to do their duties – remote study (distant education).

II. Problem Formulation

The advantages of the virtual laboratories are well known. Their development has started in the last decade of the 20th century and has increased rapidly with the production of cheaper and faster powerful computers as well as the development of the web technologies. Their main task to solve the three resource type problems related to time, space and saving money has enhanced lots of scientists to put efforts in the evolution of the basic idea – global access to laboratory equipment anytime.

From simulations to real experiments the virtual laboratories has been named after remote laboratories, web-based laboratories, computer based laboratories and so on. But no matter the name one fact is indisputable - the advantages that come from their development. As far as it concerns the education the virtual laboratories can improve significantly the accessibility of the knowledge since they offer modern methods bounded by a strong platform that user orientated and aims only to facilitate.

Till now there is not experience in using the virtual laboratories in the education of students in ELFE. The problem comes from the not cheap components necessary to build such a laboratory together with "tuning" of the teaching staff to use this "not traditional" resource of education. The big question and the most important factor is how the students will accept the idea. Is it really easier for them or since they do not have an experience working that way they will prefer to keep on the status quo?

III. Problem Solution

As it can be seen the problem is that the easiest thing does not seem to happen so easy. To translate that question it can be asked other way – how not to make the students to try something new but the new to attract them to try?

The development of the virtual labs in ELFE can be divided into 6 stages (fig 2):

1) Choosing appropriate laboratory exercises to be virtualized.
2) Choosing appropriate software for virtualization
3) Virtualization of the laboratory exercise
4) Improving of the interface
5) Producing manual to lead the students through the execution
6) Feedback

In this article we will describe shortly just one of the exercises of the laboratory that was virtualized just to show the pattern.

The laboratory for Information measurement systems is one of the renewed laboratories in the faculty. Equipped with new computers and educational laboratory equipment form FEEDBACK and National Instruments it seemed like a natural choice since it responded to all necessary conditions for virtualizations. The FEEDBACK board Micamaster MIC960 is connected with a computer with a controller via RS 232 interface (fig. 1). On the board, 8 LEDs are placed so to be controlled by the computer sending appropriate commands to the controller.

ISBN: 978-1-61804-238-5

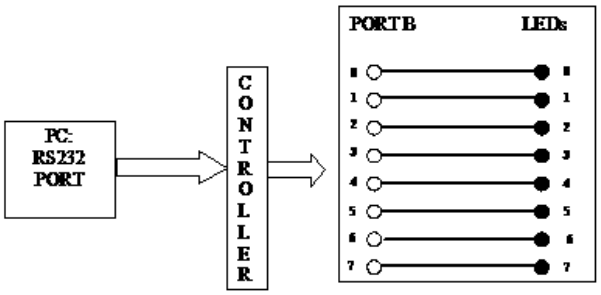

Fig.1

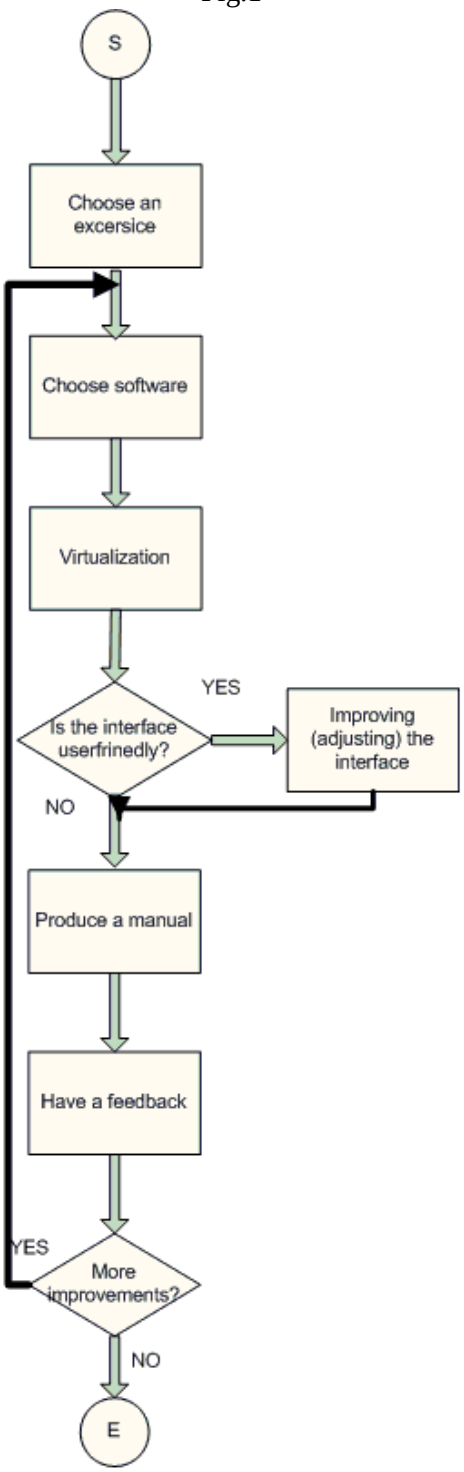

Fig.2

The task is simple – the students should send decimal numbers from the computer to the LEDs so to make them turn on and off. The preliminary information about the control functions of the controller is assured. With this stage 1has been fulfilled.

To choose an appropriate software is not an easy task and very relative [5]. For our purpose we chose National Instruments' LabVIEW – a very strong tool to accomplish such tasks.

The virtualization process did not take very long. It should be mentioned that the students would control real hardware in their work. In other words they would virtually control real devices so the real LEDS on the MICAMASTER board would be controlled.

A LabVIEW block diagram was created together with a front panel where from the students would control the virtual exercise (fig.3 and 4).

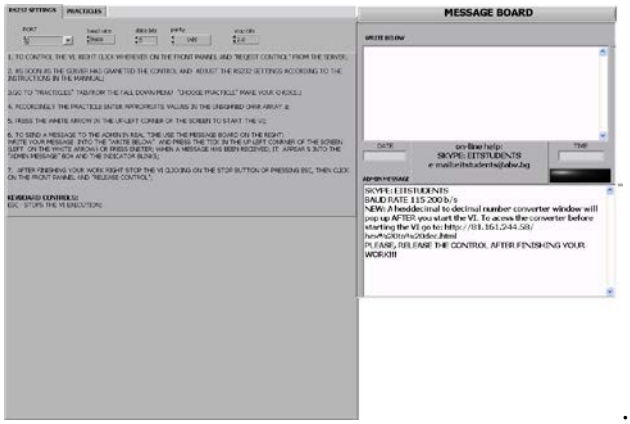

Fig. 3

In the first tab the students are required to insert correct communication parameters for the serial port (the computer and the controller are connected via RS232).

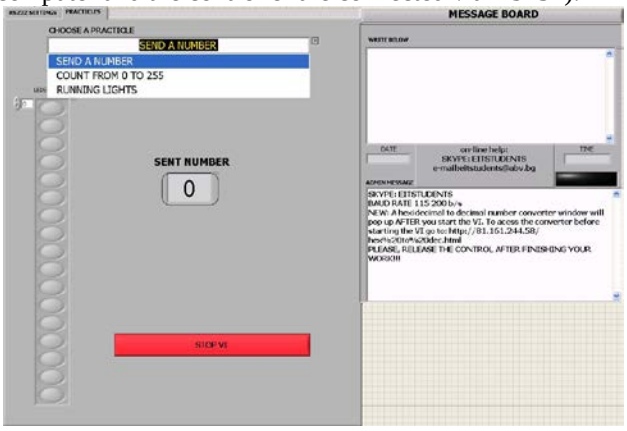

Fig. 4

ISBN: 978-1-61804-238-5

The second tab is the in fact working space. From here, the students choose a task to complete (according to the individual assignment) and try to manage the functions of the controller so to send the numbers from the computer to the LEDs.

Of course to know what exactly to do the students were supplied with a manual where all the necessary information of "how does it work?" was presented (stage 5).

Stage 4 is in fact the threshold of the development. On one hand the interface is very important just to attract the students to the exercise, on the other it should facilitate them so to make them feel like they are in a real environment. A key issue was that the virtual exercise should supply enough functionality not only to the students but to the teachers as well. So imagine, the students does something and the teacher cannot control it or even correct it!? Not a good educational approach. Important functionality that should be implemented in each virtual exercise and virtual laboratory is the communication tool or the feedback tool. In other words the teacher should have the opportunity to help the student now, on-line in real time if he/she needs it and the student should have the opportunity to enquire that help. Furthermore, the teacher might need to collect a list of the students who had logged in and executed the exercise -to have a summary of "who, when and how" did the assignment.

In our case a "message board" was developed to facilitate the real-time communication between the two sides. Of course, the LabVIEW's implemented functionality significantly facilitated the process described above.

The last stage is to receive a feedback from the students. This last stage has not been executed yet. The feedback will be under a questionnaire developed especially to estimate the quality of the virtual labs from the students point of view. The questionnaire consists of three sections:

1) Categorization – this section is necessary to categorize the target group on certain criteria
2) Estimation - This section aims to assess the quality of training in the virtual laboratory system of signs. Responses are required.
3) Improvement – the section is designed based on comments and recommendations of the students to improve the quality of education in the virtual laboratory.

In the following table how the second section looks like:

Table 1: Section 2 of the questionnaire for estimation of the virtual lab

I found the virtual laboratory:	**1**	**2**	**3**	**4**	**5**
Easy to operate					
Easy to understand					
Flexible to use in relation to time and place					
Stimulating					
Satisfying of learning activities					
I learn and understand more in a virtual lab environment than a traditional lab					
I can use virtual laboratory (over the Internet) instead of physically staying in a laboratory					
Opportunity to use virtual laboratory at any time and anywhere					
Allows more opportunities to practice experiments					
Provides a safe workshop environment without the need for supervision					
Enhances my enthusiasm for learning through interactivity					
Increase my motivation for learning					
Increase my IT literacy					

IV. Conclusion

In 2013 the English Faculty of Engineering started the development of virtual laboratories for engineering education in Technical University of Sofia. This first step is based on methodology designed after a deep research of existing solutions.

Although it is not finished yet since the last but very important component of the process is not finished – the feedback. It is expected that the feedback will give food for plenty of considerations for improvements. Nevertheless, it can be considered that the direction is right.

ACKNOWLEDGEMENT

This paper was developed under the project BG051PO001-4.3.04-0058 "Innovative forms of distance learning in Bulgarian Universities."

The project is implemented with the financial support of Operational Program "Human Resources Development", funded by European Social Fund of the European Union. Technical University - Sofia solely responsible for the content of this document and under no circumstances be regarded as official position of the European Union or General Directorate Structural funds as well as international educational programs.

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Driving Factors and Management Framework in Enabling Effective University – Industry Collaborations

E.S. Lim , M.S. Liew, T.N. Tengku Shahdan

***Abstract* - University – industry collaborations (UIC) are key proponents to an academic institution due to the financial sustainability it provides and to the industry due to enhanced technological and economic value it provides to the process chain. However, studies have shown that only twenty percent of collaborations have resulted in successful tangibles that are industry-applicable. This is highly related to the difference in expectations between the academia and the industry in approaching the collaboration. In a review of the success factors and inherent weaknesses of the current UIC practice, a management framework is proposed to bridge the different expectations. Benchmarking among various studies shows a clear indication towards three main pillars, namely technical, commercial and social strategy. The findings from this paper indicate that technology transfer mechanism, having a dedicated collaboration driver and good inter-organizational relationship as key factors in UIC success and is attempted to be addressed by the proposed framework.**

Keywords: hindering factors, management framework University-industry collaboration, success factors

I. INTRODUCTION

University-industry collaborations (UIC) have been the staple of development in science and technology and as such, exist through many modes of execution. The presence of universities in the research area is seen as key to the progress of an institution. They provide a major platform for universities to transfer technology, rejuvenate research and improve the curriculum (Chou, n.d.) on top of eventually possibly being a prime avenue for the sustainability of the research faculties. On the industry front, benefits can be derived primarily in the form of business/economic development, market impact, human capital development and even political leveraging. Collaborations can take the form of differing levels of engagement; ranging from traditional forms of engagement such as internships, and publications of results to more holistic forms of engagement such as Joint Industry Projects (JIP) and research consultancies. Universities can serve the different facets of the industry depending on the magnitude of the business involved; they can range from small and medium industries (SME) or consultants/turnkey contractors who leverage on the universities' capabilities and facilities in design and execution. Larger companies that possess in-house expertise on the other hand may leverage on universities to provide talent pools in operational optimization while the university can stand the gain tremendously in terms of sharing and strengthening of networking ties. However, the success of a relationship between the industry and universities are subjected to open interpretation depending on the parameters of measure. Previous research have indicated parameters of measurement which included the increased number of publications while some others took claim to the number of Intellectual Property (IP) patents being filed for. While they may account for a certain weightage of the overall university's Key Performance Indicators (KPI), they may not necessarily reflect the success of the collaboration with the industry. This paper intends to drive further the initial objectives that the UIC had set out to achieve since its inception, which is the applicability of research works as a result of the collaboration into industrial applications. The measure of such applicability is the direct application and adoption of technological research and development in the joint area of interest rather than producing many intellectual properties (IP) under the research but with little or no impact on company productivity or efficiency. These include collaborative research projects sometimes result in the setup of consultancy arms that fulfill the intended deliverables via transfer of technology or know-how to the industry. As such, from this point hereon, the success of a collaborative work shall be defined as the degree of

ISBN: 978-1-61804-238-5

applicability of technological development for industrial applications.

