RECENT ADVANCES in EDUCATIONAL TECHNOLOGIES and EDUCATION

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

Interlaken, Switzerland
February 22-24, 2014

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Plenary Lecture 1

Discrete Lyapunov Controllers for an Actuator in Camless Engines

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Abstract: This paper deals with a hybrid actuator composed by a piezo and a hydraulic part controlled using two cascade Lyapunov controllers for camless engine motor applications. The idea is to use the advantages of both, the high precision of the piezo and the force of the hydraulic part. In fact, piezoelectric actuators (PEAs) are commonly used for precision positionings, despite PEAs present nonlinearities, such as hysteresis, satura- tions, and creep. In the control problem such nonlinearities must be taken into account. In this paper the Preisach dynamic model with the above mentioned nonlinearities is considered together with cascade controllers which are Lyapunov based. The sampled control laws are derived using the well known Backward Euler method. An analysis of the Backward and Forward Euler method is also presented. In particular, the hysteresis effect is considered and a model with a switching function is used also for the controller design. Simulations with real data are shown.

Brief Biography of the Speaker: Paolo Mercorelli received the (Laurea) M.S. degree in Electronic Engineering from the University of Florence, Florence, Italy, in 1992, and the Ph.D. degree in Systems Engineering from the University of Bologna, Bologna, Italy, in 1998. In 1997, he was a Visiting Researcher for one year in the Department of Mechanical and Environmental Engineering, University of California, Santa Barbara, USA. From 1998 to 2001, he was a Postdoctoral Researcher with Asea Brown Boveri, Heidelberg, Germany. From 2002 to 2005, he was a Senior Researcher with the Institute of Automation and Informatics, Wernigerode, Germany, where he was the Leader of the Control Group. From 2005 to 2011, he was an Associate Professor of Process Informatics with Ostfalia University of Applied Sciences, Wolfsburg, Germany. In 2010 he received the call from the German University in Cairo (Egypt) for a Full Professorship (Chair) in Mechatronics which he declined. In 2011 he was a Visiting Professor at Villanova University, Philadelphia, USA. Since 2012 he has been a Full Professor (Chair) of Control and Drive Systems at the Institute of Product and Process Innovation, Leuphana University of Lueneburg, Lueneburg, Germany.
Research interests: His current research interests include mechatronics, automatic control, signal processing, wavelets; sensorless control; Kalman filter, camless control, knock control, lambda control, robotics.

The full paper of this lecture can be found on page 19 of the Proceedings of the 2014 International Conference on Circuits, Systems and Control, as well as in the CD-ROM proceedings.

Plenary Lecture 2

EMG-Analysis for Intelligent Robotic based Rehabilitation

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Abstract: The establishment of wireless sensor network (WSN) technology in physiotherapy and rehabilitation is a clue for improvement of the thera- peutic process, quality assessment and development of supporting tech- nologies such as robotics. Especially for complex therapeutic interventions such as sensorimotor training, a continuous monitoring during the ther- apy as well as for all sessions would be quite useful. For the usage of robotic support in rehabilitation various input informa- tion about the status of patient and his/her activity status of various muscles have to be detected and evaluated. The critical point for robotic intervention is the response time. Under physiotherapeutic and rehabilita- tion conditions, the robotic device should be able to react differently and in various patterns. A complex analysis procedure of input signals such as EMG is essential to ensure an effective response of the robot. However sensor nodes in a wireless (body) area network have limited resources for calculating and storage processes. A stepwise procedure with distributed analysis tasks is proposed. Electromyogram (EMG) measurements of eight muscles were collected and evaluated in an experimental setting of a sensorimotor training using different types of balance boards. Fast and easy methods for detection of activity and rest states based on time domain analysis using low pass IIR filter und dynamic threshold adaption. These procedures can be done on the sensor nodes themselves or special calculation nodes in the network. More advanced methods in frequency domain or analysis of dynamical system behavior request much more system power in calculation as well as storage. These tasks could be done on the level of mobile devices such as mobile phones or tablet computer. A broad range of resources can be provided by cloud/internet. Such level based organization of analysis and system control can be com- pared with biological systems such as human nervous system.

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Plenary Lecture 3

Atmospheric Boundary Layer Effects on Aerodynamics of NREL Phase VI Windturbine in Parked Condition

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Abstract: In a natural condition, the wind is affected by the groundcover and the type of terrains which impose vertical velocity profile to the wind. This wind profile, which is also called atmospheric boundary layer (ABL), dramatically influences the aerodynamic behaviors and loadings of horizontalaxis wind turbines. However, for the sake of simplicity, many numerical simulations only deal with the uniform wind speed. To consider the effects of the ABL, numerical simulations of the two-bladed NREL Phase VI wind turbines aerodynamicat the parked condition are conducted under both uniform and ABL. The Deaves-Harris (DH)model is applied to the ABL. The wind turbine blades are kept at the six o'clock position and are considered at two different pitch angles. The aerodynamic forces and moments of the uniform the DH model are compared.The results show that the pitch angle at which the HAWT is parked plays an important role on the blade loading. Also it is observed that for the fully separated conditions, the Down-blade and the blade in the uniform wind are under approximately similar aerodynamic loadings, while the Up-blade encounters more aerodynamic loads, which is even noticeable value for this small wind turbine. This in turn means that for an appropriate and exact design, effects of ABL should be considered with more care.

Brief Biography of the Speaker: Dr. Mohammad Moshfeghi works in Multi-phenomena CFD Engineerng Research Center (ERC) Sogang University, Seoul, South Korea. He is also Lecturer in Qazvin Azad University. He has a registered patent: "Split-Blade For Horizontal Axis Wind Turbines" (Inventors: Mohammad Moshfeghi, Nahmkeon Hur).

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Plenary Lecture 4

Laminar and Turbulent Simulations of Several TVD Schemes in Two-Dimensions

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Abstract: This work, first part of this study, describes five numerical tools to perform perfect gas simulations of the laminar and turbulent viscous flow in two-dimensions. The Van Leer, Harten, Frink, Parikh and Pirzadeh, Liou and Steffen Jr. and Radespiel and Kroll schemes, in their first- and second-order versions, are implemented to accomplish the numerical simulations. The Navier-Stokes equations, on a finite volume context and employing structured spatial discretization, are applied to solve the supersonic flow along a ramp in two-dimensions. Three turbulence models are applied to close the system, namely: Cebeci and Smith, Baldwin and Lomax and Sparlat and Allmaras. On the one hand, the second-order version of the Van Leer, Frink, Parikh and Pirzadeh, Liou and Sreffen Jr., and Radespiel and Kroll schemes is obtained from a "MUSCL" extrapolation procedure, whereas on the other hand, the second order version of the Harten scheme is obtained from the modified flux function approach. The convergence process is accelerated to the steady state condition through a spatially variable time step procedure, which has proved effective gains in terms of computational acceleration (see Maciel). The results have shown that, with the exception of the Harten scheme, all other schemes have yielded the best result in terms of the prediction of the shock angle at the ramp. Moreover, the wall pressure distribution is also better predicted by the Van Leer scheme. This work treats the laminar first- and second-order and the Cebeci and Smith second- order results obtained by the five schemes.

Brief Biography of the Speaker: Professor Edisson Sávio de Góes Maciel was born in Recife, Pernambuco, Brazil in 1969, February, 25. He studied in Pernambuco until obtains his Master degree in Thermal Engineering, in 1996, August. With the desire of study aerospace and aeronautical problems using numerical methods as tools, he obtains his Doctor degree in Aeronautical Engineering, in 2002, December, in ITA and his Post-Doctor degree in Aerospace Engineering, in 2009, July, also in ITA. He is currently Professor at UFGD (Federal University of Great Dourados) – Mato Grosso do Sul – Brasil. He is author in 47 papers in international journals, 2 books, 67 papers in international conference proceedings. His research interestes includes a) Applications of the Euler equations to solve inviscid perfect gas 2D and 3D flows (Structured and unstructured discretizations) b) Applications of the Navier-Stokes equations to solve viscous perfect gas 2D and 3D flows (Structured and unstructured discretizations) c) Applications of the Euler and Navier-Stokes to solve magneto gas dynamics flows 2D and 3D; (Structured and unstructured discretizations) d) Applications of algebraic, one-equation, and two-equations turbulence models to predict turbulent effects in viscous 2D flows (Structured and unstructured discretizations), e) Study of artificial dissipation models to centered schemes

in 2D and 3D spaces (Structured and unstructures discretizations) f)Applications of the Euler and Navier-Stokes equations to solve reentry flows in the Earth atmosphere and entry flows in Mars atmosphere in 2D and 3D (Structured and unstructured discretizations).

The full paper of this lecture can be found on page 79 of the Proceedings of the 2014 International Conference on Mechanics, Fluid Mechanics, Heat and Mass Transfer, as well as in the CD-ROM proceedings.

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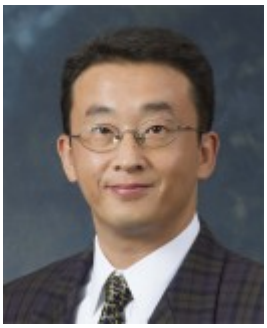
Plenary Lecture 5

The Flocking Based and GPU Accelerated Internet Traffic Classification



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Abstract: Mainstream attentions have been brought to the issue of Internet traffic classification due to its political, economic, and legal impacts on appropriate use, pricing, and management of the Internet. Nowadays, both the research and operational communities prefer to classify network traffic through approaches that are based on the statistics of traffic flow features due to their high accuracy and improved robustness. However, these approaches are faced with two main challenges: identify key flow features that capture fundamental characteristics of different types of traffic in an unsupervised way; and complete the task of traffic classification with acceptable time and space costs. In this paper, we address these challenges using a biologically inspired computational model that imitates the flocking behavior of social animals (e.g. birds) and implement it in the form of parallel programs on the Graphics Processing Unit (GPU) based platform of CUDA from NVIDIA™. The experimental results demonstrate that our flocking model accelerated by GPU can not only effectively select and prioritize key flow features to classify both well-known and unseen network traffic into different categories, but also get the job done significantly faster than its traditional CPU-based counterparts due to the high magnitude of parallelism that it exhibits.

Brief Biography of the Speaker: Prof. Zhiguang Xu received his Ph.D. in Computer Science from University of Central Florida, FL, USA in 2001. He is currently Professor of Computer Science in the Department of Math and Computer Science at Valdosta State University, GA, USA. His research and teaching interests include Computer Networking, Artificial Intelligence, Parallel and Distributed Computing, and Computer Science Education. Professor Xu is author or co-author of more than 25 published papers in refereed journals or conference proceedings. He has been awarded many grants from both academic and industrial entities. He is actively serving as committee member, reviewer, or lecturer of many national and international conferences and organizations.

The full paper of this lecture can be found on page 88 of the Proceedings of the 2014 International Conference on Mathematical Methods, Mathematical Models and Simulation in Science and Engineering, as well as in the CD-ROM proceedings.

Plenary Lecture 6

The State of Civil Political Culture among Youth: Goals and Results of Education

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Abstract: Political culture is viewed as a phenomenon of social reality. Attitudes toward it (its meaning or significance) are historically conditioned. This research studies enduring presuppositions about (dispositions toward) society and the state, and how these are reflected in conscious stereotypes and cognitive structures among young people within the sociocultural mechanisms that form and modify the basic characteristics of political culture.

Brief Biography of the Speaker: Prof. Irina Dolinina was born in 1960, in Perm, Russia. She is Team Leader in the Research Project «Formation of the political culture of the students», and Professor of Philosophy and Law of the Faculty of Humanities, Perm National Research Technical University since 2012. She has received a lot of honors and awards (2012 - Diploma of the All-Russian Roswitha fund national education and the Education Committee of the State Duma of the Federal Assembly of the Russian Federation. 2013 - Diploma of the All-Russian Roswitha fund national education and the Education Committee of the State Duma of the Federal Assembly of the Russian Federation. Diploma-Russian contest "Best Science Book in the humanitarian sphere - 2013). Prof. Dolinina has various progessional organizations and activities.
(Expert on the legislative activities of the Council of Federation of Russia. Board member of the Interregional Association "For civic education." Director of the Research Centre of the political culture).

The full paper of this lecture can be found on page 57 of the present volume, as well as in the CD-ROM proceedings.

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Methodology and measurement system for higher education service quality estimation

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***Abstract*—**The main goal of this paper is to design and analyse the higher educational service quality measurement methodology and tools. The proposed methodology has been implemented as Customer Satisfaction Measurement System (CSMS) for higher educational service quality assessment. The conceptual base of the proposed CSMS is the connection of the pure humanitarian ephemeral categories with technical approaches for the purpose of further educational marketing. To show the proposed methodology in practice by applying the CSMS tools as the topic for investigation the *quality of the educational services offered by university* has been used. Based on the data obtained from this stakeholder different statistical approaches have been applied for data analyses to get estimates of the topic under investigation. Some conclusions and findings have been pointed out.

Keywords*—*High Education Service Quality, Personal Construct Theory, Kansei Engineering

I. INTRODUCTION

The higher education sector throughout the world has undergone enormous growth in recent years, mostly to keep the moderate level of the proposed educational services [1], [32]. That is why nowadays marketing has received increasing attention from high education institutions as the response on recent achievement in global economy and trends in high education sector [1], [10]–[13], [17].

Educational services in a modern market are very similar in their characteristics to ordinary products and it is generally recognized that impressions from products is becoming very important for differential advantage [2], [9], [20]. Quantity analysis of customer impressions and their evaluations in modern marketing is of extreme importance, because it enables the marketing analysis, prediction, planning and correction of marketing activities [17]. According to the numerous research studies, regardless of the type of service, customers basically use the same criteria to assess quality [24], [25]. Service quality is a general opinion the client forms regarding its delivery, which is constituted by a series of successful or unsuccessful experiences [24]. To assess this category two arguments can be taken into consideration, namely the customer perception and their initial expectation regarding the service received. One of the most extensively used, developed and modified service quality methodology and corresponding measurement instruments is SERVQUAL, because of easiness to use, possession of simple structure and capability of generalization [26]. The customer satisfaction can be measured as the difference between expectation and the performance obtained within five dimensions of service quality: *reliability*, *tangibility*, *responsibility*, *security* and *empathy* [24], [26]. An adapted version of the SERVQUAL scale for Higher education services was proposed in [23]. Due to the controversy relating to the basic SERVQUAL methodology a more direct approach to the measurement of service quality have been proposed in [6]. This approach was developed as the measurement instrument called SERVPERF and like SERVQUAL it uses an attributes-based approach. However, compared with SERVQUAL, the SERVPERF tool is measuring customer's expectations of the service quality only [6].

More recently, a new industry-scale methodology for higher education service quality estimation, called HedPERF (Higher Education PERFormance) have been developed comprising a set of 41 items to be taken into consideration [8]. The author identified five dimensions of the service quality concept: *academic dimension*; *programmer issues*; *non-academic aspects*; *reputation*; *access dimension*. The SERVPERF and HedPERF scales were compared in terms of reliability and validity and concluded for the superiority of the HedPERF measurement instrument [8]. There are several SERVQUAL like methodologies including FM-SERVQUAL, INTQUAL, DL-eSQUAL, EduQUAL, Weighted SERVQUAL, Weighted SERVPERF and Weighted Hed PERF [16], [18]. Practically all existing methodologies and corresponding instruments for high education service quality assessment, including all mentioned above, based on the data obtained from the respondents belongs to different customer domains, such as *students*, *parents*, *academic stuff* and *alumni*.

II. CSMS METHODOLOGY AND STRUCTURE

As have been pointed in [6], [16], [17], [22], [30] the all existing higher education service quality methodologies and measurement tools have oriented to get the answer whether perceptions of service quality meet or exceed consumer expectations. It is the key conceptual background of the

This work were supported by the *Centre for Information Security and Network Research* University of Plymouth, UK and *Institute of Applied Informatics*University of Applied Sciences Darmstadt, Germany.

original SERVQUAL, as well as different other nowadays methodologies and tools [16], [24], [31]. There are two common features in modern higher education service quality methodologies and measurement tools, namely the structural representation the service quality as the set of different domain described by the set of questions and the applying in most cases the Likert-type rating scale for evaluation purposes.

Despite a leading position in measuring higher educational service quality the original SERVQUAL and other existing tools have some criticisms [16], [24], [31]. These criticisms related to conceptual, methodological and analytical issue in original SERVQUAL approach [17]. The use of the perception and expectation gap measure of service quality raises related analytical concerns about low reliability, poor discriminant validity and parasitic correlations [8], [17], [18], [21], [23], [31]. All existing approaches have been designed and used without taking into account the pure humanitarian categories and trans-disciplinary features, as well as new research achievements, like Kansei engineering.

The main idea of the CSMS proposed in [30] is the attempt to connect the technical approaches with pure humanitarian ephemeral categories applying for educational marketing. Such a problem statement challenges the analysis on different abstraction levels from general societal conditions to a personal level, and also causes the nature of the research to be trans-disciplinary with approaches required from philosophy, psychology, marketing and mathematics [30]. The key area of our investigation is the CSMS, which is based on fundamental psychological Personal Construct Theory [15], modern Kansei Engineering approach [3] and statistical methods for data analyses. The numerous modes of the proposed CSMS allow getting different data sets and estimates for further Quantitative Analysis of Consumer Response to Educational Service. Educational Management and Marketing, Total Quality Management (TQM) in High Educational Institution (HEI) within the context of existing social and political environments are the bases for CSMS [30], [31].

The phenomenon of educational services have a dual nature: it is both utilitarian and hedonic services. Some intangible characteristics; for example, an emotional spirit, created by the teacher, or the successful image offered by marketer, can hugely increase the grade of perceived value of educational services [1], [2]. This specificity is also reflected in the offered structure of proposed methodology and tool. The marketing context of research requires the analysis of all important for marketer stakeholders groups: *students*, *graduates*, *staff members* and *employers*. The interaction of these groups and theirs attitudes toward the educational services (or perceived value) defines the position of Educational Institution in the market. The most important, so-called, end-customers are, of course, students. This is not a homogenous group, in this structure the segmentation depending on consumption stage is implemented: *first year student*, *student*, *graduate*, *former graduate*. As the next step, parameters could be cross-tabulated also with demographic, lucrative or others variables, such as gender or purchasing capacity, to understand differences of perceptions, if any, among different students segments and make the most interesting offer for the segment, that was chosen as a strategic most important. The methodology and schematic structure of CSMS were presented in [31].

Some of the features have not been included yet in the CSMS structure. For example, one of the very important respondent's group, such as *parents* and other *relatives* also should be included into proposed structure. This domain can be approximated by the domain of *former graduates* but nevertheless for the some countries such groups are quite important [31].

The proposed structure of CSMS can be regarded as a methodology for further instrumental evaluation. For example, in a case of the topic under investigation such as *quality of the educational services offered by university* the two main respondent's groups such as *graduates* and *former graduates* can be chosen. The proposed CSMS allows getting the data by web-based survey at different time periods from different respondent's groups. The main approach for data gathering is a questionnaire-based approach that can be designed by the researcher themselves or can be generated by the respondents based on CSMS.

III. Questionnaire design based on Repertory Grid Technique

The *Repertory Grid Technique* (RGT), have been proposed within the framework of Personal Construct Philosophy (PCP) developed by clinical psychologist George Kelly more than 60th years ago [15]. RGT represents the mechanism that allows evaluate the individual's personal constructs concerning researched objects. A repertory grid is a cognitive mapping tool used to elicit and analyze the mental models of individuals through a structured interview technique [5], [7]. Each grid is constructed around one *topic*, which includes the problem to be considered along with the peculiarities (characteristics) of the respondent's group (domain). For example, the problem of *quality of the educational services offered by university* can be chosen. RGT is constituted into three parts: *Elements* corresponding to topics (objects) that have to be investigated; *Constructs* consisting on ideas, descriptions or associations of respondents about elements; *Rating Scale* helps to identify how elements differ in a fundamental way [7]. In a case of educational marketing the precise and proper determination of research topics (objects), has been presented in [29]. The research topic can be defined as the set of elements with constructs (categories).

The students were considered as the main *subject* (group of respondents) of educational marketing activity, and educational service as the main *object* (topic). To understand the phenomenon of educational service the main topics that describe this category, as well as the elements on which these topics depend have been deeply analyzed in [29]. The following main topics can be considered: *Educational concept*, *Management and Teaching technologies*, *Teaching technique*, *Teaching form*, *Territorial aspect*, *Teaching staff and its functions*, and *Whom to teach*? [29], [30].

Once the topic for the grid of RGT has been chosen, words constitute the *elements* are generated to represent the space in which topic is to be investigated. Then elements become the

subject matter for discussion with the respondents. In a case of the high education service quality assessment the following elements can be chosen: *Studies Organization*, *Teaching Staff*, *Program Design*, *Technical equipment*, *Science and Research Students Activity*, as well as many others elements can be proposed. The set of elements can be designed by the researcher themselves or can be generated by the respondents via CSMS facilities. This set is very flexible especially with the respondent's domain characteristics. For example in a case of student's group the element concerning the *Students Studying Abilities* is not as important and valuable as for the respondents consisting from the university teaching staff members. And vice versa for the students as respondents the element *Teaching Staff* is very important and less valuable for the university teaching staff members due to difficulties of the self-estimation procedure and adequacy of obtained result.

The next stage is to elicit the *constructs* by which the elements are compared. Taking the elements in groups of three, the interviewer asks the respondents to tell them how two of the elements are similar in some way but different from the third. The construction of the groups was performed by CSMS in random fashion and one group with three elements on separated message (card) has been presented to respondent with the qualifying phase "*Looking at these three factors related to the high education service quality could you tell us how two of them are similar in some way but different from the third in terms of reason you wish to get from high education service at the high education institution or didn't want to get it*". These bipolar distinctions are called constructs and illustrate the qualities that the individual uses to explain and differentiate between the elements. For example, for respondent (student) the card with three elements *Teaching Staff*, *Program Design* and *Science and Research Students Activity* has been given. If the student is motivated to get good job position and don't think about his future research activities he can generate the following answer "*Good Teaching Staff* and *Program Design* both are very important to fulfill the requirements of labor market, *Science and Research Students Activity* is less important". This answer can be used to elicit the construct concerning the issue how this particular high institution is providing its educational service fulfills the requirements of labor market. This construct has a bipolar meaning: *Fulfill requirements of labor market* and *doesn't fulfill requirements of labor market*. Formally all constructs represent the rows of the grid, where the column corresponds to all previously generated elements.

Once all constructs have been elicited the links between elements and constructs are mapped on the grid based on some rating scale. In doing so, respondents are asked to quantitatively estimate the degree to which each element can be characterized by the construct. Kelly originally used a 2-point scale, but today some researchers use 16-point scales [7]. The most popular, however, is the 5-point Likert scale. The consistent use of the Likert scale format in the questionnaire is a good way to easily collect and code the data. The 5-point Likert scale responses were noted as: 5 − *Strongly Agree*; 4 − *Agree*; 3 − *Neither Agree nor Disagree*; 2 − *Disagree*; and 1 − *Strongly Disagree*. Point 5 corresponds to the construct, 1 to its opposite. In the case of CSMS the six-point Likert scale have been chosen, where 0 means that the construct is not appropriate (applicable) for the element. The end product is a cognitive matrix (grid), which describes the relationship between individual's mental representations of the topic under investigation.