Historically, UICs have been ramping up especially among Asian nations in the past 20 years due to the fundamental need to stay in competition with in particular the United States (U.S.). Taking Japan as a close example of the development of UIC, much of their UIC efforts only began on the 1990s as a result of stiff competition from the U.S. (Nezu, 2005) due to their strong standing in the information technology and biotechnology industry. This is a change from earlier trends whereby Japan was largely reliant on the manufacturing sector to stamp its mark. In 2002, Japan Ministry of Economy, Trade and Industry (METI) set about a target of 1000 UICs to be created by March 2005 in a target set about a major policy shift in UICs. This figure exceeded expectations with major contributors from Tokyo University, Waseda University and Osaka University. The following table illustrates this positive trend (Nezu, 2005).

Table 1. Number of start-up companies in Japan according to MEXT: Ministry of Education, Science and Technology and METI: Ministry of Economy, Trade and Industry.

	1997	1998	1999	2000
MEXT Survey	22	33	62	127
METI Survey	32	53	86	142

This increased number of UICs in Japan as a result in favourable policies is a clear indicator that a framework or strategy must be in place to effectively produce successful industry collaborative. Their shift in policy has allowed Japan to compete once again industrially through continuously evolving technologies that originate from successful UICs. The role of successful UICs have played a large role in the constant battle for market share between the two industrial giants and as such, the U.S. has also been playing an active role in implementing frameworks and policies to meet the challenging industrial environment. The Bayh-Dole Act in 1980 was instrumental in facilitating up to USD40 billion in research activity since its inception until 2005 which contributed to lowering high unemployment and inflation rates by reinstating itself as the forefront of technology ahead of Germany and Japan by successfully commercializing research works. This is further iterated by the act being successful in creating nearly 260,000 new jobs (as a result of 5,000 new companies being set up around the growing research consultancies) until 2005 on top of resulting in the creation of nearly 3,641 different products in the marketplace. Former NASDAQ president was also quoted that nearly 30% of NASDAQ's value lies within university and federally funded research results that have been created as a result of the framework that act allowed (AUTM Public Policy Committee, 2006). All only serves to further drive home the point that success of a UIC is very much dependent on how the research outcomes affects both the microeconomics and macroeconomics of a nation. On a smaller scale, trends across the 90s to the early 2000s have indicated that there is an exponentially increasing support from the industry on research although federal funding still dominates the portion of the research funding; from 1991 to 1997 industry contribution rose to nearly 20% share at USD1.05billion (National Science Board, 1998). Upon implementation of the Bayh-Dole Act in 1980, U.S. saw the creation and transfer of nearly 458 patents which grew to almost four times the amount by 1995; of which the contribution of the top 100 universities in the patent count dropped from 70% to 50% (National Science Board, 1998). These points only served to further iterate the fact that the industrial acceptance of the contribution of research institutions have grown over the years and that there is a greater depth and breadth of research activities across the institutions.

Easier said than done, previous studies have indicated that the success of a research is constantly hampered by what is termed as the Outcome-Impact Gap. With the rapid increase in the number of successful UICs, so are the ones that have failed. A study in 2010 (Pertuze, Calder, Greitzer, & Lucas, 2010) reviewed 106 UICs and of this total, only 50% had seen significant outcomes in terms of potentially beneficial IPs. While this may indicate a rather good ratio considering the outcome-related risks of research, only 40% of the halved amount led to applications which were able to impact the efficiency as well as the productivity of the companies in collaboration (Pertuze, Calder, Greitzer, & Lucas, 2010). A similar effect was also noted in government-sponsored Engineering Research Centers (Ailes, Roessner, & Feller, 1997), thus indicating that this is not a problem isolated to UICs. This study is therefore aimed at isolating the primary issue of UICs being unable to meet its aforementioned deliverables and proposing a

ISBN: 978-1-61804-238-5

framework or a collaboration matrix in which it is able to effectively identify the denominators that will contribute to a successful UIC in which will result in favourable outcomes for both the university and the industry.

II. DRİVİNG FACTORS OF SUCCESSFUL UICS

In order to identify key issues that have been plaguing the effective execution of UICs, a literature review was conducted to check for common denominators across different demographics and settings. The findings are strikingly similar and tend to gravitate along common themes. These are mutually agreed upon by both the industry and academia as hindrances to a successful relationship. Other factors which are specific to the industry or the academia are also presented as these are common issues that crop up with the respective organizations.

Buy-in from Company Management

In all UICs, having a positive working relationship between the academia and the industrial collaborator is tantamount to its effectiveness. The involvement of the industry in the UIC is to benefit from the economically beneficial solutions that may churn out of the research project and as such, it becomes imperative for academics to align their goals in similar fashion. This is in contrast with fundamental research topics whereby the deliverables are not directly tangible or able to be directly applied unless commercialization research takes place. In view of such requirements, the timeline of these projects are greatly compressed and require direct application in the industry's core business activities. In order to achieve such mutual agreement, it becomes important to the academic institutions to obtain the appropriate buy-in from the industrial bodies. Having a proper platform to discuss, deliberate and debate issues pertinent to industry while being able to negotiate for UIC arrangements that fulfill the requirement of an academic institution will facilitate this buy-in process. A study (Wohlin, et al., 2012) done on sample sets from Sweden and Australia had indicated that the biggest hindrance to effective UICs is the lack of proper buy-in from the management, in particular the industry captains. It is also acknowledged jointly by institutional and industrial leads in the United Kingdom (Jones & Clulow, 2012) that for any collaboration to succeed, would ultimately fall upon the buy-in of the senior management. They further reinforced this point by mentioning that issues such as technology transfer, IP rights and inter-organizational communication are seen as problems that can only be tackled once buy-in is secured. Drawing upon a successful example, Universiti Teknologi PETRONAS (UTP), Malaysia had setup the Offshore Engineering Centre UTP (OECU) in 2009 with the primary purpose of supporting the industry's needs, primarily its' benefactor, PETRONAS while still contributing to the university's philosophies and key performance criteria. Being setup for the sole purpose of serving the industry, its major mode of sustainability is through successful implementation of UIC frameworks and models. To this end, they have initiated the setup of a UTP-SKG11 Steering Committee to serve as a platform for industry captains and the academia to mutually agree upon areas of research directly serving the industry (Offshore Engineering Centre UTP, 2013). The PETRONAS Skill Group 11 (SKG11) is dedicated to resolving and managing issues pertaining the civil structures in the ownership of PETRONAS and its subsidiaries. Being the custodian of the country's national oil assets, requirements dictate such that they have little resources to expend into the area of future research. This served as the perfect business model for both the industry and academia and managed to obtain positive buy-in from respective managements. This arrangement has allowed OECU to expand rapidly into many key civil engineering areas whilst still maintaining their strong relationship with PETRONAS.

Inter-organizational Communication

One of the critical defining points of any UIC is the informal aspect of the technical communications and personal relationships (Pertuze, Calder, Greitzer, & Lucas, 2010). This sort of relationship allows two things in essential; a) the transfer of tacit knowledge between working members, and b) building the level of trust between working members. The former being important as it allows the transfer of knowledge that is conventionally not possible by work in isolation or lacking face-to-face interaction. This is important in two aspects; a) innovations which requires

extensive knowledge on previous methodologies for comparative purposes, and b) garnering feedback essential in keeping the research in line with industrial applicability. Contrasting itself from formal lines of communications, 90% of collaborations between U.S. institutions were carried out informally (Hagedoorn, Link, & Vonortas, 2000) as these could impart knowledge at a much higher frequency. A positive impact on knowledge acquisition and process adaptation (Yli-Renko, 2001) as well as informal communications being precursors to agreements being made at a formal level on a much later stage can be seen as a result (Debackere & Veugelers, 2005) (Bercovitz & Feldman, 2007).

This sort of knowledge sharing is possible via industrial attachments as well as interim meetings which serve to include participation from concerned members. This leads to the second part which is the build of trust between working members. Constant and regular interaction between working members can build an informal personal touch which can serve to maintain the free flow of information which would otherwise be difficult to procure formally. Scenarios could arise whereby there is a strict sense of confidentiality regarding the overall strategy of the company which is kept from the research team. This could lead to problems whereby the research team could be groping in the dark with constant hit-and-miss situations that could never satisfy the different facets of the UIC. A descriptive study done shows that there is a strong correlation between the between the strength of the link of the business and the researcher and the rate and diversity of knowledge transfer into the UIC (Felez, Bekkers, & Gallart, 2010). In practice, such ideal situations do not always occur as a study showed that a vast number of faculty members were less enthusiastic about business partnerships with the industry and a more market-driven university (Lee, 1996). Reasons for such include low yield in the academic KPI, considerable risks and higher level of commitment and accountability (Rosenberg & Nelson, 1994). Also noted was the inability of academicians to make sound decisions and tradeoffs from industrial partners, resulting in income and research support being traded in for securing new contracts; also dubbed as the 'Faustian bargain' (Lee, 1996).

Another intrinsic value that good communication lines can foster in a UIC is the cultivation of trust between collaborative partners. It is established that with any form of collaboration, there may arise situations where acts of opportunism may prevail and disrupt the dynamics of the relationship, thus making trust an inherent requirement for the success of any UIC. Trust is defined as a collaborative partner that, a) can be relied on to fulfill obligations; 2) will behave in a predictable manner; and 3) will act and negotiate fairly when the possibility for opportunism is present (Zaheer, McEvily, & Perrone, 1998). Even though mechanism to avoid breach of trust such as non-disclosure agreements (NDA) are present, the impact of loss of trust is far reaching and may not be deemed by certain collaborative partners as "worth the risk". The development of high levels of trust allows the transfer of knowledge that goes beyond the scope of a typical NDA, as it may involve the transfer of tacit knowledge and strategic information which cannot be translated directly into the collaboration. Having multiple open channels of communication between collaborators and a project driver that upholds strong values of integrity are key to fostering trust, which possesses a value that can only be built on the long-term.

Administration of Technology Transfer (TT)

This particular mechanism is seen as a critical point in ensuring the transition of technology from the research machine into practical applications in the industry and does so by managing the IP and the marketing aspect of the final outcome as well. ToTs will oversee the movement of know-how, technical knowledge or technology from one organizational setting to another (Roessner, 1996). The process is usually split into three key processes, a) the developmental stage, b) the patent application stage and c) the final licensing stage. The management of intellectual property (IP) in a UIC is seen as critical in being able to define in particular the profit-sharing status, ownership as well as definition of works and responsibilities of parties at stake. Traditionally, research would be dealt with at a personal level between the principal investigators and the companies involved in the form of project funding or even assuring job placements of postgraduate researchers in exchange for research output. This trend is quickly phasing out as

ISBN: 978-1-61804-238-5

companies prefer to opt for a more formalized and systematic framework to adopt in the execution of UICs. This framework will usually be embodied in an arm of the university also usually known as the Technology Transfer Office (TTO) or any other variants of this name. The sustainability of the TTO is widely dependent on the throughput of successful UICs coming through as sustenance of a TTO is dependent on the quantity of projects coming in, ability to assign a market value and ability to perform due diligence on the outcome (Bastani, Mintarno, & Fernandez, n.d.). The role of a TTO is not to be underestimated as it can greatly lift the burden off the research team and the companies as it will manage the legal and financial aspects of the project which either party may be unfamiliar with. Successful business models that arise from well executed technology transfer can result in economical contribution and long-term sustainability of the research institution. Furthermore, there is evidence suggesting that commercial activities such as IP production resulting from UICs have synergistic impact with the research performance of the individual or the institution (Rothaermel, Agung, & Jiang, 2007). For example in Korea, in a space of two years ranging from 2001 to 2004, 19 Korean universities reported more than a triple jump in their income from technology transfer amounting to USD 1.7 million from USD 0.42 million (Yi, n.d.). As South Korea are relatively new to the UIC concept they tend to have smaller total incomes. This is a stark contrast to the dominating countries in this field such as U.S. whereby they have had nearly USD 318 million in profit in 1993, up from USD 163 million in 1991 with more than 200 TTOs in place nationwide (Bozeman, 2000).

Table 2. Total income produced by 19 different Korean universities over a span of 4 years as a result of business models thriving of successful technology transfers.

	2001	2002	2003
No. of technology transfer	58	102	133
Income from technology transfer	473 million won	983 million won	1913 million won

The glaring difference between profitability of both South Korea and U.S. sends out a message that for countries relatively new to this concept would need to have more policies and interventions in place in order to create an artificial climate which will induce positive growth in the UIC. Backtracking to U.S. as an example, technology transfer occurred mostly in 80s to the 90s as a result of formal mandates by the federal government, not a bottom-up change. This took form of the Stevenson-Wydler Technology Innovation Act in 1980 which made it compulsory for TTOs to set aside 0.05% of research budget for technology transfer. Unfortunately many parties did not comply with this until much later when a study was conducted in 1995 (Bozeman, 2000). Active UICs in South Korea acknowledge that there is a need for a federal intervention to usher the model forward as there are numerous malpractices that could be eliminated to push forward the TT process (Yi, n.d.).