IV. Online Data Collection

As an example, the grid has been constructed based on the designed nine elements and seven constructs and thoroughly tested and validated during the research seminars at the Darmstadt University of Applied Science. As elements the following categories of high educations institutions are used: 1. *Learn infrastructure*; 2. *Program design*; 3. *Student's practical activities*; 4. *Students research activities*; 5. *Additional services*; 6. *Study's organization*; 7. *Level of received theoretical knowledge*; 8. *Program compliance with labor market*; 9. *Teaching staff*.

The 9 elements in the same row were rated according to their proximity to either left or right pole of the construct based on how matters are currently happening. The constructs used in data gathering procedure are the following: 1. *The factor of high priority − The factor of low priority*; 2. *Exciting − Boring*; 3. *Modern − Outdated*; 4. *Good organized − Bad organized*; 5. *Excel the expectations − Doesn't match the expectations*; 6. *Ideal − Unacceptable*; 7. *Motivates for study − Demotivates*. The output of the described above experiment is a classical for the PCP fixed Grid. However, it was decided to adapt this grid for further implementation. The reason for this decision was to simplify the classical Grid form for better understanding. During the expert group discussion at the research seminars, mentioned above, the matrix form of the questionnaire was commented as "*too complicated for the students*" and even "*irritating*".

For the survey was chosen the evaluation software for education, the tool CASED *EvaSys*, allowing online surveys design and its further implementation. The survey have been started at the 28.03.2012 and finished at the 04.04.2012. The respondents for this survey were the Bachelor (except the first year students) and Master students of the Informatics Department of the Darmstadt University of Applied Science. The survey was undertaken anonymously and participants were free to withdraw at any stage. The number of fully and correctly filled questionnaires is 123 or approximately 15% of the total respondent number. It is a usual result for the anonymous surveys and for *EvaSys* application, as well [14]. The following Table 1 is the resulting data set of interviewing the students of Darmstadt University of Applied Science by the CASED *EvaSys* system.

TABLE 1. The resulting data set (*Grid_Example*)

		Elements								
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Constructs	*1*	2.07	1.74	2.05	2.97	2.75	1.86	2.20	1.71	1.72
	2	3.03	2.84	2.64	3.08	3.40	2.65	2.93	2.58	2.68
	3	2.64	2.72	2.75	2.77	3.37	2.52	2.76	2.77	2.86
	4	2.60	2.63	2.72	3.28	3.50	2.47	2.68	2.88	2.57
	5	2.48	2.78	2.79	3.34	3.57	2.53	2.75	2.87	2.61
	6	2.79	2.88	2.80	3.33	3.56	2.63	2.84	2.99	2.69
	7	3.13	2.93	2.62	2.97	3.66	2.76	3.02	2.68	2.64

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All numerical values have been presented by the above mentioned CASED *EvaSys* system, as the average values. This system allows getting some statistical values like data are shown in Table 1. For example, in a case of first construct for the first element the average value 2.07 have been presented by CASED *EvaSys* system by the following Fig. 1.

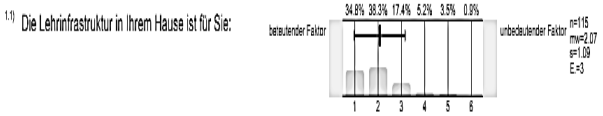

Fig. 1. The average value of construct 1 for element 1

It should be emphasized that all numerical values in Table 1 were obtained as the answer for the chosen topic under investigations as assessment of the educational offer at some particular higher educational institution. This data can be regarded as average values obtained from one of the respondent's domain.

The estimates of each element have the implication on the entire level of the educational service value. In this interpretation the elements can be regarded as sample data (vector or point) $X_i=\{x_{i1}, x_{i2}, \ldots, x_{i7}\}$, where $i\in\{1,2,\ldots,9\}$ with seven arguments $x_{i,j}$, $j\in\{1,2,\ldots,7\}$ (constructs). As the main data set the Grid, presented in Table 1 is chosen for the following analysis.

V. CSMS DATA ANALYSES MODES

To show the proposed methodology in practice the data presented in Table 1 have been used. During the all stages of data analysis by the corresponding CSMS tools this data has to be thoroughly investigated and analyzed. For data analyses the CSMS tools are based on the MATLAB Statistics Toolbox functions were chosen (MATLAB Stats Toolbox).

A. Pilot Testing

According to the CSMS methodology at the beginning of the data analysis the *pilot test* or so called *pre-test* should be provided [14]. According to the CSMS methodology the validity of the proposed example of questionnaire should be established using a panel of experts during, so called *field* test. In the presented questionnaire example the field test have been carried on by the research participants of PhD Seminar offered by Darmstadt University of Applied Science. The following questions for the questionnaire validations during the field test have been addressed [28]: *Is the questionnaire measuring what it intended to measure*? *Does it represent the content*? *Is it appropriate for the respondent's domain*? *Is the questionnaire comprehensive enough to collect all the information needed to address the purpose and goals of the study*? *Does the instrument look like a questionnaire*? As the result of the field test the final version of the questionnaire was produced.

As the numerical estimation for questionnaire validity the CSMS support the calculating the *response rate* (R_r) as the percentage of respondents who responded to the proposed questionnaire, which was comparably high R_r = 14,3% to ensure that the results are representative. To measure the *reliability* the standardized *Cronbach's α* characteristic is supported by the CSMS facilities. The *Cronbach's α* has been calculated for all nine elements represented as N = 123 measurements $Q_1, Q_2, ..., Q_N$, where $Q_i = \{q_{i1}, q_{i2}, \ldots, q_{i7}\}$, $i \in \{1, 2, \ldots, 123\}$ and $q_{i1}, q_{i2}, \ldots, q_{i7}$ are the constructs values for chosen element. As an example the *Cronbach's α* value for the first element *Learn infrastructure* is 0.8567. A reliability coefficients *Cronbach's α* for the data gathered by the online survey based on *EvaSys* are higher of 0.8 what allow to consider the measurement results presented in Table 1 as acceptable reliable.

B. Data visualization

For more detailed analyses the different kinds of histogram and average values can be generated by CSMS, what is very convenient for visualization the data presented in Table 1. For representation of the data set very often the *Box plot* mode is used, as convenient way of graphically depicting groups of numerical data through their five-number summaries. For our data, are shown in Table 1, this visualization has the following form (see Fig.2).

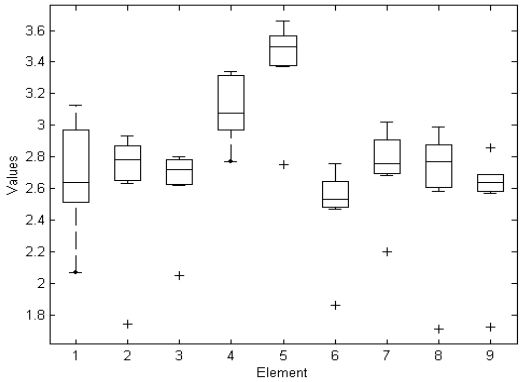

Fig. 2. The average value of construct 1 for element 1

Some very general information about the respondent's answers concerning all elements influencing for the level of high educational service based on histograms and Box plots can be done. For example, the minimal average respondent's score is 1.71 what is far from minimal values 1, and the highest score 3.66 is sufficiently lower than maximal value equals to 5. The average value is very close to 3 point and equals to 2.7624. These results allow making the conclusion that the affective value *of higher educational service* at the Darmstadt University of Applied Science has been estimated at the quite moderate level by the students of the Informatics Department. The element number 5 (*Additional services*) has got the maximal construct's average score 3.4014 as well as element number 6 (*Study's organization*) has been estimated with the lowest average score equals to 2.4886. The rest of elements have their average construct's score very close to 2.6. This data allow pointing out that additional service is organized at the moderate level and probably there are some problems with study's organization at the University.

C. Data descriptive statistics

The first simple characteristics are measuring by CSMS is *Central Tendency*. There are five major types of central

tendency characteristics available under CSMS, namely: *mean* (μ) or average (*arithmetic mean*), *median*, *trimmed mean*, *harmmean* and *geometric mean*. Fig. 3 shows the average values as the points Xi, where i ∈ {1,2,…,9}, which connected with line for all nine elements.

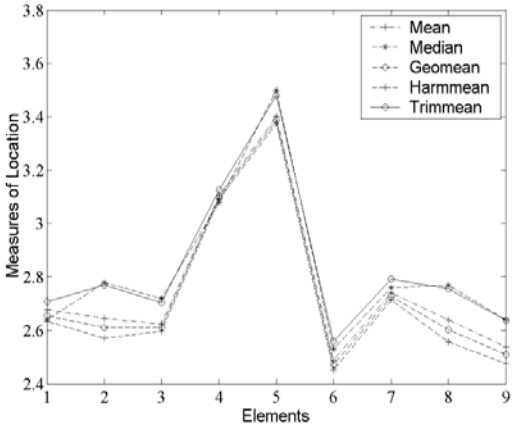

Fig.3. Average values for all nine elements

The maximal average value around 3.4 points has element number 5 − *Additional services*, and the lowest average score has got the element number 6 − *Study's organization* (see Fig.3). This information is quite valuable for researcher to make the right marketing and management conclusions for the service quality improving.

The CSMS tools based on MATLAB facilities can generate five dispersion measures, namely *standard deviation* (σ), *interquartile*, *mean absolute deviation*, *range* and *variance*. For the above presented data (Table 1) the resulting plot is shown in Fig.4.

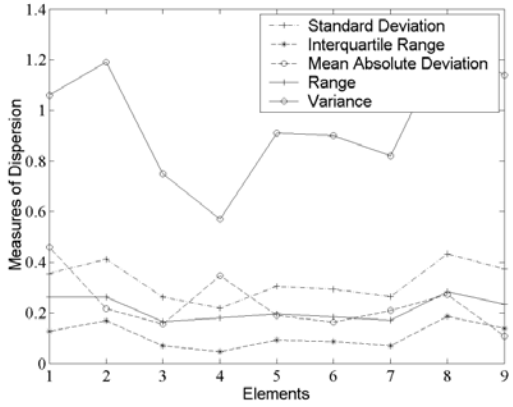

Fig. 4. Measures of dispersion (b) for all nine elements

According to above presented data the element 4 has practically constant scores.

The value of covariance $cov(X_i,X_j)$ as well as correlation coefficient C_{XiXj} will allow to get the answer how two variables (sets of samples) X_i and X_j are associated. CSMS used MATLAB function *corrcoef*(*data*) which returns a matrix of correlation coefficient calculated from an input matrix data set whose rows are observations and whose columns are variables. In this example X_i represents element number i where $i \in (1,2, \dots ,9)$ from the Table 1. As the result the element 1 completely cannot be predicted based on element 4 ($C_{X_1X_4}$ = –0.0215) and at the same time can be predicted with high level of accuracy based on the element 7 due to the high level of correlation ($C_{X_1X_7}$ = 0.9483). These numerical values can be interpreted as follows the element *Learn infrastructure* does not depend on the *Students research activities*, as well as is very close related to the element *Level of received theoretical knowledge*. The value $C_{X_2X_6}$ = 0.9907 indicates that element *Program design* is very close correlated with the element *Study's organization*.

D. Cluster analyses

Cluster analysis also calls segmentation analysis or taxonomy is a way for grouping objects of similar kind into respective categories [4], [21]. A hierarchical clustering, supported by CSMS, is often displayed graphically using a tree-like diagram called a *dendrogram*, is shown in Fig. 5 [4], [19].