Divergence of Incentives and Working Philosophies

When it comes to management of knowledge and IP between the academics and industry, the divergence in expectations and objectives can lead to potentially conflicting outcomes in the UIC (Salter, Bruneel, & D'Este, 2009). This roots itself in the varying institutional norms that govern both publicly available and exclusive knowledge (Dasgupta P., 1994). The growth of of publicly available knowledge via the academic institutions have been central to their economic support from the federal bodies (Geuna, Steinmeuller, & Salter, 2003). This is coupled with a study that indicates that academicians operate and perform based on intrinsic goals and social objectives when it comes to knowledge management rather than being based upon the “bottomline” of coprorate bodies (Stern, 2004). As such, the practice of publishing knowledge and findings becomes a central performance indicator and career marker for academicians, creating internal dynamics which are separate from the typical supply and demand free markets in which the industry is dictated by (P. & David, 1994). Such reputation eventually relates to the academicians ability to source for funding and ensuring research sustainability in their field of study. While this may be beneficial in ensuring the sustainability and autonomy of research in the institutional confines, they pose significant conflict with industrial practice and approach to the same matter.

ISBN: 978-1-61804-238-5

In essence, the industries approach to knowledge management is centred around the concept of gaining economic and commercial advantage over its' competition in the market (Teece, 1986). It is further acknowledged that such divulsion of knowledge is only done when it provides advantage in creating temporary monopolies in a particular field by the filing of patents; effectively closing down on similarly developing technologies (P. & David, 1994). Knowledge that propagates through the industries are done on a more open manner on the basis of establishing competencies to the open market or establishing control over competitive technologies. They may also manifest themselves through open-sourcing of technologies to reduce the cost of development and lastly, thorugh trading of information with competitors on a strategic basis to create condolidation and cartel-like monopoly over the industry (Hippel, 1987). As such, this creates an environment of divergence between the expected outputs by the industry and the academia even in the similar field of study. It may be seen as more favourable for researchers to engage in projects there are novel and provide research mileage to their resume than to engage in practical and real-world problems faced by the industry (Nelson, 2004).

Human Capital Development and Retention

Studies have indicated that the development of human capital for UICs are relatively more cost effective than engaging federal or private research centers to perform them. Conventionally, UICs will draw upon the student talent pool in the form postgraduates in exchange for valuable industrial training. This form of arrangement will draw upon principal investigators to conduct on-the-job training (OJT) in order to achieve knowledge transfer and development. They can manifest themselves in direct staff attachments with the collaborating company (Bozeman, 2000). However, these postgraduates play a much larger role in the UIC, namely to be the informal bond between working groups in the university and the host company (Roessner, 1996). For example, in the U.S., industries benefited greatly from pre-trained postgrads from Engineering Research Centers (ERC) as these will help them reduce time and effort put into procuring competent professionals. Japan Research Institute of Economy, Trade and Industry (RIETI) also indicates that lack of close business ties on the project as leading factors for lack of success in UICs (Kazuyuki & Jan, 2004), further strengthening the rationale behind bartering in postgraduates in exchange for valuable industrial attachment time.

However, a pertinent issue that plagues this type of setup is the ability to retain high caliber researchers which exist on a project-to-project basis (Martin, 2000). Postgraduates constitute the largest power of the human capital resource in a research university and as a result of their limited project tenure; as a result, they tend to be recruited in by the industry upon completion of these or project. This results in a situation there is a constant need to retrain and relook human capital resources which for one can, a) be time consuming and b) cause a lack of continued development into higher level competencies among researchers. As a result, there is a need to simulate and create conditions which will allow the retention of a portion of the research workforce to reduce the competency gaps that arise due to high turnovers (Martin, 2000). Understandably, UICs are not traditional mainstream activities in universities and therefore researchers and principal investigators may not see the priority or motivation to engage intensively in such activities (Martin, 2000). For example in the Hebrew University of Jerusalem, Israel, a scale of fees was proposed as a measure to incentivize UIC efforts as well as limit abuse of collaboration funds. Contracts with profit organizations allow the principal researcher to derive up to a maximum of 50% of his principal pay and up to 90% if he has brought in extramural funds (Vigdor, n.d.). Incentives also can appear in the form of payments-in-kind and can manifest themselves in promotions and material/facilities priority.

ISBN: 978-1-61804-238-5

Table 3. Scale of fees for prinicpal investigators as practiced by the Hebrew University of Jerusalem as part of a financial incentive scheme to promote higher involvement of manpower in UICs.

Type	Value	Salary addition
Internal	**No additional increase**	
Governmental, non-profit organization	Less than USD 6,000	0
	USD 6,000 – USD 12,000	6
	USD 12,000 – USD 20,000	12
	USD 20,000 – USD 45,000	20
	More than USD 45,000	25
Profit organization	Less than USD 6,000	0
	USD 6,000 – USD 48,000	30
	USD 48,000 – USD 75,000	40
	More than USD 75,000	50

Financial Viability

A brief study on funding in various countries have indicated towards heavy inclination on the part of the government in providing funding for UICs. This is largely attributed by the growing need to stay abreast in the multi-faceted business environment which can only be achieved with sufficient support from the government in the form of financial funding, tax incentives, facilities and incubation centers based on the market failure concept. Such ventures cannot be supported even by the largest of private research institutions due to extensive externalities, high transaction costs and potential information distortion of the marketplace (Bozeman, 2000). It is a highly influential concept that has been enduring ever since the advent of the World War 2 and has profound roots in neo-classical economics compared to other policy models which have only seen brief periods of success in the 90s (Machan, 2001). For example in China, approximately RMB 2.2 billion had been poured in from the republic's coffers itself which accounts for nearly 50% of the total R&D funds (Nezu, 2005). Further incentives were also provided in the form of matching funds to support the project if the project champion came from the industry-side. In similar fashion, Japan had also nearly 90% of its funds channeled to public universities as well as national laboratories despite the country being heavily run on a deficit basis. In Malaysia, the Ministry of Higher Education (Universiti Tunku Abdul Rahman (UTAR), 2010) has allocated a total of MYR 3.1 billion between 2006-2010 for research under the 9th Malaysian Plan in which MYR 336 million had been approved out of a MYR 285 million allocation for the Fundamental Research Grant Scheme (FRGS) (Universiti Tunku Abdul Rahman (UTAR), 2010), indicating strong drive in commitment towards UICs from both government, academia and industry. This only serves to further iterate the point that governing bodies understand the magnitude of sufficient funding as a catalyst for a successful UIC which eventually leads to positive economic growth.

What this trend indicates is that UICs are recognized as a capital intensive venture and as such, securing funds from the platform already provided will be critical in ensuring the research framework is sustainable for the duration required. A clear positive correlation can be seen between the level of funding and the quality and speed of research produced as the level of equipment/facilities and expertise that can be procured will be increased as well (Machan, 2001). While the framework to access the coffers allocated for research is already there, a proper strategy and concept must be applied when applying for funding and this stretches all the way from capturing fundamentals to highlighting applicability. According to MOHE Malaysia, a report in 2010 indicated that factors that attributed to UICs being unable to procure funding included, a) lacking fundamentals (too exploratory in nature), b) inability to highlight industrial significance of research, c) technology is well established; no novelty in project, d) economics of the project is not feasible, and e) lack of expertise to supervise and conduct research (Universiti Tunku Abdul Rahman (UTAR), 2010). On top of that, strong evidence supports belief that having a good project champion is second to having strong relationship and significance on industrial application in order to secure funds (Nezu, 2005). Change in economic climate has also forced the industry/private sector to reform their funding policies which has in turn forced universities to rethink their funding strategy. Large companies such as IBM and HP no longer enjoy large sums of profits as they did back in the 80s as the emerging dominance of Japan and later China ate away into their market share. This forced the companies to rethink their research strategy as

ISBN: 978-1-61804-238-5

this has rendered their large-scale research facilities less flexible and economical to run, prompting outsourcing to be a possible solution (Schindler, 2007). As such, companies have been shifting their research policies towards short-term application research rather than long-term fundamental research; this has directly forced the outsourced bodies, i.e. universities to rethink their approach to securing funding. In general, smaller companies tend to view applied research as appropriate for university collaborations. A large or small company can utilize universities to conduct exploratory research before developing a technology in-house, although small companies may try to use the university to provide all their research needs as it would be more economical to leverage on the setting up of facilities. Large, technology-driven companies often find it practical to work with universities for long-term complementing existing master plans. Short-term research needs of large companies generally do not match university goals or timeframes and as such may outsource it to solution-specific firms (Hasselmo & McKinnell, 2001).

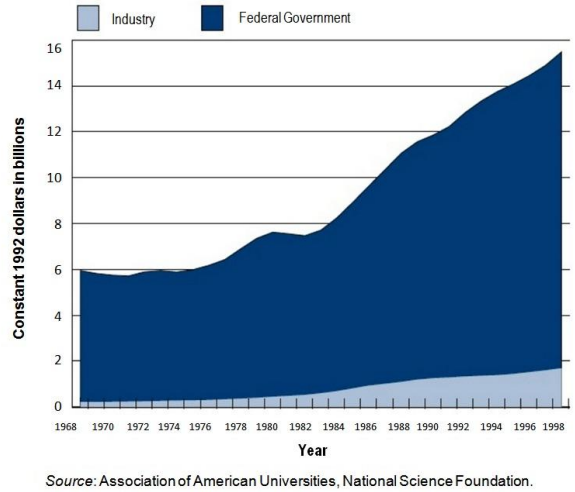

Figure 1. Ratio of federal funding against industrial funding in research and development from 1968-1998 in the U.S. (Hasselmo & McKinnell, 2001)

III. PROPOSED MANAGEMENT FRAMEWORK

In order to address the success of collaboration, it is largely reliant on the ability to identify the common denominators between the university and the industry and execute them in a structured management framework. These denominators will become parameters that will be prioritized in the collaboration framework to ensure the resources of both collaborators are sufficient. This will allow the development of long-term strategies that will become the platform for delivery. These proposed methods serve only as a guideline to best practices and will not guarantee success in every scenario but will provide a baseline in directing a UIC.

Based upon the key factors of an effective UIC identified in Section 2, they can be categorically grouped into three (3) distinct management processes, a) technical alignment, b) commercial alignment and c) social alignment (Philbin, 2013). Figure 3 is a diagrammatic representation of the proposed framework.

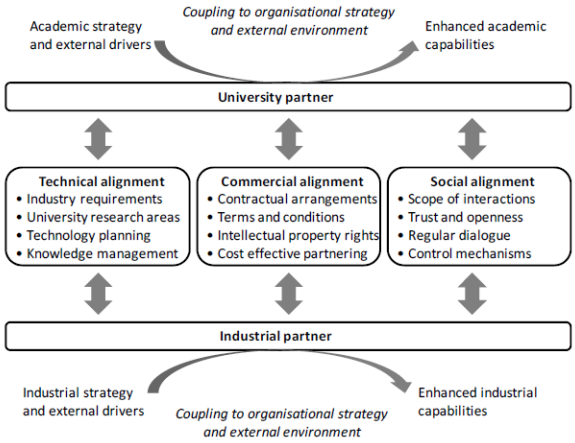

Figure 2. Proposed management framework for UIC (Philbin, 2013)

Under the framework in Figure 3, the factors of corporate buy-in, divergence of incentives and knowledge management are addressed under the technical alignment while administration of technology transfer, financial viability and human capital are addressed under commercial alignment. The more subjective and intrinsic issue of inter-organizational communication is captured under the alignment of social processes. Using the framework as a guideline, the critical challenges of a UIC are able to be identified and addressed systematically. Inability to address a particular alignment or process has to be factored into the risk analysis of any project as it will affect the outputs of respective stakeholders. The risks incurred are interrelated and hinge largely upon the risk imposed by the social alignment; relational risks are deemed to be far-reaching as they impact the stakeholders' ability to agree upon technical and commercial terms.

ISBN: 978-1-61804-238-5

IV. CONCLUSION

In essence, the message intended to be driven home in this paper is that common best practices being maintained out in the industry possess a strong sense of similarity between each other. Driving factors of successful UICs can be addressed through a structured framework which takes care of the three (3) critical processes in any UIC, commercial, technical and social alignments. The generic framework should allow the flexibility and scope of varying UIC mechanisms provided the core alignments are addressed in the planning stage. The various key drivers that should be addressed include the buy-in from corporate management, establishing strong inter-organizational communication and addressing technology transfer and IP mechanisms. These are identified from literature review as common denominators of UIC barriers between the industry and academia. Other factors are more academic or institution based such as the retention of human capital for research and securing financial viability of projects.

Future research in this area is proposed to include case studies in order to investigate the effectiveness of the framework in responding to UIC issues. Driving factors identified in this paper shall be used to benchmark these case studies to validate the significance of these factors.

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APPENDIX

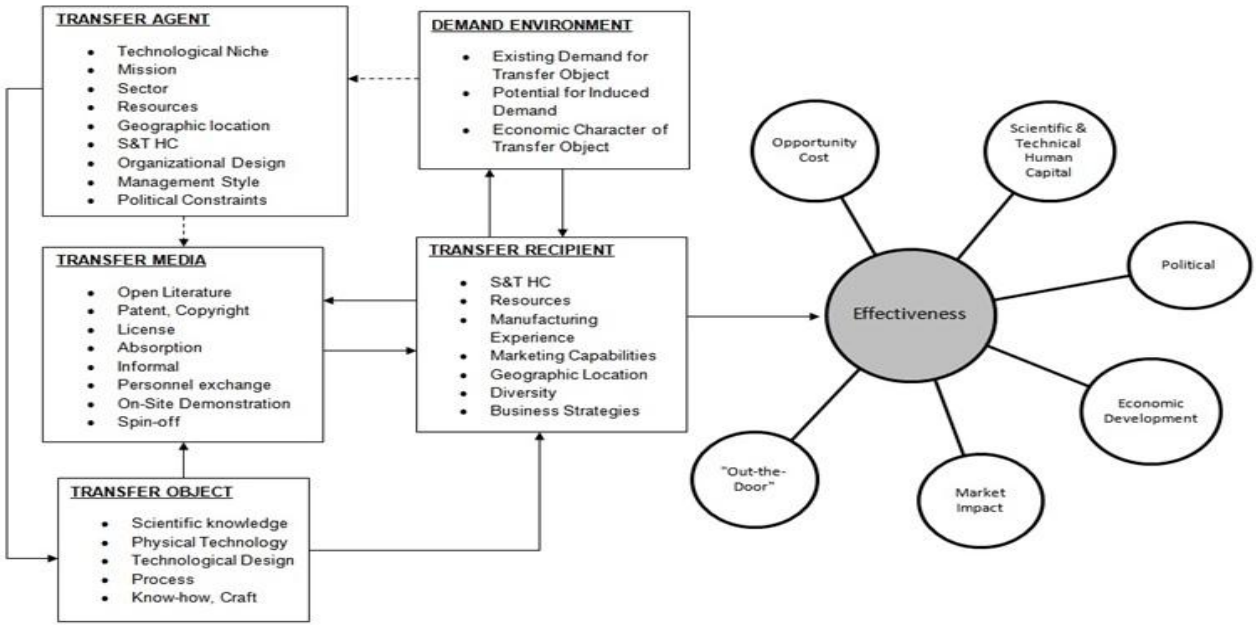


Figure 3. A typical model depicting the technology transfer process and its proponents (Bozeman, 2000)

ISBN: 978-1-61804-238-5

The philosophical roots of civic education, the regulatory framework and the reality. New global thinking

E. V. Chashchin

Abstract **–** This article focuses on the regulatory framework of civic education in Russia, as well as to the spread of a new global mindset can foster civic principles in education. Civic education in Russia is undergoing significant changes. Its role and importance increases, so require different new techniques that would make the process of obtaining more efficient.

Keywords **–** global thinking, civic education, modern civil law.

I. INTRODUCTION

The main question facing all those who are trying to characterize the nature of civic education, is what results should lead its development? Who will be a graduate of secondary or higher vocational institution that implements the principles of citizenship in the educational process – a law-abiding patriot, keeping up with all, or not depending on the will of the majority of a person? Do not hide a contradiction here?

II. THE NATURE OF NORMS OF CIVIC EDUCATION

At a meeting of the Council of Europe workshop made a number of signs of civilization:

1) law-abiding;
2) the responsibility for their actions and their choices to the society and the state;
3) the ability to exercise their rights and freedoms, without violating the rights and freedoms of others;
4) patriotism;
5) the ability to dialogue with the authorities and interpersonal dialogue;
6) an understanding of the legal and moral obligations to society;
7) critical attitude toward reality [1].

Each of these items can be a starting point for the implementation of civic education. Thus, the scale of the problem we raised is that the only solution to reduce it to the introduction of one or more courses is not enough. That is such a volume that requires a special focus of the entire educational process at all levels of education. Additionally, you must refer to specific methods of training sessions, which contemplates the realization of key democratic ideals. For example, the introduction of a panel discussion of issues addressed in the classroom, allowing each student to express their opinion, attract the attention of students to the various problems associated with the activities of their institution, the use in the educational process of information resources of various media.

Civic education in Russia at the beginning of the XXI century finds some support from the public administration system. Thus, in accordance with the "concept of the federal target program of education on the years 2006 – 2010"(N 1340-r dated 09/03/05 was) [2] and "The Concept of Modernization of Russian Education for the period up to 2010" is the establishment of a democratic state, based on market principles in the economy should be a guide in the preparation of students of Russian citizens. The latter should not just learn to live in reality to create a civil society, but also take an active part in building it [3]. Extensive discussion was created with the support of all active participants in the implementation of civic education "National Plan of Action for Civic Education on the 2005 – 2006 years [4]." In 2004, a commission was formed on civic education and legal education, serving in the Council under the President of the Russian Federation for the Promotion of Civil Society Institutions and Human Rights. Its merit is the project of the state program "Civic Education in the Russian Federation on the years 2005 – 2010"[5], established with the support of the Commissioner for Human Rights in the Russian Federation. Regions are not far behind from the federal government in establishing a regulatory framework for implementing the principles of

civic education. For example, according to the extraction of the "Program of development of the education system of the Perm region of 2006 – 2010" (item 13. "Citizens' character education") "system of education should be the basis and the subject of civil society. Interaction of school and civic institutions in the development of education, upbringing of citizens, modeling of basic public relations should be a major mechanism of educational policy [6]".

Based on these and other programs can be formulated as a general idea about the nature of civic education. Civic education, focused on the creation of the democratic foundations of civil society is a unified system of formation of legal and political culture of the young man, his spiritual and moral education[7]. This enables the development of a multilateral personality with a high level of social activism and civic awareness, recognize and protect the rights and freedoms of others. This person – a patriot, who has dignity and is not only responsible for the committed acts but also for the fate of the motherland. Brought thus man is capable of any civil act for the benefit of their country.

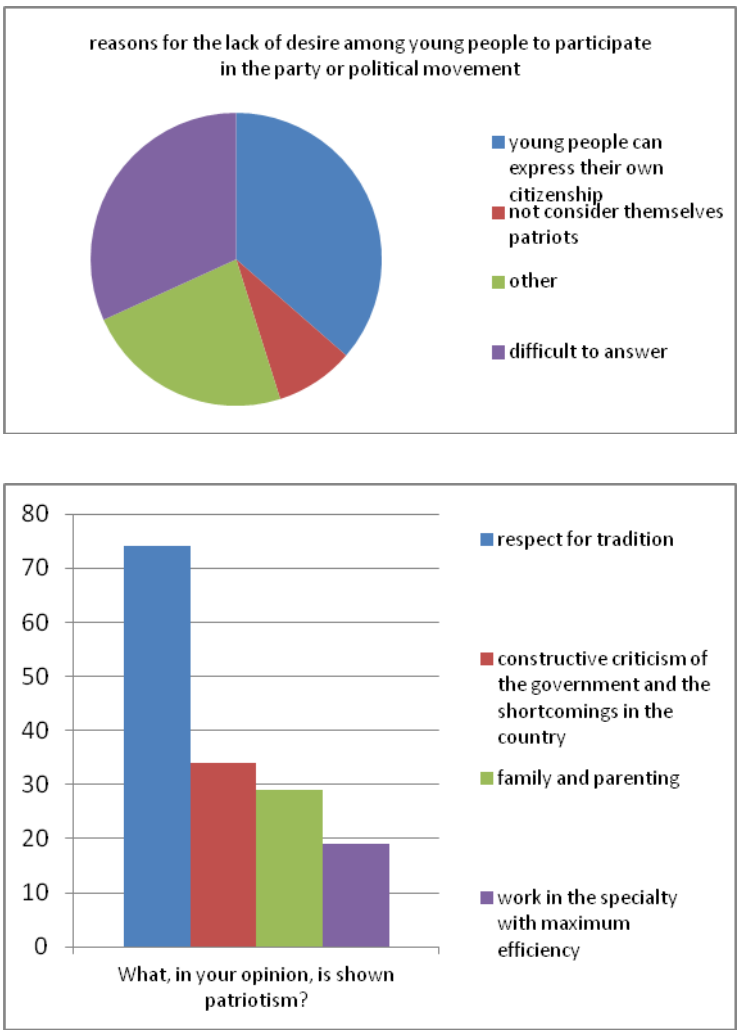
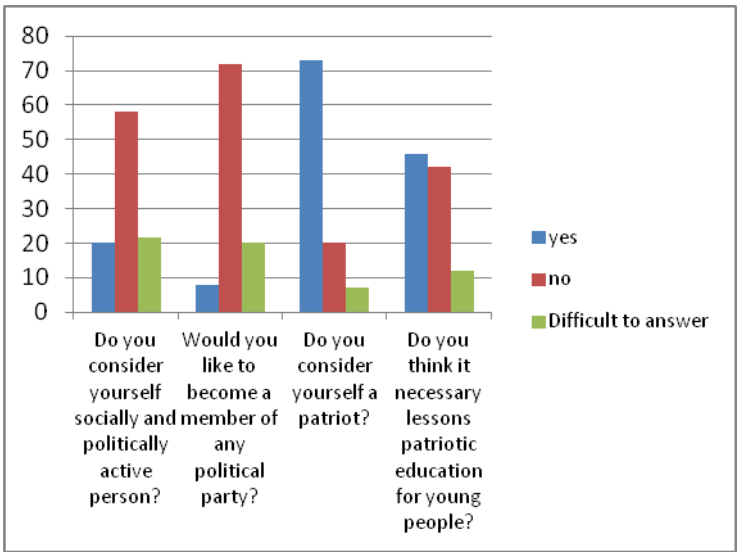


Fig. 1-3 Study of the Political Science Department of the St. Petersburg State Polytechnic University. Date: December 2010. Research topic: What is the "patriotism"? The number of respondents - 224. Age from 17 to 22 years. Author-Safonova Anna "Modern understanding of patriotism among youth" http://sibac.info/index.php/2009-07-01-10-21-16



III. FEDERAL STATE EDUCATIONAL STANDARD AND CIVIC EDUCATION

Impetus to the development of civic education in Russia was obtained as a result of the new Federal state educational standards. Federal state educational standard to keep civic values in the education system as an institution of socialization Russians. Importance of this condition due to the need to counter global threats from the world of extremism, anti-democratic influences a number of leading political forces, the complexities of building a multicultural world civilization system. Task of the Federal state educational standards can be called the preservation of national and cultural identity in line with Russia its interaction with the international community. So Federal State

Educational Standard primary education includes installation on:

• spiritual and moral development and education, the development of students' civic identity as the basis of development of civil society;

• acquisition of spiritual values and culture of the multinational people of the Russian Federation;

• democratization through the development of forms of public-public administration, expanding opportunities for the right choice of teaching staff training and education, methods of assessment of students' knowledge [8].

Federal state educational standard of general education is focused on:

• formation of the Russian civil identity of students;

• the preservation and promotion of cultural diversity and linguistic heritage of the multinational people of the Russian Federation, the realization of the right to study their native language, the possibility of obtaining the basic general education in their native language, learning the culture and spiritual values of the multinational people of the Russian Federation;

• spiritual and moral development, education of students and the preservation of their health;

• development of the state and public administration in education;

• ensuring the creation of the social situation of development of pupils, ensuring their social identity through personally meaningful activities [9]

Principles of construction of civic education, are realized according to federal state educational standards require a radical change not only approaches to the educational process as part of the teacher, and from the student, but also a change of the student's relationship to the world around him. We believe that the basis for the formation of citizenship traits and parties in education can become a new global thinking.

IV. CIVIC EDUCATION AND NEW GLOBAL THINKING

Changing the methods and conditions for the transfer of knowledge and skills should include new benefits of modern information exchange, as well as smooth objective shortcomings, reflecting specific manifestations of socio-historical practices in the field of mental activity[10]. Guided by these principles, we can say that thinking in education reinforces the need to develop their analytical skills. Paramount importance for the direction in accordance with the objective tendencies in the changing nature of social relations becomes not assimilation of large amounts of information in the form of finished memorizing empirical data included in a specific theory, but an independent manipulation of the known facts, including complex reflexive understanding. Such analytical activities will be accompanied by students finding answers to questions such as why, how, why this or that phenomenon is known intermediate result in each particular branch of knowledge, as well as accompanied by emotional value judgments subject reflection earned material.

The need to disseminate the principles of analysis and reflective thinking may be due to the current requirement to optimize the learning process.

Memory unit level reaches the level of the particular and the general, the individual consciousness (subject to the inclusion of the latter in the information and communication connection) can benefit from the knowledge of other members of the group or the whole of society as a whole.