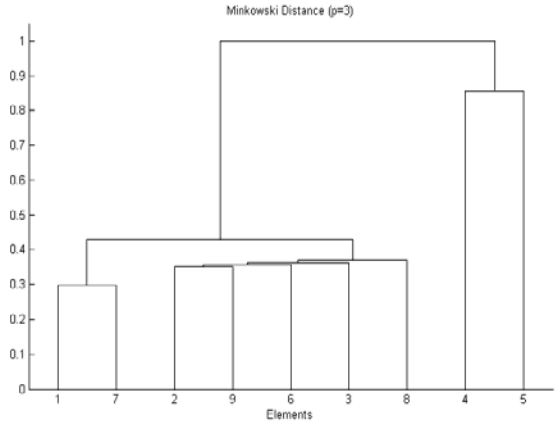

Fig.5. Dendrogram for Elements (*Minkowski Distance* (*p*=3))

The crucial element of the clustering is the proximity measure that quantifies the notation of closest *point* (*data*) for the specific data under consideration. As the numerical values for these purposes the different types of distance between the data represented as points can be used by CSMS. The most known and used *Euclidean distance* (D_E) is defined as follows: the distance between points X_i and X_j is the length of the line segment connecting them. There are some modifications of the Euclidean distance such as *Standardized Euclidean distance* and *Mahalanobis distance* [19]. *City block distance* (D_{CB}), *Manhattan distance*, or *Manhattan length*, which also widely used for data clustering.

The plot is shown on Fig. 5 is the result of dendrogram building for *Minkowski Distance* (*p*=3) metrics available under CSMS facilities. As can be observable from the above presented figures, there are at least two separate groups (clusters) of elements. Namely the first cluster includes the elements 4 − *Students research activities* and 5 − *Additional services* and the second cluster can be created from the rest of elements.

E. Factor Analysis

One of the Factor Analysis approach, supported by CSMS, is *principal component analysis* (PCA). *PCA* was invented in

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1901 by *Karl Pearson* [27], and depending on the field of application, it is also named the discrete *Karhunen–Loève transform* (*KLT*), the *Hotelling transform* or *proper orthogonal decomposition* (*POD*).

To find principle components the function *princomp* have been used (MATLAB Stats Toolbox). The first values *pcs* of the output of the *princomp* contain the principle components as the linear combinations of the data presented in Table 1. Five components are shown in Table 2.

TABLE 2. The resulting data set (*Grid_Example*)

*pcs*1	*pcs*2	*pcs*3	*pcs*4	*pcs*5
0.3094	0.3771	0.5045	-0.2891	0.5562
-0.3715	0.0395	0.0345	-0.0554	-0.3882
-0.3477	-0.2045	-0.3957	-0.1789	-0.1073
-0.1053	-0.8129	0.4680	-0.2725	-0.0618
-0.3608	-0.1147	0.0827	0.8067	0.0441
-0.3668	0.1260	0.1546	0.0540	-0.1538
-0.3551	0.2186	0.2515	-0.0138	-0.3722
-0.3454	-0.2607	-0.3152	0.0857	0.5981
-0.3524	0.0937	-0.4188	-0.3819	-0.0512

The largest contribution in the first principle component is made by the second (-0.3715) and sixths (-0.3668) elements, namely *Program design* and *Study's organization*, from the data under investigations. The first principle component is constructed as the linear combination of all elements practically with the same contributions except the fourths element *Students research activities* (-0.1053).

The *pareto* plots, supported by CSMS, can show percent variability by each principle component for the case of variables represented by the Elements and Constructs for original data set (Table 1). In both cases there are three principle components and the first one explains more the 80% of the total variability.

F. Regression analysis

Regression analysis is one of the most commonly used statistical techniques in social and behavioral sciences, as well as in others sciences. There are a number of functions for fitting various types of linear models supported by CSMS. The one-way ANOVA is used to find out whether data from several groups have a common mean. That is, to determine whether the groups are actually different in the measured characteristic. One-way ANOVA is a simple special case of linear model $Y_{ij} = \mu_j + \varepsilon_{ij}$, where Y_{ij} is a matrix of observations in which each column represents a different group; μ_j is a matrix whose columns are the group means (μ_j is the same for all *i*); ε_{ij} is a matrix of random disturbances. This model posits that the columns of *Y* are a constant (μ_j) plus a random disturbance (ε_{ij}).

The data set under investigation is presented in Table 1. The *n*=9 columns of the Table 1 represent parameters (elements of higher educational service). The *m*=7 rows are estimates (constructs) of elements which have the implication on the entire level of the educational service quality. The question is do some elements have higher influence on education service quality than others? Resulting data obtained by ANOVA contain the sum of squares (*SS*), degree of freedom (*df*), *F* statistic, and *Prob*-value, as have been shown in Table 3.

TABLE 3. The resulting data set (*Grid_Example*)

Source of Variation	Sums of Squares (*SS*)	*df*	Mean Square	*F*	*Prob>F*
Columns	4.9472	8	0.6184	5,6407	3.2918e-005
Error	5.9201	54	0.1096		
Total	10.8673	62			

Actually the ANOVA is comparing the means of nine columns of data in the matrix shown in Table 1, where each column represents an independent observation (Element). Generally if *Prob* is near zero, it casts doubt on the null hypothesis and suggests that at least one sample (element) mean is significantly different than the other sample means. It is exactly our case due to the element 5 (*Additional services*) has the mean differ than the other elements as can be seen on Box plot for Elements shown in Fig.2. Common significance levels are 0.05 or 0.01. In this case the *Prob* -value is 3.2918e-005, what is sufficiently lower compare with the indicated significance levels. This is a strong indication that element's estimations are not the same. The low *Prob* value indicates that there are differences between the elements means. This fact allows making the conclusion that the 9 elements presented in Table 1 have different contribution into the estimation of the *affective value of higher educational service* at the Computer Science Department of the Darmstadt University.

Sometimes it is important to determine specifically which pairs of means are significantly different. For this purpose a series of *t* tests (paired *t* test) for each pair of means should be performed. In a *t* test a *t* statistic is computed and compared it to a critical value. The critical value is chosen so that when the means are really the same, the probability that the *t* statistic will exceed the critical value is small, equals to 5%. When the means are different, the probability that the statistic will exceed the critical value is larger.

In offered example there are nine means, so there are 36 pairs of means to compare. Based on the MATLAB Statistics Toolbox the procedure known as *multiple comparison procedures* can be performed (MATLAB Stats Toolbox). The first output from MATLAB *multcompare* procedure has one row for each pair of groups, with estimates of the difference in group means and confidence interval for that group. In our example the row number 27 out of all 36 rows has the values shown below.

5.0000 6.0000 0.3411 0.9129 1.4846

This data indicating that the mean of elements 5 minus mean of element 6 is estimated as -0.9129 and a 95% confidence interval for this difference is [0.3411, 1.4846]. In this example the difference is significant at the 0.05 level due to confidence interval does not contain 0.0 value. Within the same our example the pair of the 8 and 9 elements has the values.

8.0000 9.0000 -0.4704 0.1014 0.6732

This indicates that the means of 8 and 9 elements are not different.

It is possible to analyze the difference between elements means by using the graph produces by *multcompare* procedure. The examples of the analysis based on this graph are shown below for the case of Elements shown in Table 1.

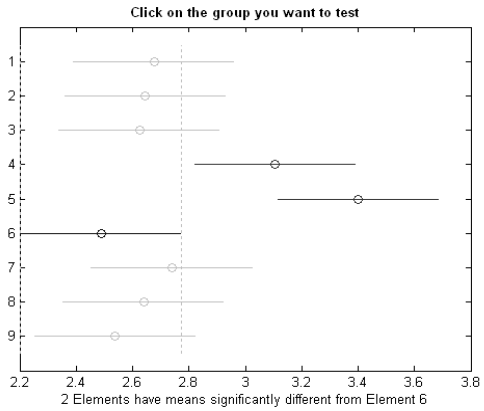

Fig.6. Dendrogram for Elements (*Minkowski Distance* (*p*=3))

This graph indicates that there are two elements, namely 4 − *Students research activities* and 5 − *Additional services* with means significantly different from means of the rest of elements.

The same graph for constructs strongly indicates that the first construct − (*The factor of high priority − The factor of low priority*) has significantly different mean compare with the others constructs. This result can be interpreted as the first construct is not appropriate for quality of higher educational service assessment.

VI. Discussion

The proposed paper deals with the development CSMS methodology and tools for service quality of higher education institution assessment. For the purposes of experimental validation of proposed CSMS methodology an experimental investigations have been carried out. To perform data analysis based on CSMS and input data set presented as the Grid the following procedure implemented on MATLAB Statistics Toolbox functions have been carried out. First of all the data reorganization, presentation, pilot testing and simple data analyses based on *descriptive statistics* have been made. More complicated analyses like *cluster analyses*, *factor analyses* and *regression analyses* were conducted. As the result of data analyses the following statement can be formulated.

The methodology and instrument called as CSMS for measurement of service quality at higher educational institutions has been proposed and investigated. Experimental results allow making the conclusion that seven constructs under nine elements constitute relevant variable for the proposed methodology.

Due to restricted statistical data consisting from one respondent's domain survey only, at this point the following findings can be formulated with respect to one particular institution providing its educational service.

The first obvious finding concerning the service quality at this higher institution can be formulated as the higher levels *Students research activities* (Element 4) and *Additional services* (Element 5) proposed to the student at the department of Informatics. The rest of service qualities elements have been estimated at the approximately the same level.

As the second finding the very low rate equals to 2.1189 of the construct 1 (*The factor of high priority – The factor of low priority*) compare to the average rate. This result can be interpreted as the all elements describing the service quality are the factor of low priority rather than high priority to all respondents. At the same time the construct 6 (*Ideal − Unacceptable*) has the highest average value 2.9456. These results can be interpreted as the service quality elements, generally, are the factor of low priority to the student of this department but, particularly, is ideal rather than unacceptable at this department.

As can be observable from the above presented cluster analyses, there are at least two separate groups (clusters) of elements. Namely the first cluster includes the elements 4 − *Students research activities* and 5 − *Additional services* and the second cluster can be created from the rest of elements. This cluster, probably have been appeared due to the fact that these two elements are very common in nature for the students of Darmstadt University of Applied Science, as it is traditionally very close to the industry unlike the classical Universities that orient more on the theoretical science. It is not surprising that research activities can be interpreted by these students as additional service. There is another possibility for elements separation into three clusters, where elements 4 and 5 is the first cluster, the 1 − *Program design* and 7 − *Level of received theoretical knowledge* elements is the second one and the rest of elements organized the third group.

As can be observable from the above presented results, there are at least two separate groups of constructs. Namely the first cluster includes the construct 1 − (*The factor of high priority − The factor of low priority*) and the rest of constructs. Sufficient large distance from the construct 1 and all others construct allows to make the conclusions that this construct probably expressed the personal attitude to all elements using for *affective value of higher educational service* estimations in generally, rather than estimations of service at some particular educational institution. More precise analyses of the results concerning the constructs allow to emphasize strong correlation between construct 4 − (*Good organised − Bad organised*) and 5 − (*Excel the expectations − Doesn't match the expectations*). Both constructs are within the same cluster which can be extended to three constructs including construct 6 − (*Ideal − Unacceptable*). It is the matter for further investigation to select representative set of constructs.

VII. Conclusions and Scope for further Research

Survey at the Informatics Department of the Darmstadt University of Applied Science has been carried out with statistically significant response rate but it is not enough to generalize the results. The experimental investigations of CSMS have been carried out based on only one group of stakeholder. Other domains of stakeholders may evaluate the same service quality differently. The study can be extended to a large sample with emphasis on weights of each *Construct* of the resulting Grid and relative importance of *Elements*. Benchmarking of higher educational institutions can be extended to not only technical Universities what will lead to

redesign the CSMS methodology and corresponding tools for evaluating educational services.