Due to the cooperation efforts social group memory replaces the single set of knowledge of the individual, allowing the latter to engage more deeply analyzing the profile for it sets the facts and turning them into the structure of the represented knowledge. Opportunity for knowledge translation in a universal form, and not only on the intra-group level as determined by the degree of development of the global style of thinking in complex society in a specific historical period. Different parts of the educational process, are associated with the social relevance of a particular historical situation can reveal the mechanisms of complex understanding necessary for adequate development of the individual requirements of the society, not only due these historical conditions, but also coming from itself, it past filter "common sense" and because less dependent on political party ideology. In practical terms, this means opening unique worldview accentuation by posing unsolved problems in various branches of educational activities. On the one hand, enables the subject of education (especially true for those who are still in the process of socialization) more convincingly choose industry specific activity of its potential. On the other, the most excluded from this choice, as well as the subsequent implementation of this activity, potentially distorting the results

influence political party ideology in favor of individual socio-ideological interpreted it. Educational process in the implementation of this kind of modernization will contain fewer predefined empirical data, supporting facts that will be replaced with basic facts and key methods that require creative thinking and suggests an increasing number of independent logical conclusions. Based on analysis of the contemporary historical situation, it is possible to identify many examples of search and research sectors of society teaching universal ways of education and training of its members. Adaptable to modern realities principles of dialectical materialism of the education system, the test method, the concept of Montessori – all this explains the desire of society to move from local systems thinking organization that requires memorizing large amounts of information to global, based on the theoretical reflective intelligence. The task of the education system of the future to meet these social and psychological needs.

Transformation of education carried out in this vein, as its results will have in shaping the thinking of future generations and universal set of necessary mental skills, which, in particular, will enable more effective than the current historical situation occurs intercultural directed for construction of civil society in various parts of the world. Distribution of a new model of education will also help overcome the effects of global problems. Whereas, the modernization of education, carried out on such a model will facilitate the formation of socio-psychological basis postnonclassical science able to offer effective solutions for various polyvariant problems facing the society.

V. CONCLUSION

Society – a self-regulating system in which the public authorities and the education sector, are interacting and interdependent subsystems. Imperfections that appear in one, will inevitably lead to problems in another.

To address the emerging needs of contradictions systems approach as a program of action for the development of civic education in our state.

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Résumé: Global thinking may be a good basis for the implementation of the principles of civil thinking in Russia, increasing the level of civic consciousness. Mastery of the principles of the organization of the educational process with the included element of civic education and global thinking one of the main tasks of the modern teacher.

Mots-cles: global thinking, civic education, modern civil law.

The Development of Forecasting Technique in Business by Using R - Programming

Somruay Apichatibutarapong

***Abstract*—**The research aims to develop business forecasting technique learning source by applying R programming. The researcher has emerged the learning media by utilizing C++, enhanced with R and concerning database by Microsoft Access to store data. The data were collected on 4 forecasting techniques as follows: Exponential Smoothing Model, Holt-Winters Model, 3 types of Stationary Model (Moving Average Model: MA, Autoregressive Model: AR, Mixed Autoregressive Moving Average Model: ARMA), and 3 types of Non-Stationary Models (Non-Seasonal ARIMA Model, Seasonal ARIMA Model, and Autoregressive conditional Heteroskedasticity: ARCH), including 30 examples application for business. The quantitative approach was used to investigate the quality of learning media on business forecasting by applying R Programming based on experts and students who interested in business forecasting technique. It was revealed that the experts' opinions were on moderate level in all contents except in fonts and colors aspect is good level. On the other hand, concerning students, the good level is granted either in summary or in each indicator.

***Keywords*—** ARCH model, Business forecasting technique, R Programming, Smoothing model.

I. Introduction

BUSINESS competition is tougher than former before, it forces the firm's role played to use more information and forecasts in decision-making. In addition, the business environment is changing with increasing complex. Makridakis et al. [1] note that various factors (e.g. complex of organizations, demand and technology change, more systematically decision-making, etc.) which have caused the increasing organization's forecasting need. Armstrong [2] also points that the demand for research on forecasting is strong. All business will need to require an analysis of the competition, forecasting becomes an essential discipline for running a business especially for planning strategies and making decisions on any operations of people in any professional fields and also of organizations: business, industry, agriculture, politics, public health, etc. In big or small business, public or private sectors, if the decision - makers are able to forecast upcoming circumstances at a certain level of reliability, the plan and the operation will flow as expected. Forecast with high accuracy rate is hence required. Loomis and Cox [3] show that forecasting is an important process in business and economic; moreover, the demand for professional forecasters is growing. It is driven forecasting course is necessary for students both in business and economic curriculum. Because of forecasting requires the study on trends and types of the condition from the past records and/or knowledge experience, and forecaster's consideration. A forecast is necessary to use a strong statistical task and mathematical modelling for inform the forecasts.

In forecasting class, we do not assume anything about the students' statistical knowledge background. Student backgrounds could vary from none to master achievement. Furthermore, forecasting technique concepts are complex, abstract and there are computational difficulties. Many of statisticians and researchers have developed the forecasting software from 1960s up to forecasting software reaches a stage where even persons with no technical training can benefit from it [4]. The more efficiency forecasting software, the more cost provides.

R-Program is an effective and internationally popular program for statistical analysis and downloadable onto PC with no charge (freeware). The program is of Object Oriented Language category and interactively functioning. Users are able to write desired functions onto the program for a specific purpose, and are able to design graphics. Furthermore, users can process data stored in other programs like Excel, SPSS, and SAS, with R-Program. That ability is greatly useful for researchers [5].

The approach of this study is to enhance learning sources in business forecasting techniques which is able to calculate statistics, investigate the forecasting model development, and demonstrate samples, articles research of the former, and suggestion on how to apply the forecast appropriately for responding to the problematic of the research. It is considered widely practical for researchers and students to ease up the studies and quests for statistical data on forecasting techniques.

II. Conceptual Background and Methodology

A. Business Forecasting Technique

Forecasting is about predicting the future by using time series data as accurately as possible. It involved both historical data and knowledge of any events. The major objective of forecasting is to minimize uncertainly and to identify evaluate risk. Modern organizations require short, medium, and long-

This work was supported in finance by the Suan Sunandha Rajabhat University.

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term forecasts to manage business. Business forecasting can be made in various methods. All methods fall into two approached: Qualitative, Quantitative [6-7].

Qualitative models have generally used with short-term forecast by employing the judgment of the appropriate experts. The advantage of this procedure is that we can apply in situation where historical data are not available or there are significant environmental condition changes. The qualitative models include: Delphi Technique, Scenario Writing, and Subjective Approach. Delphi technique develops the forecasts through experts' consensus by asking separately experts to respond initial questionnaire. The second questionnaire is incorporating by whole group. Then, each expert is asked to reconsider or revise his initial response. Delphi technique is not produce single answer, but it attempts to restrict the narrow spread opinions. Scenario writing starts with different sets of assumption. The forecaster would be generated various future scenarios corresponding to the different assumptions. The decision maker decides which scenario is most likely to preponderate. And, Subjective Approach allows individuals brainstorm to generate new ideas or solve complex problems for participating in forecasting decision.

Quantitative methods are based on an analysis of historical time series data. This approach concentrates to predict the long-term quantitative data (e.g. sales, prices, product, etc.) There are two major categories. The first category is called time series method which uses only past data of variables to future forecasts, for example: - Exponential Smoothing Model Holt-Winters Model, MA, AR, ARMA, SARIMA Model, and ARCH.

B. Materials and Methods

The Business Forecasting Techniques learning resources was developed by using C++ and R- program for applying applications and using Microsoft Access for managing database system. The learning media of business forecasting Technique is processed through following steps: 1) Data collection for developing the statistical analysis for techniques by applying R-Program with quantitative methods such as Exponential Smoothing Model Holt-Winters Model, Moving Average Model, Autoregressive Model, Mixed Autoregressive Moving Average Model, Seasonal ARIMA Model, Seasonal ARIMA Model, and Autoregressive conditional Heteroskedasticity. 2) Database design 3) Database and 30 applications establishment 4) Implementation and 5) Evaluation.

There are 2 forms to assess the appropriateness of the business forecasting techniques learning materials. The first form is a quality evaluation form for experts. It contains 3 aspects: Content and presentation (10 items), Font and Color (6 items), and Technical media production (10 items). The other form is Students' survey regarding the easiness of learning resources for business forecasting techniques.

The first evaluation form was administered by 3 experts who are in each following fields; program application, media design, and applied statistics. The 30 students who interested in business forecasting technique are welcome invited to practice the learning media with no limited of usage time. Then they assess the usage of media production. The quantitative approach was used to investigate the descriptive statistics of the evaluation survey.

III. Results

In assessing the descriptive statistics of quality of statistical analysis learning resource for business forecasting techniques by using R programming from the experts' opinions, the evaluation discovered that the quality of such development regarding fonts and colors is in good level; while the overall aspect, contents and presentation are categorized in moderate level. The text and background colors and icon usage are considered easy to use, based on the average of 3.67. Second to the former is the clarity of content explanation, the appropriateness in each section's presentation, the size of fonts, and the design of users' window are rated in average of 3.50, and the appropriateness of language use in icons is graded the least at the average of 2.67. The result was shown as Table I.

TABLE I

QUALITY OF BUSINESS FORECASTING TECHNIQUES LEARNING RESOURCE ACCORDING TO EXPERTS' OPINIONS

Items	$\overline{X}$	S.D.	Assessment
I. Content and Presentation	**3.29**	**0.45**	**Moderate**
1.1 Clarity in describing the content	3.50	0.55	Good
1.2 Amount of content	3.17	0.98	Moderate
1.3 Sequence of content	3.17	0.98	Moderate
1.4 Accuracy of content	3.17	0.41	Moderate
1.5 Accuracy of language used	3.33	0.52	Moderate
1.6 Appropriate in style and presentation	3.17	0.41	Moderate
1.7 Appropriateness of the content presented in each episode	3.50	0.55	Good
II. Font and Color	**3.50**	**0.55**	**Good**
2.1 Format of font used	3.33	0.52	Moderate
2.2 Size of font used	3.50	0.55	Good
2.3 Clarity of text	3.50	0.55	Good
2.4 Color of text	3.67	0.82	Good
2.5 Color of Background	3.67	1.03	Good
2.6 Overall color of screen	3.33	1.03	Moderate
III. Technical media production	**3.28**	**0.52**	**Moderate**
3.1 Screen overall design	3.33	0.52	Moderate
3.2 Appropriateness of the size of the command button	3.17	1.17	Moderate
3.3 Interpretation of the language	2.67	0.52	Moderate
3.4 Speed and accuracy of searching information	3.17	0.41	Moderate
3.5 Availability of the input to the calculation.	3.33	0.81	Moderate
3.6 Speed and accuracy of the Statistical data analysis	3.33	0.52	Moderate
3.7 Flexibility in use	3.33	0.52	Moderate
3.8 Suitability of the design of the home page	3.50	0.55	Good
3.9 Simple and easy to use clicking buttons.	3.67	0.82	Good
3.10 Suitability of the operating instructions	3.33	0.52	Moderate
Total	**3.34**	**0.43**	**Moderate**

The evaluation of students' survey regarding the convenience of the learning media for business forecasting techniques by R programming, it found that the rating of overall aspect is at mostly high level ($\bar{X} = 4.15$), meanwhile the clarity in content explanation is at rather high level ($\bar{X} = 4.43$), and the convenience to input data has the least rate ($\bar{X} = 3.90$). The result was shown in Table II.

TABLE II

QUALITY OF BUSINESS FORECASTING TECHNIQUES LEARNING RESOURCE BY STUDENTS' OPINIONS

Items	$\bar{X}$	S.D.	Assessment
1. Searching form of statistical data	4.27	0.58	**Good**
2. Searching time for statistical data	4.07	0.45	Good
3. Clarity in describing the content.	4.43	0.63	Good
4. Volumes of content.	4.33	0.66	Good
5. Sequence of content presentation	4.27	0.69	Good
6. Accuracy of the content	4.33	0.66	Good
7. Appropriateness of the language used	4.49	0.57	Good
8. Patterns of letters used	3.97	0.81	Good
9. Font size	3.93	0.65	**Good**
10. Font color	4.03	0.81	Good
11. Clarity in describing the content	4.10	0.88	Good
12. Screen Display	4.07	0.74	Good
13. Homepage design	4.10	0.71	Good
14. Command buttons	3.97	0.96	Good
15. Flexible and easy usage	4.13	0.63	Good
16. Speed and accuracy of searching information	4.17	0.75	**Good**
17. Ease to input data	3.90	0.80	Good
18. Speed and accuracy for analyzing data	4.13	0.73	Good
19. Patterns of presenting content	4.23	0.79	Good
20. Manual	4.17	0.75	Good
Total	**4.15**	**0.38**	**Good**

IV. Conclusion

According to the quality of the development of business forecasting techniques by applying R programming indicated that the educational media achieves the good level based on students who interested in business forecasting techniques, and it attains the moderate level from the experts.

This study was intended to be the beginning step for new strategies in learning business forecasting techniques by using R programming. It would be beneficial to those looking for alternative strategies in learning forecasting techniques for students in Thailand. For the further investigation, it should be added more several forecasting model and applied in various aspects in Statistics.

Acknowledgment

The research was successful by many helps from my friends, colleague, and students from Faculty of Science and Technology, Suan Sunandha Rajabhat University. The author really appreciates and many thanks for all.

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INTERDISCIPLINARY APPROACH to the DESIGN of a QUALITY ASSURANCE SYSTEM of HIGHER EDUCATION on the BASIS of the EFQM MODEL

Yskak A.Nabi

Abstract— The article covers the essence of the "quality" category; for the design of the quality assurance system of higher education based on the EFQM model an interdisciplinary approach is taken, in particular there are used the principles of the design of technical systems, some information from the logic, as well as some philosophy and pedagogy concepts; it shows that the design technology consists of three stages, with the characteristic of each stage given; developed a block diagram of technological process of designing the system of quality assurance of higher education based on the EFQM model.

Keywords— design, the EFQM model, an interdisciplinary approach, the quality assurance system.

I. Introduction

In Europe they often use the term "*quality assurance*," which can be understood as "*confidence in quality*." In the Kazakh pedagogical literature "the guarantee of quality" is mentioned. Currently there is a problem of lack of clarity connected with the term "quality assurance," as well as the application of the concepts in different contexts, i.e. there is no unambiguous and clear answer to the question what the quality of education is. The analysis of numerous sources on the problem shows that this is the case for all the attempts to answer the question.

In our opinion, this is connected with the fact that quality is a philosophical category and therefore cannot be identified through other concepts. In this regard, we think it expedient not to take any definitions as a basis of this research or attempt to give our own definition, but consider the quality of education in general, as a concept. Indeed, in the UNESCO program document, quality is defined as "a multilateral concept, covering all the basic functions and types of activity in relation to higher education" [8].

In the previous works we have shown that quality assurance systems are the integrity objects with clear objectives (increasing the effectiveness and efficiency of the activity of an educational institution as well as the development level of the participants of educational activity) and functional set of components, so they can be regarded as educational systems. The result of the completed pedagogical research on the creation of the system is the appropriate project, so we raise the problem of instructional design. The controversy surrounding the possibility of designing complex systems in social sphere still exists. This is due to the fundamental problem of the completeness of each constructed model. No model, even very complex one, cannot either give a complete representation of the subject under research or accurately predict its development, or describe the pattern of its movement in its own space. Scientists when designing the systems have to balance on the border of their completeness and validity. The increase in the importance of interdisciplinary research in education together with the enhance of integrative function of pedagogical science, marked by V.Kraevski [7] are associated with the use of knowledge derived from other scientific disciplines and appear as one of the methodological conditions of modeling and design in educational sphere. Any judgments on such a complex issue must be based on deep analysis [2].

Considering the foregoing thesis, we have the task of designing the system of quality assurance for higher education based on the EFQM model and the interdisciplinary approach. We will use the principles of design of technical systems, some information from the logic, and some philosophical and pedagogical concepts.

II. Technical Systems Design Philosophy

Design is a process that initiates the changes in the artificial environment, so technical systems can be described as the activity on creation (design, planning, and construction) of any system, object or model. Therefore, the main principle of design of technical systems is the use of scientific concepts, technical information and imagination to identify the mechanical structure of the machine or system intended to fulfill the pre-defined functions with the greatest efficiency and effectiveness. On this basis it is generally accepted that design is something what architects, engineers, artists of applied art, etc. make when creating drawings for their clients and for the purposes of production [2].

The American Heritage Dictionary defines design as: "To conceive or fashion in the mind; invent," and "To formulate a plan", and defines engineering as: "The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems."[1].

In general engineers put into practice 8 stages of design and construction:

1. Initial Contact
2. Preliminary Works Stage
3. Contract Stage
4. Approvals Stage
5. Selections Stage
6. Construction Stage
7. Completion and Handover Stage
8. Maintenance Stage [9].

Thus, the design is aimed at creating of models of planned (prospective) processes and phenomena, in contrast to modeling, which can be extended to the past experience with a view to its deeper reflection. The components of the project activity can be represented by particular models or modules (functional units that combine a set of elements). Human project activity is determined by one's ability to build something in one's mind, invent the ideal models, only partially reflecting the real situation.

III. The Technology of Designing the System of Quality Assurance of Higher Education on the Basis of the EFQM Model

Literature on design and its methods began to appear in the industrialized countries in the 50-60-ies of the XIX century [2]. Since then, along with the traditional methods a lot of new, particularly in the social sphere have appeared [5].

Austrian scientist Kurt Gedel has proved two famous theorems of incompleteness and consistency of formal systems. Based on this it can be concluded that the uncertainty will be greater when designing social systems, including educational ones. E.N.Gusinsky has formulated the principle of the uncertainty for the academic systems, according to which the results of interaction and development of the academic systems cannot be predicted in detail [6]. Therefore, for such systems they apply the probabilistic design.

The instructional design is an activity of subject or subjects of education, aimed at the construction of models for transformation of the pedagogical reality. The essence of the instructional design consists in the identification and analysis of pedagogical problems and causes of their origin, building axiological bases and strategies of design, identification of objectives and tasks, search of methods and means to implement the educational project.

The essence of the design of an educational system is that it is the **process** of adjustment of the system characteristics for achieving or improving their effectiveness, adaptation and efficiency, so the subject of design of the quality assurance system of higher education is changing of the status of the object of the design through implementation of ideas to assure the quality of education. According to A. C. Boyarintseva, the subject of the design is the form of existence of the relationship of subject and object of design [3]. In this case, the object of design is the educational system, created for solving specific didactic tasks in a specific sphere, i.e. in the sphere of organization and management of the educational system. In this connection, the **objective of design** is to develop a new system based on the EFQM model, and **the result** will be a set of regulatory, technological, organizational documentation that is necessary to assure the system serviceability.

Implementation of the design process requires the development of appropriate technology. As is known, the **design technology** is a sequence of activities allowing to technically perform the design of the specified object; contains a number of essential components, which are listed in the model scheme of the design process.

Thus, there is a need for detailed description of the activities on designing the system, a clear definition of design stages, and the identification of the design task. Classical is J.C.Jones's view that the design process in its development goes through three stages [4]. Based on this provision, as well as on the results of our own studies on development of theoretical and methodological basis of the design of the system of quality assurance for higher education on the basis of the EFQM model, we believe that the design of the system should be implemented in 3 stages:

1. **Preliminary preparation**: **identifying the objective and the expected results, development** of methodological and theoretical aspects of the design;

2.**development the design technology** as the sequence of activities intended for achieving the **anticipated results** of the design;

3. approbation of **design technology** and evaluation of the project efficiency.

Similarly to the design stages, the design technology is also divided into 3 stages:

1) **Preliminary preparation**, which is an implementation of the practical part in the developed models (models of subsystem of quality management, model of subsystem of internal quality assurance, model of subsystem of quality confirmation). After identifying the functions of educational activity in accordance with the criteria of the EFQM model you will need the decomposition, which is the process of dividing the overall objective of the designed system into separate sub- objectives in accordance with the selected model. Functions of the project activity are complex and multifaceted, and decomposition will allow dismembering all the work on realization of the models into a set of detailed jobs that allows solving the problems of their rational organization, monitoring, control, etc. After justification input and output parameters of the model, you need to aggregate them, i.e. to connect the "inputs" and "outputs", adjusting them to each other. For transition to the next stage of the process the study of the conditions is not unimportant.

2) **Technical design** represents work on the basis of analytical reports on the implementation of the first stage in accordance with the "functioning" parameter of the developed models, taking into account the fact that the specified parameter in the models corresponds to the matrix of RADAR indicators of the EFQM model.

3) Full-scale development, consisting in the development of operating documentation: regulations, plans, schemes, calculations, innovative educational technologies, methodologies, etc.

Each preceding stage is aimed to achieve its specific objectives so that to provide us with the real opportunity to move to solving the tasks of the next work phase. Each following stage is deepening and enhancing the results of the preceding stage. The final results of work are mostly determined by the mutual influence of the results achieved at separate phases of work.

Having considered the above stages one can see that we have transferred design patterns of technical systems to the design of social systems. Indeed, the terms "technical design", "full-scale development" are typical for technical systems. We believe that design should be based on scientific methods, well-proven not only in the related spheres, but also in those where it is impossible at first sight to find an analogy, conventional schemes, or developed methods. At the same time, we believe that the design of such a complex system, which our object is, shall be the responsibility of the experts, familiar with the methodology of the design of educational systems, having experience, or at least scientific intuition. We agree with the opinion of A. V. Boyarintseva that the design process shall be proceeding in specially organized designing activities aimed at the working out of the project of the development of the institution. Indeed, the design activities is carried out directly by professional engineers or by teaching staff either alone or in cooperation and under the guidance of the experts in the field of development of educational systems. This author's idea is well compatible with the idea of interdisciplinary approach, since the engineers get specific instruction and training in technical universities. Therefore, in our opinion, the system design should be performed by the engineers that are professional scientists who have mastered the design of educational systems and, if possible, by the representatives of educational institutions, directly implementing the educational-scientific-training process or managing the activities of the institution.

To organize of activity of professional engineers, the staff and stakeholders, we have developed a block scheme of the technological process considered (figure 1). The scheme displays the attempt to re-apply the patterns of mechanical systems design to the design of a social system. Indeed, in the left part of the scheme, the sequence of design stages is shown, with each block having two outputs: "yes" and "no." Then, depending on the response there is an alternative for further steps. In the right part there are blocks, representing the existing system and the planned one, and besides the latter lists all three subsystems. Blocks related to the newly designed system, are enclosed in a polygon, bounded with thin lines and slightly colored. The transition from the left blocks to the right ones enables the serial design of subsystems, which ultimately will result in the project of the entire system, or, in the case of output "no" will return to the existing system. In case of positive results you can move on to the next phase of the design process that is to the approbation of the technology and evaluation of the design effectiveness.

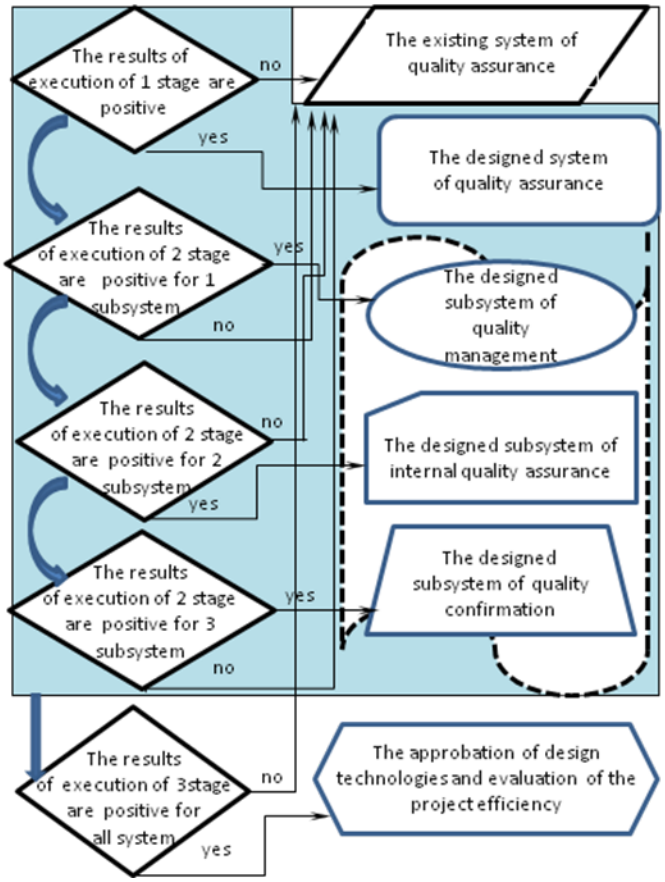

Fig.1 Block scheme of technological process of designing of the quality assurance system of higher education on the basis of the EFQM model

IV. Conclusions

The interdisciplinary approach to the design of the quality assurance system of higher education on the basis of the EFQM model has enabled all-round analysis of the issue and practical implementation of the objective.

The proposed construction of the block scheme of the technological process of designing the system promotes the principles of design of technical systems, the laws of logic, philosophical and pedagogical concepts.

The block scheme developed is used as the foundation of technological process implementation chart for each subsystem. Future research will be focused on determining the effectiveness of the design of the quality assurance system of higher education on the basis of the EFQM model from the views of the interdisciplinary approach.

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Towards a new approach for constructing concept maps based on fuzzy logic

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***Abstract*—** In recent years, adaptive learning systems rely increasingly on concept maps to customize the educational logic developed in their courses. Most approaches do not take into account the possibility of combining the concept maps predefined by experts of field and those developed automatically using the Fuzzy Sets Theory. In this article, we present a hybrid approach using on the one hand the feedback from experts of domain to select, prioritize relevant concepts and create prerequisite relationships to get the initial concept map, on the other hand we use the fuzzy logic to measure relevance degree of all relationships existing in this concept map, these links are considered as fuzzy relationships. With this approach we got two types of prerequisite relationships between concepts, the first type can be classified as relationships correctly established by the expert. These relationships must be kept in the final concept map. The second type can be considered as relationships incorrectly established by the expert, because the concepts involved in these relationships are independent, in this case these relations must be deleted or substituted with the inverse of the original relations, or because the items used in evaluations of these concepts, connected by erroneous relations, are inappropriate and must to be reviewed.