As the any research concerning the issue of quality in service is required to be extended considering the limitation of the study. Some of these where further research is required to be carried out to tackle the limitations of CSMS. The following further research directions can be proposed. A large number of samples (surveys) from different stakeholder domains may be collected to have better understanding of the elements and corresponding constructs to represent the service quality more adequate and more precisely. Applying the same CSMS methodologies effectively in other sectors such as health care, tourism, hotels and restaurants, banks and finical institutions, transportation facilities, repair and maintenance shops and information service may carry out extension of this research.

Further steps of data analyzing to get more precise picture of the service quality at higher education institutions the nowadays technologies of data mining should be applied.

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REFERENCES

[1] P.G. Altbach, L. Reisberg, and L.E. Rumbley, 2009. *Trends in Global Higher Education: Tracking an Academic Revolution.* A report Prepared for the UNESCO 2009 World Conference on Higher Education, UNESCO, France.

[2] A. Athiyaman, 1997. Linking student satisfaction and service quality perception. *European Journal of Marketing* 31, no. 7: 528–540.

[3] C. Barnes, T. Childs, B. Henson, and S.P. Lillford, 2008. Kansei engineering toolkit for the packaging industry. *The TQM Journal* 20, no. 4: 372–388.

[4] M.J.A. Berry, and G. Linoff, 1997. *Data Mining Techniques for Marketing, Sales and Customer Support*. USA: Wiley & Sons, Ltd.

[5] V. Cho, and R. Wright, 2009. Exploring the evaluation framework of strategic information system using repertory grid technique: a cognitive perspective from chief information officers. *Behavior & Information Technology* 29, no. 5: 447–457.

[6] J.J. Cronin, and S.A. Taylor, 1992. Measuring service quality: A re-examination and extension. *Journal of Marketing* 56, no. 6: 55–68.

[7] M.H. Edwards, S.S. McDonald, and M. Young, 2009. The repertory grid technique: Its place in empirical software engineering research. *Information and Software Technology* 51, no. 4: 785–798.

[8] A. Firdaus, 2006. Measuring service quality in higher education: three instruments compared. *International Journal of Research & Method in Education* 29, no. 1: 71–89.

[9] P. Gibbs, and M. Knapp, 2002. *Marketing Higher and Further Education*. London, UK: Kogan Page.

[10] *Guide to the Bologna Process.* 2006. Edition 2. UK HE Europe Unit.

[11] Higher Education Marketing. 2012. Benchmarking Report: Not-for-Profit Colleges & Universities (Published September): CUNET Company.

[12] Higher Education Marketing. 2012. A Benchmarking Report: For-Profit Schools (Published June): CUNET Company.

[13] T. Hayes, 2007. Delphi study of the future of marketing of higher education. *Journal of Business Research* 60, no. 9: 927–931.

[14] G. Iarossi, 2006. *The Power of Survey Design: A user's Guide for Managing Survey, Interpreting Results and Influencing Respondents*. Washington, D.C., USA: The World Bank.

[15] G. Kelly, 1955. *The Psychology of Personal construct*. New York, USA: Norton.

[16] M.S. Khan, 2007. Studies on some aspects of service quality evaluation with specific relevance to Indian service industries. *PhD Thesis*. National Institute of Technology, INDIA.

[17] P. Kotler, and K.F.A. Fox, 1985. *Strategic Marketing for Educational Institutions*. Englewood Cliffs, USA: Prentice-Hall, Inc.

[18] S.S. Mahapatra, and M.S. Khan, 2007. A framework for analyzing quality in education settings. *European Journal of Engineering Education* 32, no. 2: 205–217.

[19] MATLAB Stats Toolbox.

[20] G.H.G. McDougall, and T. Levesque, 2000. Customer satisfaction with services: putting perceived value into the equitation. *Journal of Service Marketing* 15, no. 5: 392–410.

[21] J.B. MacQueen, 1967. Some Methods for classification and Analysis of Multivariate Observations, Proceedings of 5-th Berkeley Symposium on Mathematical Statistics and Probability, Berkeley USA: University of California Press: 281–297.

[22] S. Nagasawa, 2002. Revision and Verification of Seven Tools for new Product Planning. *Kansei Engineering International - International Journal of Kansei Engineering* 3, no. 4: 3–8.

[23] J.O. Otavio, and E.C. Ferreira, 2009. Adaptation and application of the SERVQUAL scale in higher education. Proceedings of POMS 20th Annual Conference. May, Orlando, Florida USA: 1–4.

[24] A. Parasuraman, V.A. Zeithaml, and L.L. Berry, 1985. A Conceptual Model of Service Quality and its Implication for Future Research. *Journal of Marketing* 49, Fall 1985: 41–50.

[25] A. Parasuraman, V.A. Zeithaml, and L.L. Berry, 1988. SERVQUAL: A Multiple-item Scale for Measuring Customer Perceptions of Service Quality. *Journal of Retailing* 64, no. 1: 12–37.

[26] A. Parasuraman, V.A. Zeithaml, and L.L. Berry, 1994. Reassessment of expectations as a comparison standard in measuring service quality: Implications for further research. *Journal of Marketing* 58, no. 1: 111–124.

[27] K. Pearson, 1901. On lines and planes of closest fit to system of points in space. *Philosophical Magazine* 2, no. 6: 559–572.

[28] R.B. Radhakrishna, 2007. Tips for Developing and Testing Questionnaires/Instruments. *Journal of Extension (JOE)* 45, no. 1. http://www.joe.org/joe/2007february/tt2.php

[29] H. Shauchenka, U. Bleimann, M. Knoll, and N. Clarke, 2008. Quantitative analysis of educational services for innovative marketing in higher education. Proceedings of the Forth Collaborative Research Symposium on Security, E-Learning, Internet and Networking (SEIN'08). Glyndwr University, UK: 35–45.

[30] H. Shauchenka, 2010a. Innovative Marketing in High Education based on affective quality of educational services measurement. MPhil/PhD Transfer Report. School of Computing and Mathematics University of Plymouth.

[31] H. Shauchenka, and E. Buslowska, 2010b. Methods and Tools for Higher Education Service Quality Assessment (Survay). *Zeszyty naukowe Politechniki Bialostockiej, Informatyka* 5: 87–102.

[32] T. Wilen-Daugenti, A. Grace, and R. Mckee, 2008. 21st Centuty Trends for Higher Education. Top Trends 2008-2009. Higher Education Practice. CISCO InternetBusiness Solution Group.http://www. industrycortex.com/ datasheets/profile/256903550/21st-century-trends-for -higher-education-2008-2009/

Learning Control Network Programming with the *Bouquet* Cloud Compiler

Kostadin Kratchanov, Buket Yüksel, Tzanko Golemanov, and Emilia Golemanova

"And just like everything else important in your life, Bouquet CNP development environment is cloud-based"
- Re-phrased from the video on [29]
"Primitives + Control Network = Control Network Program"
Claimed in Sec. II C

***Abstract*—**The ultimate goal of this paper is to introduce a cloud development environment for Control Network Programming (CNP) called *Bouquet*. However, our route to that goal is not strait. We address a number of related objectives and use the corresponding conclusions. We discuss the distinguishing features of CNP and deduct the summarizing maxim **"Primitives + Control Network = Control Network Program"**. Then we analyze the types of CNP development environments paying special attention to the most advanced CNP IDE, *SpiderCNP*. We address the reasons for devising a cloud compiler, and include an extended review of cloud IDEs and their advantages. Finally, we are at a position to explain the principles and some design and implementation details of the *Bouquet* cloud CNP environment. All these issues are considered within the context of teaching and learning – teaching major concepts of computer science and mathematics with the help of CNP tools, and learning CNP by students, programmers, and researchers.

***Keywords*—**Control Network Programming, CNP, cloud IDE, cloud compiler, online compiler, learning system.

I. INTRODUCTION

Control Network Programming (CNP) is an unusual programming style. It is especially advantageous for solving problems which exhibit one or more of the following traits: the problem description or its procedural solution have a natural graph-like representation, involve nondeterminism or randomness, are based on search. Distinguishing features of CNP are discussed in Section II.

We have been successfully using CNP as a tool for simulating various computational models and algorithms in our Computer/Software Engineering curricula at undergraduate and graduate levels. Other areas where concepts such as computation, search, inference, nondeterminism and randomness are fundamental, and where CNP could be a great teaching tool, are Computer Science, Mathematics, Industrial Engineering, Robotics, and others. A short summary of our teaching experience with CNP is given in Sec. II E.

We need a CNP programming environment in order to create, modify, compile, and run CNP applications. Such a powerful IDE (with embedded graphical editor) is *SpiderCNP*. This report focuses on describing a much simpler, light-weight, online cloud CNP compiler which we call the *Bouquet* compiler. (Bouquet is the English equivalent of the name of the programmer most involved in the development of this compiler, Buket). Being run in the cloud, this approach is not only 'trendy' but in fact frees a user from the burden related to installation, maintenance and updating the tool. This is especially important for a user who wants to learn the basics of CNP and use it for running demos or creating their own small-size CNP applications. Generally, our students belong to this class of user, together with other students, researchers or programmers whose aims are to get basic awareness of CNP and its possibilities but are not yet its heavy users.

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II. DISTINGUISHING FEATURES OF CNP AS A NEW PROGRAMMING PARADIGM

A. Introduction to CNP

The name **Control Network Programming** or **CNP** can be deciphered as 'programming through control networks'. It is a combination of the declarative and imperative programming styles. A 'program' consists of two fundamental parts. The first one is called a **Control Network** (**CN**). It can be considered as a declarative description of the problem at hand and is an explicit system of graphs called subnets. The arrows of the subnets are labeled with sequences of simple actions, called **primitives**. The primitives are defined separately or taken from existing libraries simple procedures.

In CNP, other synonymic names for the computation process would be inference or search. The goal is to find a path from the initial node of the CN to a final node, possibly going in the process through invoked subnets. The execution of a primitive might result in failure in which case the system executes primitives backwards, restoring the state of the data, and attempts another path. The passing of the control through the CN is thus highly intuitive and easily understandable.

Some major resources describing the technical details of CNP are [5]-[9]. How CNP can be applied for solving

different types of problems is demonstrated in [10]. The computation/inference in a CN program is based on search. Therefore, the built-in powerful tools for user control of the computation can be used to implement heuristic search strategies in an unusual, non-procedural manner [11]-[13].

B. *CNP distinguishing features*

We describe CNP as a new programming paradigm extending and integrating declarative programming, imperative programming, and programming rule-based systems. As all other programming paradigms CNP is universal – that is, it can be used for implementing any algorithm. However, it is especially effective when solving problems which can be naturally represented in a graph-like manner, and/or whose descriptions exhibit nondeterminism and declarativeness.

As we mentioned already, the CN can be looked at as a declarative description of the problem to be solved. Typical illustration of this viewpoint is the CNP solutions to the Animals classification problem in [10], the Map traversal problem in [7], the non-recursive heuristic solutions to the same problem in [13] as well as its iterative and recursive solutions in [7] and [13], the iterative and recursive solutions to the Wolves and sheep problem in [10], etc.

CNP can be successfully used for typical procedural solutions as well. Such an example is the SelectionSort algorithm in [10]. Here, the CN is an explicit graphical representation of the program control (as understood in imperative programming). In other words, in CNP the program control is extracted from the imperative program and made explicit. The actions on data are defined in the simple and well-understood primitives. This helps for easier understanding, creating, modifying, or verifying the algorithm.