Keywords*—Concept map; Fuzzy Sets Theory; Adaptive Learning Environments; Fuzzy prerequisites relationships; Data mining.*

I. INTRODUCTION

Since 1998, Novak developed the theory of meaningful learning, based on the concept maps to facilitate the students for understanding certain scientific concepts [1-2], this theory gave birth to teaching by objectives. The big idea of this pedagogy involves cutting of knowledge in as many teachable units, the selection criterion is, above all, the possibility of acquisition related to the evaluation and the knowledge that if you cut enough , it is always possible for a learner to learn and the tutor to assess the acquisition [3] . Concept maps have the advantage of reproducing the conditions of development of thought, as presupposed by the assimilation theory [4] and these concept maps are an excellent teaching tool in adaptive learning systems. In fact relations between the prerequisite relationships among concepts in the map must beings established with maximum certainty that allows the learner to follow a logical process of learning. However, it is not easy to predict in some way a link between two concepts is a prerequisite relationships or not. Indeed the Fuzzy Sets Theory (Fuzzy Sets Theory - FST) is the most appropriate technical to build fuzzy prerequisite relationships with their relevance degree among learning concepts for creating the concept map in a particular field [5].

The following section presents a brief overview of some existing approaches for the concept maps constructing process and discusses their limits.

II. SOME EXISTING APPROACHES FOR THE CONCEPT MAPS CONSTRUCTING PROCESS

A. Approach based on methods of neuro linguistic programming (NLP)

This approach, using methods of neural linguistic programming NLP are used in information retrieval. This approach is generally used in areas such as construction of automatic summarization, information retrieval in documents and metadata documents [6], and the creation of conceptual maps for unstructured sources data [7]. It is also used to extract a summary of an original document without any change [8]. This approach is applicable only for the language is technical tools and methods are not available for many languages.

B. Approach based on Fuzzy Sets Theory (FST)

Several learning systems use this approach on a number of different methods of fuzzy logic [9-13]. Sue et al. used a two-phase method that extracts the association rules between the concepts by applying fuzzy logic to convert the grades learners into three levels of difficulty and construct a concept map [14]. Bai and Chen simplified and improved the latter method in adaptive way [15]. Wang based on the FST has developed another method for the non-explicit links between concepts [16]. These methods mentioned above do not take into account the possibility of combining the concept maps predefined by experts of field and the automatic generation of these concepts map from the evaluation results obtained by learners during of process learning.

In this paper, a new approach is proposed to build fuzzy prerequisite relationships with their relevance degree among learning concepts for creating the concept map in a particular area.

III. FUZZY SETS THEORY (FST)

Since 1965, the Fuzzy Sets Theory has advanced in a variety of ways and in many disciplines. Fuzzy sets were introduced by Zadeh [17, 18, and 19] to represent mathematically the vagueness on certain classes of objects and provide the basis for fuzzy logic.

The fuzzy sets were introduced to model human knowledge representation, and thus improve the performance of systems that use this modelling decision. Fuzzy sets admit gradation such as all tones between black and white. A fuzzy set has a graphical description that expresses how the transition from one to another takes place. This graphical description is called a membership function.

A fuzzy part (or fuzzy set) of a set E is an application $\mu_A(x)$: E ➔ [0, 1]:

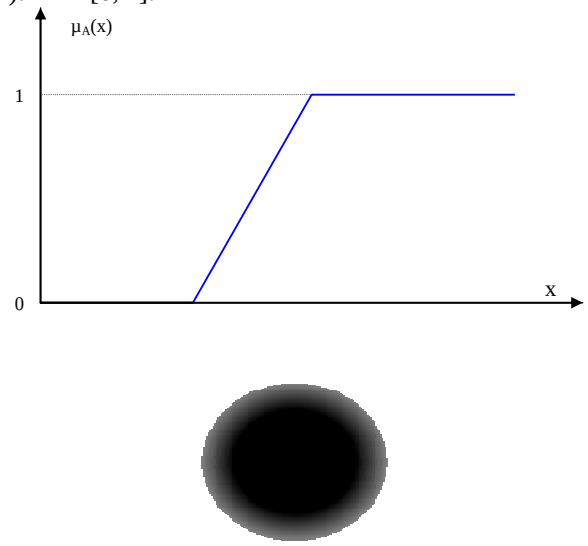

Fig. 1. *$\mu_A(x)$: A membership function . The gray level indicates the degree of membership*

IV. OUR PROPOSED APPROACH

In our approach we follow three phases to build the concept map of a specific area. The first phase determines an initial predefined concept map, the second phase mine the association rules between the concepts from the numeric testing records of learners, in the third phase we propose to build fuzzy prerequisite relationships with their relevance degree among learning concepts.

A. First phase: define an initial concept map

For an expert in a particular field, the presentation of the methodology and sequence to be used for the construction of concept maps is achievable by following the steps below described by Novak [2]:

Step 1: Identify all the domain concepts, then make a classification of these concepts in descending order of importance.

Step 2: Start building the map starting with the more general concept (at the top of the map) to go to the most specific concept (located at the bottom of the map), by establishing, progressively, the all relationships that may appear between the relevant concepts.

At the end we will have an initial concept map as shown in figure below:

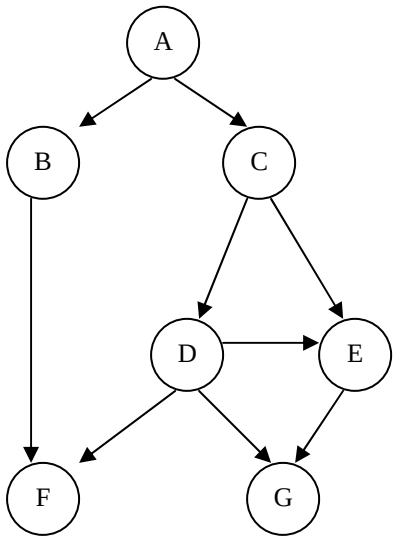

Fig. 2. *Example of an initial concept map prepared by an expert in a specific field*

The Figure 2 shows an example of a concept map of a course containing 10 relevant concepts, and prerequisite relationships among them.

From the links of the concept map we define the matrix M of prerequisites between concepts, where the value of each element M_{ij} is calculated as below:

M_{ij} = 1 means the concept « i » is a prerequisite of the concept « j ».

M_{ij} = 0 means the concept « i » is not a prerequisite of the concept « j ».

« i » represents the rows and « j » the columns.

Table 1 below, shows a matrix representation ($\mathbf{M_{ij}}$) of initial predefined concept map of the figure 2.

For example, the first line means that the concept A is a prerequisite of the concepts B and C.

TABLE I. MATRIX REPRESENTATION OF INITIAL PREDEFINED CONCEPT MAP

$\mathbf{M_{ij}}$	A	B	C	D	E	F	G
A	0	1	1	0	0	0	0
B	0	0	0	0	0	1	0
C	0	0	0	1	1	0	0
D	0	0	0	0	1	1	1

E	0	0	0	0	0	0	1
F	0	0	0	0	0	0	0
G	0	0	0	0	0	0	0

B. Second phase : fuzzification of learners' testing records

1) Retrieving digital data

In this sub-phase, we retrieve the numerical grades obtained during assessments of each student in each concept in a learning process [20]. These grades are collected in a matrix called the matrix grades: Grades (Learner (Si), Concept (i)) such as:

TABLE II. MATRIX REPRESENTATION OF INITIAL PREDEFINED CONCEPT MAP EXAMPLE OF NUMERICAL GRADES

Grades	A	B	C	D	E	F	G
S_1	10	10	1	3	7	9	3
S_2	11	12	5	7	11	11	7
S_3	10	11	5	3	8	10	5
S_4	13	10	6	6	10	10	10
S_5	15	18	10	12	16	16	15
S_6	19	18	6	10	14	19	13
S_7	12	11	1	5	6	10	4
S_8	3	4	0	2	5	7	5
S_9	15	16	6	10	11	18	13
S_{10}	12	14	5	3	0	13	0

Table 2 shows an example of 10 students and their grades within 7 concepts that constitute the initial conceptual map.
Where:
The maximum score that a student can have in an assessment is equal to 20.

2) Measure of variation of grades

In this sub-phase, we measure the variation of grades of all prerequisite relationships of initial predefined concept map.
The Matrix of variation of grades ΔGrades (i, j) is calculated using the both matrix:

- Matrix Grades $_{(\text{Learner (Si), Concept (i)})}$
- Matrix Mij

$\Delta\text{Grades (i, j)}_{\text{Learner}}$ = [Grade (j) – Grade (i)] with $M_{ij} = 1$ i.e the concept « i » is a prerequisite of the concept « j ».

And $-20 \leq \Delta\text{Grades} \leq 20$

In table bellow we proposer an example of matrix ΔGrades (i, j) based on the data of the tables 1 and 2:

TABLE III. MATRIX OF VARIATION OF GRAGES OF INITIAL MAP

ΔGrades	A ↓ B	A ↓ C	B ↓ F	C ↓ D	C ↓ E	D ↓ E	E ↓ G	D ↓ G	D ↓ F
S_1	0	-9	-1	2	6	4	-4	0	6
S_2	1	-6	-1	2	6	4	-4	0	4
S_3	1	-5	-1	-2	3	5	-3	2	7
S_4	-3	-7	0	0	4	4	0	4	4
S_5	3	-5	-2	2	6	4	-1	3	4
S_6	-1	-13	1	4	8	4	-1	3	9
S_7	-1	-11	-1	4	5	1	-2	-1	5
S_8	1	-3	3	2	5	3	0	3	5
S_9	1	-9	2	4	5	1	2	3	8
S_{10}	2	-7	-1	-2	-5	-3	0	-3	10

3) Prerequisite relationships fuzzification

The fuzzy set theory is used to simplify the analysis of the numerical results of the evaluations of learners with transforming their digital data in membership functions.
In our approach this theory is applied to the prerequisite relationships of initial concept map.

Let X a set of prerequisite relationships of initial concept map.
Let CPR a fuzzy subset of prerequisite relationships that can be classified as a correct prerequisite relationships between concept « i » and concept « j ».

$$CPR = \{(k, \mu_{CPR}(k)) / k \in X\}$$

Where:

$\mu_{CPR}(k)$ Is the membership function of CPR, the values of this function present the relevance degree of each link « k » in the fuzzy set CPR.

Let RPR a fuzzy subset of links that can be classified as wrong prerequisite relationships between concept « i » and concept « j », but can be classified also as a correct prerequisite relationships between concept « j » and concept « i ».

$$RPR = \{(k, \mu_{RPR}(k)) / k \in X\}$$

Where:

$\mu_{RPR}(k)$ is the membership function of RPR, the values of this function present the relevance degree of each link « k » in the fuzzy set RPR.

The definition of the two membership functions of fuzzy sets $\mu_{CPR}(k)$ and $\mu_{RPR}(k)$ is based on the indicator expressed as « variation of grades of all prerequisite relationships of initial predefined concept map (ΔGrades) » (this indicator is calculated in the above section "*Measure of variation of grades*").
To calculate the parameters of the two functions $\mu_{CPR}(k)$ and $\mu_{RPR}(k)$, we will based on our experience feedback.

ISBN: 978-1-61804-238-5

$$\mu_{CPR}(k) = \begin{cases} 0 & \text{if } \Delta Grades < S1 \\ \frac{-1}{S1}\Delta Grades + 1 & \text{if } S1 \le \Delta Grades \le 0 \\ \frac{-1}{S2}\Delta Grades + 1 & \text{if } 0 < \Delta grades \le S2 \\ 0 & \text{if } \Delta Grades > S2 \end{cases}$$

$$\mu_{RPR}(k) = \begin{cases} 0 & \text{if } \Delta Notes < 0 \\ \frac{1}{S2}\Delta Notes & \text{if } 0 \le \Delta Notes \le S2 \\ \frac{-(\Delta Notes + S3)}{S3 - S2} & \text{if } S2 < \Delta Notes \le S3 \\ 0 & \text{if } \Delta Notes > S3 \end{cases}$$

Where:
The three thresholds S1, S2 and S3 are defined in collaboration with experts in the field studied.
In our approach the threshold values are chosen as follows:
S1 = variation of -5 grades
S2 = variation of 5 grades
S3 = variation of 10 grades
Then the two functions $\mu_{CPR}(k)$ and $\mu_{RPR}(k)$ becomes:

$$\mu_{CPR}(k) = \begin{cases} 0 & \text{if } \Delta Grade s < -5 \\ \frac{1}{5}\Delta Grades + 1 & \text{if } -5 \le \Delta Grade s \le 0 \\ \frac{-1}{5}\Delta Grade s + 1 & \text{if } 0 < \Delta grade s \le 5 \\ 0 & \text{if } \Delta Grade s > 5 \end{cases}$$

$$\mu_{RPR}(k) = \begin{cases} 0 & \text{if } \Delta Grades < 0 \\ \frac{1}{5}\Delta Grades & \text{if } 0 \le \Delta Grades \le 5 \\ \frac{-1}{5}\Delta Grades + 2 & \text{if } 5 < \Delta grades \le 10 \\ 0 & \text{if } \Delta Grades > 10 \end{cases}$$

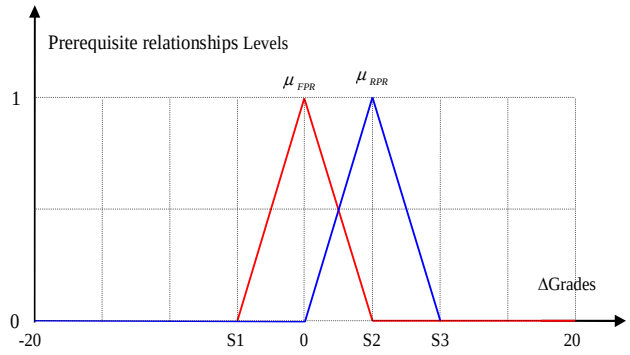

Fig. 3. membership functions

4) Results of prerequisite relationships fuzzification

Table 4 shows the result of prerequisite relationships fuzzification.