In both cases of considering a CN as a declarative problem description or as an explicit description of the control in a procedural solution, CNP can be also described as a type of graphical programming. Indeed, the CN (being the leading principal part of the CN program) is a recursive set of graphs. Depending on the development environment used this net (the CN) may be actually seen and edited in a graphical editor, or may be coded textually using our simple language for describing graphs called *Spider*.

'Executing' the CN is a kind of search. CNP has been equipped with powerful means to control this search – namely numerous system options and control states [7],[8],[12]. Some of these can also introduce randomness. This makes CNP a very powerful tool for realizing a great number of search approaches. Especially interesting and unusual are implementations of algorithms based on local search, as the execution of the CN is in fact a particular type of local search itself. This approach is called non-procedural implementation [11]-[13]. It does not involve writing any search algorithm in the usual sense – a behavior equivalent to the corresponding search algorithm is achieved 'automatically' trough the built-in search control tools.

C. *Primitives + Control network = Control network programming*

Back in 1975, Niklaus Wirth proclaimed: "Algorithms + Data Structures = Programs" [1]. First of all, this applies to structured, imperative programs. In 1979, sighting logic programs Robert Kowalski responded: "Algorithms = logic + control" [2]. Modifying the famous Wirth's statement, Zbigniew Michalewicz added in 1992: "Generic Algorithms + Data Structures = Evolution Programs" [3].

Here we notice and proclaim: **"Primitives + Control Network = Control Network Program"**.

Our statement has a very direct and literal meaning: a Control Network (CN) program consists of two parts: definitions of primitives, and a CN using these primitives. Physically, a CN programming (CNP) project includes two main files – one that contains the primitive definitions, and a second one with a textual representation of the CN. In more detail this will be discussed in the following sections.

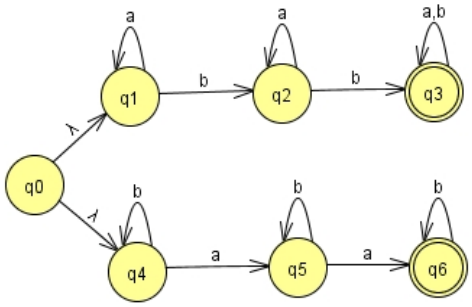

Figure 1 NDA

A note is needed. We apologize to the data for somehow neglecting its importance. The data does exist and is important. We refer to the first major component of a CN program as "Primitives". To be maximally precise, we should've called it "Data and Primitives". The primitives act on data. The data is usually declared in the same file where the primitives are (or in other project modules used). However, for simplicity, we'll keep the shorter name "Primitives". It is understood by default that there is data processed by these primitives. Generally, in CNP one focuses more on the computation control rather than on the data. As a matter of fact the control is explicit, and is presented graphically by the CN.

D. *An exemplary CNP application*

As an illustration, we show here the CNP simulation of a

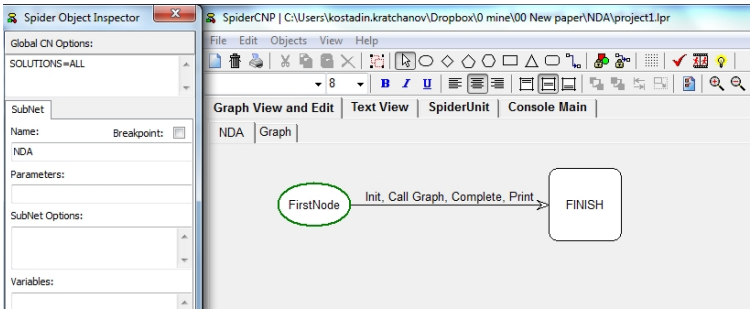

Figure 2a The *NDA* main subnet

nondeterministic automaton which accepts strings over the alphabet {a,b} that include exactly two a's or at least two b's (Problem 1.4b from [4] but implemented as an NDA). The graph of this NDA is shown in Fig. 1 (screenshot from *JFLAP*). The CN of the CNP implementation consists of two subnets. The main subnet called *NDA* is shown in Fig. 2a, and the subnet *Graph* - in Fig. 2b. The screenshots are from the *SpiderCNP* programming environment discussed below. An exemplary dialogue with the user is given in Fig. 3c. This CNP example is used in the PhD course Theory of Computation and the undergraduate course Discrete Computational Structures II at Yaşar University.

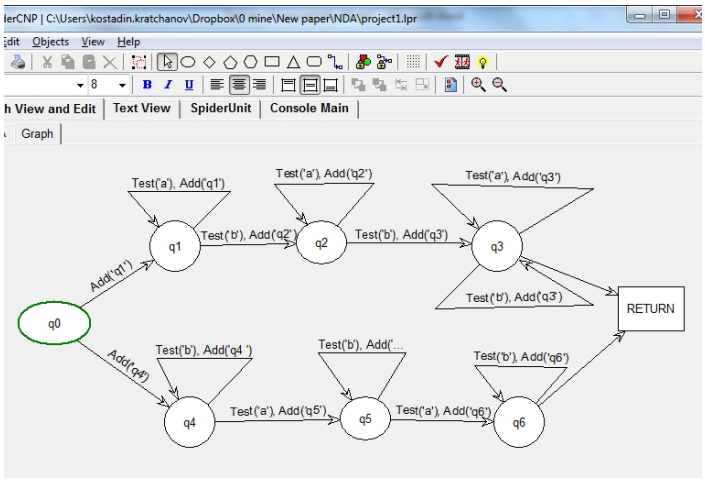

Figure 2b The *Graph* subnet

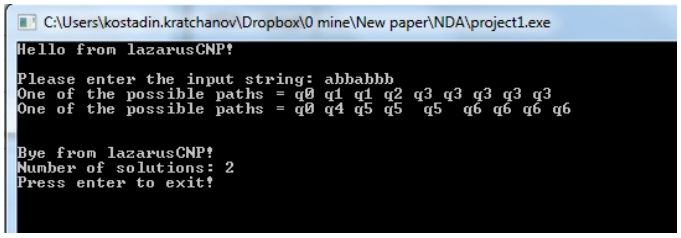

Figure 2c Console

The following primitives are used in the CN. Primitive *Init* performs some initialization and prompts the user to enter the input string. Primitive *Test(c)* completes successfully if the current input character equals *c*. Primitive *Add(n)* adds the string *n* as the name of the current node into the solution path. Primitive *Complete* checks if there are additional symbols in the input string that have not been read and used. Using this primitive in the main subnet ensures that no unused symbols have remained in the input string. Finally, primitive *Print* displays the solution path.

E. CNP in education

At Yaşar University, we have been systematically using CNP for three years in teaching the courses of Artificial Intelligence (4th year undergraduate) and Theory of Computation (PhD.) in our Computer/Software Engineering curricula, and we have found it to be a very useful tool in simulating various models and algorithms. Other possible areas include Formal languages and automata, Compilers, Algorithm analysis and design, Concepts of programming languages, Discrete mathematics, Logic, Digital design, Algorithms and data structures, and more.

In general, it is the prevailing view of the educators in areas such as computer science and mathematics that students tend to have substantial difficulties in apprehending the ideas behind nondeterministic and randomized (also referred to as stochastic) computation models and algorithms. CNP can be a great instrument to help understanding and getting confident with these concepts [17],[18]. In fact, our experience and surveying results strongly suggest that understanding and using CNP for our students (who have already developed a strong procedural way of thinking) is substantially easier than Prolog.

III. Programming Environments for CNP

To practice CNP, i.e., to create, edit, compile, and run CNP applications one needs an appropriate development environment. A number of such environments have been created.

A. SpiderCNP – a CNP IDE for graphical programming

The most powerful one is *SpiderCNP* [14]. It has two versions. They are integrated as a tool in the *Delphi* and *Lazarus* IDEs, respectively. A fundamental advantage of the chosen approach is the possibility to use all the features and tools of the larger encompassing environment and the latest versions of the programming language around which the IDE is built. This programming language is also used to program the primitives. The installation process consists of three steps: install the *Delphi* or *Lazarus* IDE, then run a simple installation program that installs *SpiderCNP* as a tool of the IDE, and finally fix some settings.

Delphi is a sophisticated, ambitious, advanced professional environment which, of course, is an important advantage of this approach. However, this is also its main disadvantage when using it in teaching. The IDE is rather expensive, free academic versions are very difficult or impossible to obtain, updates in the IDE are difficult for the same reason. The second disadvantage is the size of the software product and correspondingly the difficulties in its installation. Difficult installation was the single most important drawback of the CNP approach identified by the students in their surveys and comments during the first year of using CNP in teaching.

In our opinion the switch to the *SpiderCNP* version based on *Lazarus* (called also *LazarusCNP*) brought essential advantages. *Lazarus* is a free product; it is pretty easy to download the latest version of the product, and much easier to install it. The IDE is also quite advanced and stable. We have been using *LazarusCNP* for two years and it is our most advanced and well-tested CNP development environment.

Although the installation still requires the same three steps, it now takes less than 5 minutes, and all the components to install are free. The corresponding installation instructions and download files are available at [19].

Before discussing the CNP IDE further we need to understand the architecture of a CNP application.

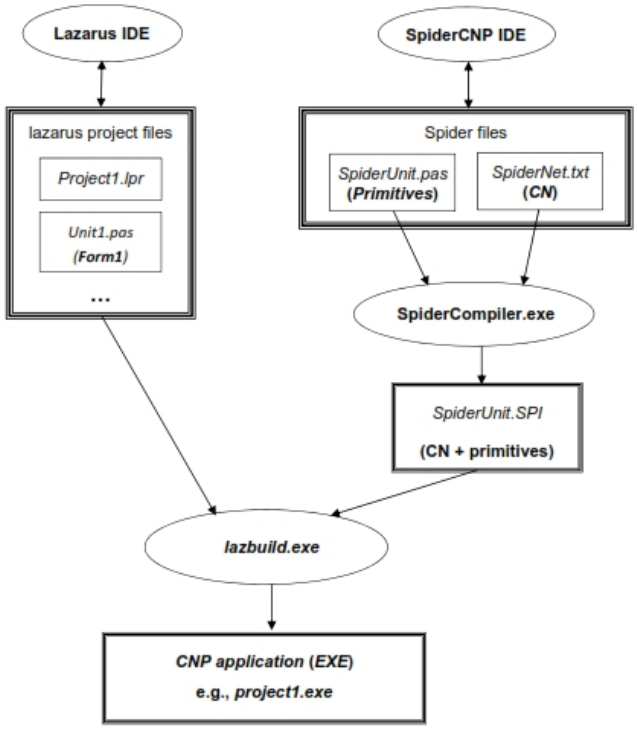

Figure 3 Structure of a CNP application

B. Architecture of a CNP application

There are two types of applications in *Free Pascal* (also known as *OO Pascal*) which is the core of *Lazarus*: console applications and window applications. Correspondingly, we have the same two types of CNP applications. Console applications are simpler; the I/O is realized through a DOS-type console. Such an I/O console is shown in Fig. 2c. The I/O of a window application is performed through various built-in or user-defined windows. This allows the creation of applications with more attractively looking and modern I/O. In practically all cases of teaching applications the console I/O is enough and even easier to follow. The online CNP compiler that we will be describing further in this report allows console applications only. Therefore, we will introduce the structure of a CNP application for the case of console applications only (although the differences are minimal). It is shown in Fig. 3.

A CNP application is created as a *Lazarus* project. All the files of the project (i.e., the CNP application) are placed in a folder. As we know, a CN program consists of two fundamental parts: primitives and CN. The file with the primitives is *SpiderUnit.pas*. Technically, it is an *OO Pascal* file in which the primitives are defined as procedures. The file may contain also definitions of global data. The CN is specified in the text file *SpiderNet.txt*. It describes the CN in textual form using a very simple language for specifying nets called *Spider* – see [6],[10] for a description of this language.