This result will be denoted matrix of fuzzy prerequisite relationships (M-FPR).

TABLE IV. RESULT OF PREREQUISITE RELATIONSHIPS FUZZIFICATION

	A ↓ B		A ↓ C		B ↓ F		C ↓ D		C ↓ E	
	μ(CPR)	μ(RPR)	μ(CPR)	μ(RPR)	μ(CPR)	μ(RPR)	μ(CPR)	μ(RPR)	μ(CPR)	μ(RPR)
S_1	1,00	0,00	0,00	0,00	0,80	0,00	0,60	0,40	0,00	0,80
S_2	0,80	0,20	0,00	0,00	0,80	0,00	0,60	0,40	0,00	0,80
S_3	0,80	0,20	0,00	0,00	0,80	0,00	0,60	0,00	0,40	0,60
S_4	0,40	0,00	0,00	0,00	1,00	0,00	1,00	0,00	0,20	0,80
S_5	0,40	0,60	0,00	0,00	0,60	0,00	0,60	0,40	0,00	0,80
S_6	0,80	0,00	0,00	0,00	0,80	0,20	0,20	0,80	0,00	0,40
S_7	0,80	0,00	0,00	0,00	0,80	0,00	0,20	0,80	0,00	1,00
S_8	0,80	0,20	0,40	0,00	0,40	0,60	0,60	0,40	0,00	1,00
S_9	0,80	0,20	0,00	0,00	0,60	0,40	0,20	0,80	0,00	1,00
S_{10}	0,60	0,40	0,00	0,00	0,80	0,00	0,60	0,00	0,00	0,00
AVG	**0,72**	**0,18**	**0,04**	**0,00**	**0,74**	**0,12**	**0,52**	**0,40**	**0,06**	**0,72**

	D ↓ E		E ↓ G		D ↓ G		D ↓ F	
	μ(CPR)	μ(RPR)	μ(CPR)	μ(RPR)	μ(CPR)	μ(RPR)	μ(CPR)	μ(RPR)
S_1	0,20	0,80	0,20	0,00	1,00	0,00	0,00	0,80
S_2	0,20	0,80	0,20	0,00	1,00	0,00	0,20	0,80
S_3	0,00	1,00	0,40	0,00	0,60	0,40	0,00	0,60
S_4	0,20	0,80	1,00	0,00	0,20	0,80	0,20	0,80
S_5	0,20	0,80	0,80	0,00	0,40	0,60	0,20	0,80
S_6	0,20	0,80	0,80	0,00	0,40	0,60	0,00	0,20
S_7	0,80	0,20	0,60	0,00	0,80	0,00	0,00	1,00
S_8	0,40	0,60	1,00	0,00	0,40	0,60	0,00	1,00
S_9	0,80	0,20	0,60	0,00	0,40	0,60	0,00	0,40
S_{10}	0,40	0,00	1,00	0,00	0,40	0,00	0,00	0,00
AVG	**0,34**	**0,60**	**0,66**	**0,00**	**0,56**	**0,36**	**0,06**	**0,64**

C. Third phase: concept map constructing process

1) Algorithm

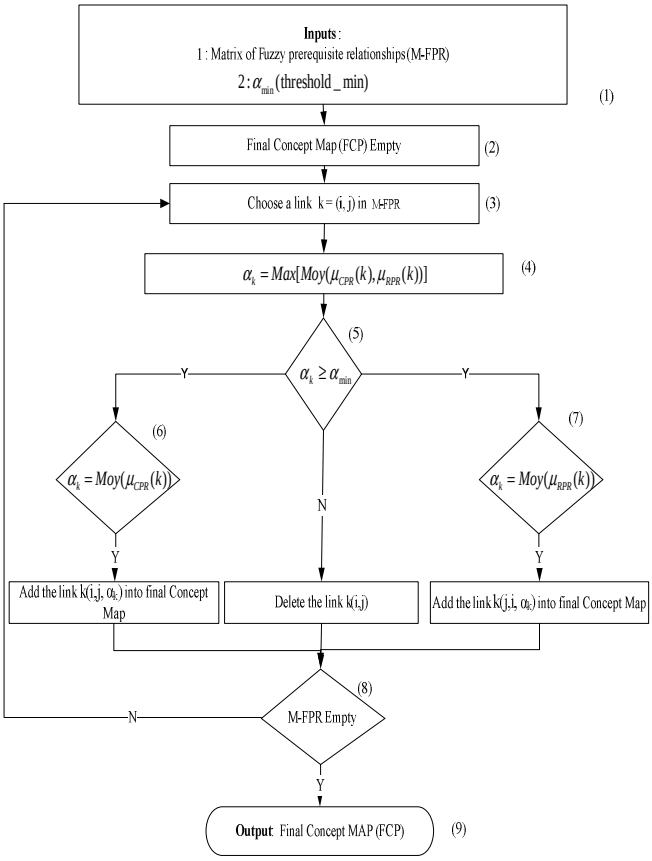

Fig. 4. Algorithm of concept map constructing process

2) Fuzzy data mining

In last step we use the algorithm above for mining the prerequisite relationships with their relevance degree and generate the final concept.

Input data of the algorithm are:

- Matrix of fuzzy prerequisite relationships (M-FPR)
- A threshold minimum of prerequisite relationships is a threshold that indicates the prerequisite relationships meaningful in the construction process.

At first, the final concept map is empty.

For each link « k » existing in the matrix of fuzzy prerequisite relationships we test:

If the value of maximum of average of each membership functions $\mu_{FPR}(k)$ and $\mu_{RPR}(k)$ is greater or not than the threshold minimum.

At the end, the link (k) may be:

- Add in the final concept map in the same direction between his two concepts with a relevance degree equal to α_k.
- Add in the final concept map in the opposite direction of the initial link with a relevance degree equal to α_k.
- Delete and it is not included in the final concept map.

3) Example of Concept map constructing process

We will apply this algorithm to the data (M-FPR) of the table 4

Input data of the algorithm are:

- Matrix of fuzzy prerequisite relationships (M-FPR) of table 4.
- A threshold minimum α_k=0,5

Thus, the final concept map is:

Initial MAP	A ↓ B	A ↓ C	B ↓ F	C ↓ D	C ↓ E	D ↓ E	E ↓ G	D ↓ G	D ↓ F
TFS	μ(CPR) μ(RPR)	μ(CPR) μ(RPR)	μ(CPR) μ(RPR)	μ(CPR) μ(RPR)	μ(CPR) μ(RPR)	μ(CPR) μ(RPR)	μ(CPR) μ(RPR)	μ(CPR) μ(RPR)	μ(CPR) μ(RPR)
AVG	0,72 0,18	0,04 0,00	0,74 0,12	0,52 0,40	0,06 0,72	0,34 0,60	0,66 0,00	0,56 0,36	0,06 0,64
Degree of relevance	0,72	-	0,74	0,52	0,72	0,60	0,66	0,56	0,64
Relationships	kept link	deleted link	kept link	kept link	substituted link	substituted link	kept link	kept link	substituted link
Final MAP	A ↓ B	-	B ↓ F	C ↓ D	E ↓ C	E ↓ D	E ↓ G	D ↓ G	F ↓ D

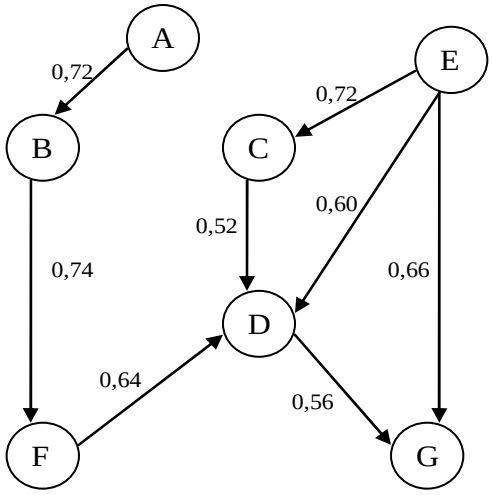

Fig. 5. Final concept map

V. CASE STUDY

In this section, we propose an implementation of our approach in the Java programming language field.

A. Define an initial concept map of JAVA programming language

1) Concepts chosen for the course of the JAVA programming language

For this course were selected following 12 concepts:

1) Elementary of Java
2) Objects and Classes
3) Packages
4) Inner Classes
5) Flux I/O
6) Exceptions
7) Inheritance
8) Serialization
9) Interfaces
10) Polymorphism
11) Threads
12) Collections

2) Initial concept map of the JAVA programming language:

Figure below shows the initial conceptual map selected:

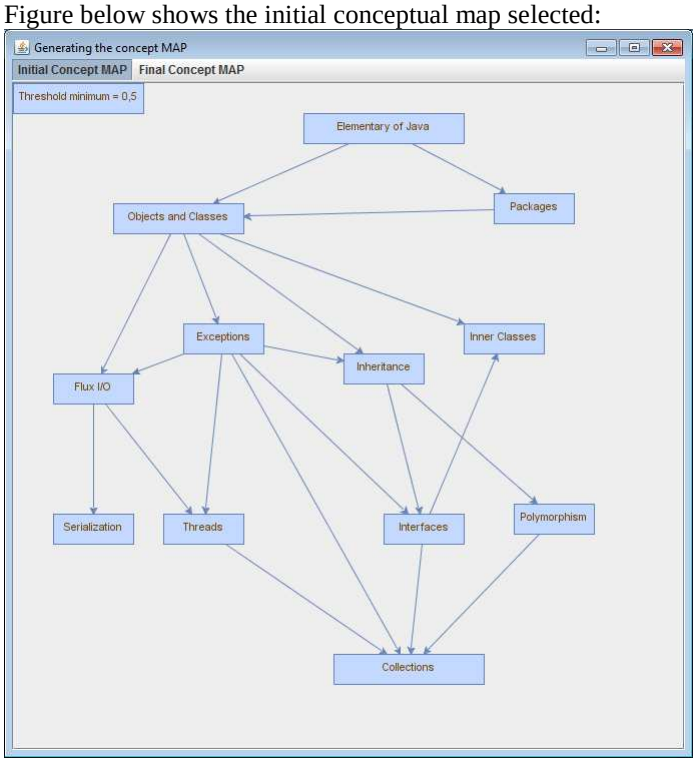

Fig. 6. Initial concept map of Java

B. Generating the final concept map of JAVA programming language

For this case study we have chosen a minimum α_k=0,5

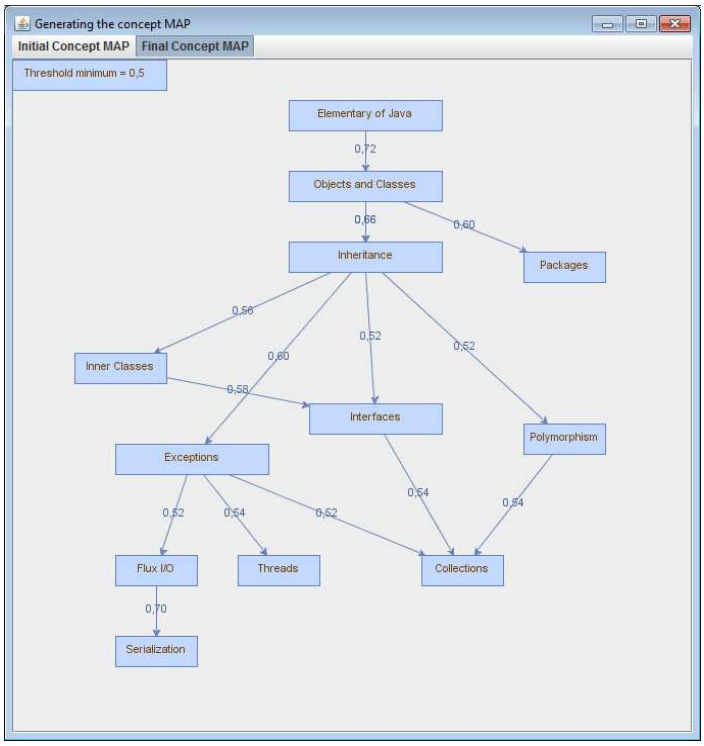

Fig. 7. Final concept map of Java

VI. CONCLUSION

In this paper we present a new hybrid approach to construct the concept map of a specific field, this approach is based on using a predefined expert concept map and we measure the degree of relevance of all relationships existing in this predefined expert concept map. This new approach improves the educational protocol to obtain two kinds of prerequisite relationships, the first type can be classified as relationships correctly established by the expert. These relationships must be kept in the final concept map. The second type can be considered as relations incorrectly established by the expert, these relations must be deleted or substituted with the inverse of the original relationships. For the second type we conclude that there is no correlation between the results obtained and the skills of learners, which can be explained by one or both of the following reasons:

- The use of inappropriate items in the tests of the two concepts
- The two concepts of this relationship are completely independent.

The results obtained from the application of this new approach on the course of JAVA programming language are good.

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ISBN: 978-1-61804-238-5