The CNP compiler (called *SpiderCompiler.exe*) uses the above two files (the CN and the Primitives) to produce a Pascal program as its object file *SpiderUnit.spi*. This program includes directly a copy of the definitions of the primitives and the global data. The behavior of the program corresponds to that of an interpreter that would execute the CN according to its semantics. The CNP compiler has been developed using ideas similar to recursive decent.

As any *Lazarus* project, the project folder contains some other files. The only one important for our description here is *Project1.lpr*. A CNP user may well survive without knowing about it, but if (s)he wants to change the initial and concluding text in the output, the user may do corresponding modifications there.

All *Lazarus* files included in the project, as well as the *SpiderUnit.spi* file, are used by the *lazbuild.exe* file (which is part of the *Lazarus* IDE) to create the file *project1.exe*. This executable file is the CNP application. It can be called (executed) from inside the IDE, or directly as a stand-alone executable file.

The general view of the *SpiderCNP* IDE can be seen in Fig. 2a. In the main window, the user may switch between displaying the CN (graphical view or textual view; the latter is the file *SpiderNet.txt*), primitives (file *SpiderUnit.pas*), or console (file *Project1.lpr*). Normally, the CN is studied and edited in the graphical view. However, if preferred, the textual file may be modified (currently, for a given project, only one of these options is possible). The textual view of the *Graph* subnet shown graphically in Fig. 2b, is given in Fig. 4.

Clearly, the most distinguishing feature of *LazarusCNP* is the existence of graphical editor of CNs. The CNP IDE has many other features, including tracing the execution within the graphical editor on the graphical view of the CN.

Working with a CNP project means creating and modifying as needed the three components (files) described: CN, primitives and *project1.lpr*.

C. Possible principles for designing a CNP development environment

Historically, the first CNP were run using **interpreters** which interpreted the CN. However, for over fifteen years all CNP environments use a **compiler** (e.g., [5]) – an approach which we found to have substantial advantages.

As we emphasizes earlier, a CN program consists of primitive definitions and a CN. For representing the CN we have always used the simple *Spider* language mentioned before. The second question arising is how to specify/program the primitives.

It is possible to use a **special, defined by us programming language for primitives** which, in a way, will make CNP self-contained. We have decided against this approach, however, as it will imply constant improvements, extensions, and modifications to the language and the corresponding environment, for which we must be responsible, together with the corresponding documentation, installation files, etc.

Following the approach we have chosen, we must **integrate our CNP development environment with the external IDE** of a programming language. As already mentioned, our main CNP development environment, *LazarusCNP* is integrated as a

tool inside the *Lazarus* IDE. Therefore, a CNP developer can avail of all the powerful features of *Lazarus*. Also, a developer working in *Lazarus*, can in principle create a 'regular' *Lazarus* project (e.g., in *OO Pascal*) using CNP only for subtasks where CNP would be most effective. Naturally, this approach also has drawbacks, the major one being the necessity to obtain, download and learn the basics of *Lazarus*. This disadvantage is not so severe as *Lazarus* is freely available and well maintained; however it still exists. For example, we need to have *Lazarus* installed in our teaching labs.

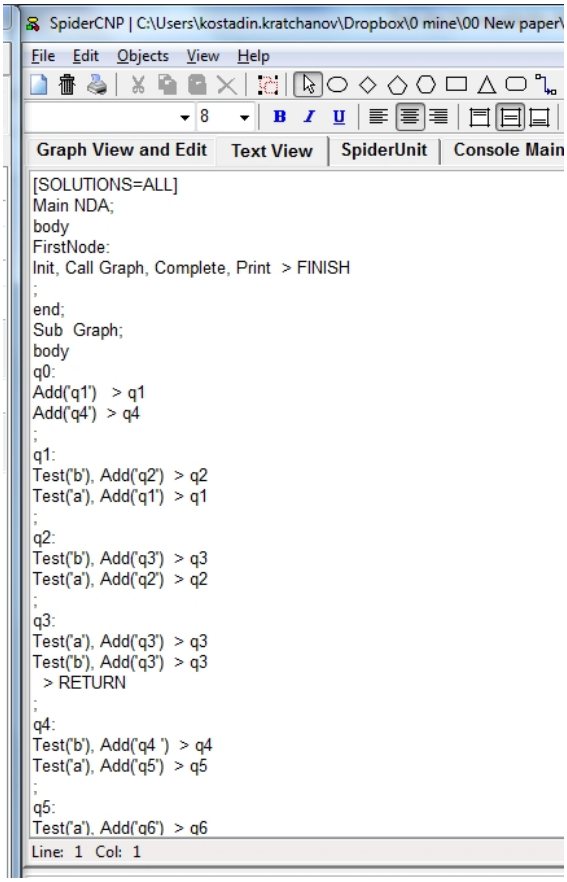

Figure 4 Textual view of *Graph* subnet

An alternative promising approach is to develop a **'stand-alone' CNP environment** which does not depend directly on any specific external development environment. However, in contrast to the approach with a specially design programming languages for coding the primitives which was mentioned above, a natural and highly appealing approach would be to use primitives programmed in different programming languages and eventually developed in different IDEs. This idea is aligned with the modern-day idea of language interoperability [20]-[24]. The idea could be implemented on the base of any of the two major groups of managed languages – the .NET SLI compliant languages and JVM compliant languages [25],[26]. Creating such a light-weight and highly-flexible CNP development environment is in our plans for the near future. In particular, being able to write primitives in a language of the student's choice is a highly desired feature of a CNP environment used in teaching. The learners of CNP come from different backgrounds, have different personal preferences, and would like to be able to use the language they feel most confident with. A main idea behind creating the declarative-driven approach of CNP is that 'programming' can be done by any user, including those with very limited or even non-existing experience in programming.

Finally, we can develop the previous approach even further by using a **cloud CNP development environment** the core component of which is a cloud CNP compiler.

A short survey of cloud compilers and development environments follows. The sections afterwards describe our current working CNP cloud compiler called *Bouquet*.

D. Cloud IDEs and compilers

It is widely accepted that cloud computing is undoubtedly one of the biggest buzzwords in the technology world today. According to Fast Company [27], the cloud is a vast network of low-cost, high availability computing resources. Almost 60% of companies are already in the cloud and an additional 20% are planning to do so within the next 12 months. Cloud computing refers to application service provisioning where typical client server software is run at a remote location. Such services are given popular acronyms like 'SaaS' (software as a service), 'PaaS' (platform as a service), 'IaaS' (infrastructure as a service), 'HaaS' (hardware as a service) and finally 'EaaS' (everything as a service) [28].

Cloud computing has well-known advantages and challenges which we are not going to address here in general. Instead, we discuss below the advantages and limitations of cloud IDE's, simpler development tools, and compilers.

Software development, and in particular its most important component – compiling - can also be shifted from being performed on a user's physical computer into being done in the cloud using available remote software resources. The result of this approach is the so called cloud development environments (most developed ones are referred to as **cloud IDEs**). Some authors use the phrase online environment/platform or online compiler – this is technically correct but does not emphasize well enough the nature of a cloud application – it is not simply contents available from the internet but it is actually an integrated resource/service available remotely, most often from a dynamic website. A cloud development environment may include much more than a single compiler – editors, libraries, online execution facilities, user storage, etc.

For some reason lifting the code production into the cloud is happening later than many other types of business and other applications. Advancement in cloud compiling and cloud IDEs is a comparatively recent development, an emerging technology.

Some of the most interesting representatives of currently available cloud development environments are [29]-[44].

They have different features. Some are simple and free; many of the best ones are (as it should be expected) paid and

highly professional. Some sites support many (e.g., 60) languages, others are highly specialized and focus on one particular programming language or tool. Some allow for the execution of the compiled object program on the cloud server or even for the deployment of the compiled embedded code into a particular device. Some IDEs also allow the developed code to be deployed into cloud platforms such as Windows Azure, Amazon Cloud Services, or Heroku.

Jimenez, founder of [32], summarizes: "The online IDE is one of the final frontiers of apps ported to the web. I would like to be able to develop from any computer or operating system and have the same experience without having to install software or install anything."

The following advantages of cloud compilers may be identified (not all sites possess all advantages).

It can be frustrating to have to install volumes of software just to write a little bit of code. Cloud IDEs keep it simple by making all these tools available in the cloud with the click of a mouse. Some cloud IDEs come equipped with almost every tool, library, etc. that the code developer may ever need. With an online IDE, one can get their projects up and running faster than ever by skipping over tedious installations, and getting right down to the programming of the project itself.

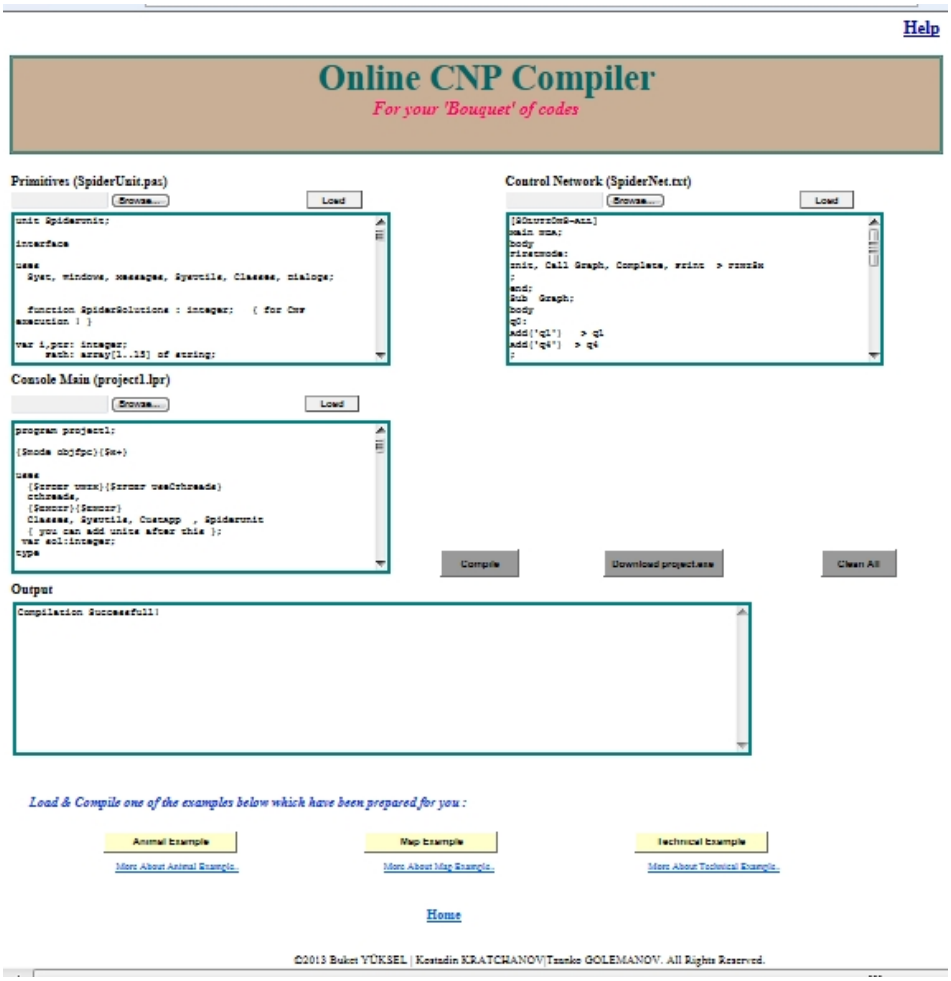

Figure 5 The *Bouquet* cloud CNP compiler

The local computer is not loaded with large-size software, neither is computer time and other resources used for compilation and other related tasks.

Cloud IDEs allow the code to be accessed and edited from just about any computer worldwide, freeing the programmer from the need to have constant access to a single computer where all the tools and files are. Typically, cloud IDEs are cross-browser and device-friendly. They have been tested across all modern desktop and mobile web browsers like Internet Explorer, Firefox, Chrome, and Safari. With support for touchscreen interaction one could write code all from their mobile or tablet device. It is possible to log into one's online IDE with a smartphone or tablet, edit the code, test it and send it off to a client in a matter of minutes.

A developer is now able to program for a wide selection of devices, without actually needing to go out and purchase them. They can write for Mac, Windows, Linux or even an iPhone or iPad without spending the money on buying one of each.

A cloud IDE can integrate features that can hardly be achieved by a compiler installed on a local computer.

The remote server can be more powerful (in terms of speed, storage and memory) than a local computer. The compiler, editor and other components may be most advanced and possess most useful and increasing the developer's productivity features. E.g., the cloud compiler may include advanced code optimizing features, the editors may support features such as autocomplete, syntax checking, multiple cursors, keyboard shortcuts, etc. Live editing might be supported where you can see real-time updates as you tweak your code. Advanced tracing may be included, even simulating the state of data. Powerful latest popular and non-standard libraries may be made available. The software components on the cloud-based site will be kept up-to-date at any time.

You can have a user account at the cloud IDE – a central depository and a virtual console. You can forget about Dropbox, USB sticks, external drives — with a cloud IDE central depository your code is always accessible online. You can access files directly from your folders on the IDE or from Dropbox, Google Drive, Amazon S3, etc. You can keep a revision history. You do not have to compile into local native images or re-download pre-compiled native images.

An especially important feature is the possibility to easily share your code and collaborate. Some cloud IDEs enable

developers around the world such as teammates or peers to edit the same code and chat together in real time.

Some IDE's allow the developer to integrate with many other services that are important within the development life cycle. Thus the user can work with the tools they know and like, or even develop and integrate their own extensions.

Some sites offer for download local servers that can automatically synch with the cloud workspace.

Of course, cloud IDE's also have shortcuts and limitations – some of them are inherent, other relate to the fact that the technology is only emerging. One of the major issues is security – both in relation to the user code, and in relation to the integrity of the servers of the provider. Another issue is the client-server communication, in particular during the editing. Usage of graphical tools such as graphical editors or complex graphical I/O in the developed programs might be a serious challenge. Reaction to errors on the server and auto-safe functionality are another issue to address.

E. Cloud IDE's and learning systems

It is often claimed that online IDEs and compilers are a perfect learning tool for students and other persons learning programming with a particular programming language or tool. Some of the systems mentioned in the previous subsection have been actually created mainly as a learning tool.

A cloud IDE is easy to be used by students. They can create their codes all from the comfort of their browsers. All the heavy lifting has been done by the creators of the cloud IDE, so students and learners can just focus on writing and learning code. A cloud IDE is a natural sandbox for learning a programming language. You can write code in the computer lab and pick up where you left off at home. You can learn programming by visualizing code execution, use advanced editors, etc.

Many of the other assets which cloud IDEs demonstrate and we discussed in the previous subsection, can be considered as essential advantages from the viewpoint of learning systems.

It is also natural to integrate a cloud IDE/compiler within an integrated learning system. In addition to the IDE, an integrated learning environment may include reference guides, online interactive tutorials, pdf and video tutorials, demos, tests, problems, projects, other resources, etc.

Cloud IDE sites often include blogs and forums. You can easily get help from the programming community as well as from other students and learners.

In addition to teaching and learning, cloud IDEs may be used in training courses and certification, recruitment, programming contests, and similar activities.

IV. THE *BOUQUET* CNP CLOUD COMPILER

Following the modern trends in 'lifting' compilers into the cloud described above, and first of all understanding the substantial advantages of cloud IDEs, we have developed two online CNP compilers. One of them is the subject of [45]. The second one, called *Bouquet* compiler, is introduced below. It can be accessed at [46].

The general view of the cloud compiler is shown in Fig. 5. The data that can be seen are from the NDA application described earlier in Sec. II D (where *SpiderCNP* was used).

The webpage includes three input and one output forms. An input area exists for each of the three files that specify a CNP application: *SpiderUnit.pas* for the primitives, *SpiderNet.txt* for the textual representation of the CN, and the console file *project1.lpr*. These files were discussed in Sec. III B.

In order to compile a CNP application we must enter (e.g., write or copy) the corresponding files into the three input windows. We can also use the *Browse* button under each form. Three exemplary applications are prepared in advance and their files can be loaded with the click of a single button – the Animals classification, Map traversal, and the Technical example. These are the major examples used for introducing CNP in [5]-[7],[9],[10], as well as in teaching CNP at university.

When the three input files of an application are ready, the user can activate the *Compile* button. This triggers the following sequence on actions. A project folder with a partially random name is created on the virtual server. The randomness of the folder name allows multiple independent users to work simultaneously with the cloud CNP environment. A new CNP project is created in that folder. The input files from the forms are uploaded into the project folder. Then compilation/building is started by executing the file *SpiderCompilerCloud.exe* on the virtual server. This file is a cloud version of *SpiderCompiler.exe* (see Fig. 3). The generated name of the project folder is given as an argument to *SpiderCompilerCloud.exe.* In addition to the application executable file, a second output file, *CompResult.txt* is produced which contains details of the compilation and is most useful in the case of errors. Finally, *lazbuild.exe* is run which in absence of errors generates the CNP application executable file *project1.exe* and saves it in the application folder in the cloud. The user can now push the *Download project1.exe* button and download the executable file of the CNP application to their local computer. Execution of the application file directly in the cloud is not offered due to the security policy of the cloud services provider.

In case the CNP compiler or the *Lazarus* builder encounter errors, corresponding messages will be displayed in the output window. The text displayed is a filtered version of *CompResult.txt.* After fixing the errors the user can initiate compilation again.

Currently the *Bouquet* CNP environment is hosted using Amazon Elastic Compute Cloud (Amazon EC2) web services [47]. We found this advanced but still convenient and user-friendly cloud services platform suitable and attractive. However, this is a paid service and we will have to find an alternative solution in the future.

The cloud CNP environment is installed on a remote virtual server (rented from Amazon WS). Windows 2008 R2 server

with IIS7 is installed on the virtual server instance. The application is coded in ASP.NET and C# using web forms with code behind. Setting properly the server configuration actually proved to be probably the most difficult part of developing the CNP compiler as allowing an executable file (the CNP cloud compiler) to run on the server was a hard job.

V. Future Development

As an emerging technology, today's online compilers are certainly not without their limitations. Most online compilers have yet to integrate reliable version control capabilities which are necessary on production projects, as well as to enhance their integrated auto-save functionality to temporarily make up for lost ground, for example when the internet connection is lost.

Bouquet is more than just a compiler, more precisely – it is a simple development environment. It is, however, still not a cloud IDE. It is missing many of the advanced features of cloud IDEs discussed in Sec. III D and E. Development continues.

The first most important feature that needs further research and improvement would be the possibility to use the graphical editor in the cloud version of the environment.

Another important task is to integrate the cloud environment into an advanced learning system for studying and improving skills in CNP. Such a system is currently under development.

References

[1] N. Wirth, *Algorithms + Data Structures = Programs*. Prentice-Hall, 1975.

[2] R. Kowalski, "Algorithms = Logic + Control", *Comm. ACM*, vol. 22, 1979, pp. 424-436.

[3] Z. Michalewicz, *Generic Algorithms + Data Structures = Evolution Programs*. Springer, 1992.

[4] M. Sipser, *Introduction to the Theory of Computation*, 3rd ed. Thomson, 2012.

[5] K. Kratchanov, T. Golemanov, and E. Golemanova, "Control Network Programming", in *Proc. 6th IEEE/ACIS Conf. on Computer and Information Science (ICIS 2007), July 2007, Melbourne, Australia*, pp. 1012-1018.

[6] K. Kratchanov, E. Golemanova, and T. Golemanov, "Control Network Programs and Their Execution", in *Proc. 8th WSEAS Int. Conf. on AI, Knowledge Engineering & Data Bases (AIKED '09), Feb 2009, Cambridge, UK*, pp. 417-422.

[7] K. Kratchanov, T. Golemanov, and E. Golemanova, "Control Network Programming: Static Search Control with System Options", in *Proc. 8th WSEAS Int. Conf. on AI, Knowledge Engineering & Data Bases (AIKED '09), Feb 2009, Cambridge, UK,* pp. 423-428.

[8] K. Kratchanov, T. Golemanov, E. Golemanova, and T. Ercan, "Control Network Programming with SPIDER: Dynamic Search Control", in *Knowledge-Based and Intelligent Information and Engineering Systems, Proc. 14th Intl Conf. (KES 2010), Cardiff, UK, Sep 2010, Part II, Lecture Notes in Computer Science (Lecture Notes in Artificial Intelligence),* vol. 6277, Springer, 2010, pp. 253-262.

[9] K. Kratchanov, E. Golemanova, T. Golemanov, and Y. Gökçen, "Implementing Search Strategies in Winspider I: Introduction to Control Network Programming and Search" in *Knowledge-Based Automated Software Engineering*, I. Stanev, and K. Grigorova, Eds., Cambridge Scholars Publ., 2012, pp. 87-113.

[10] K. Kratchanov, E. Golemanova, and T .Golemanov, "Control Network Programming Illustrated: Solving Problems With Inherent Graph-Like Structure", in *Proc. 7th IEEE/ACIS Int. Conf. on Computer and Information Science (ICIS 2008), May 2008, Portland, Oregon, USA,* pp. 453-459.

[11] K. Kratchanov, E. Golemanova, T. Golemanov, and T. Ercan, "Non-Procedural Implementation of Local Heuristic Search in Control Network Programming", in: *Knowledge-Based and Intelligent Information and Engineering Systems, Proc. 14th Intl Conf. (KES 2010), Cardiff, UK, Sep 2010, Part II, Lecture Notes in Computer Science (Lecture Notes in Artificial Intelligence),* vol. 6277, Springer, 2010, pp. 263-272.

[12] K. Kratchanov, E. Golemanova, T. Golemanov, and Y .Gökçen, "Implementing Search Strategies in Winspider II: Declarative, Procedural, and Hybrid Approaches", in *Knowledge-Based Automated Software Engineering*, I. Stanev and K. Grigorova, Eds., Cambridge Scholars Publ., 2012, pp. 115-135.

[13] E. Golemanova, "Declarative Implementations of Search Strategies for Solving CSPs in Control Network Programming". WSEAS Transactions on Computers, vol. 12, No.4, 2013, pp. 174-183.

[14] T. Golemanov, "SpiderCNP - an Integrated Environment for Visual Control Network Programming". University of Ruse Annual, vol. 51, 2012, ser. 3.2, pp. 123-127 (in Bulgarian).

[15] http://www.embarcadero.com/products/delphi

[16] http://www.lazarus.freepascal.org/

[17] K. Kratchanov, E. Golemanova, T. Golemanov, and B. Külahçıoğlu, "Using Control Network Programming in Teaching Nondeterminism", in *Proc. 13th Int. Conf. on Computer Systems and Technologies (CompSysTech'12), Ruse,* B. Rachev and A. Smrikarov, Eds., ACM Press, New York, 2012, pp. 391-398. Also, ACM Digital Library, http://dl.acm.org/citation.cfm?id=2383333&dl=ACM&coll=DL&CFID=169141915&CFTOKEN=28327026.

[18] K. Kratchanov, E. Golemanova, T. Golemanov, and B. Külahçıoğlu, "Using Control Network Programming in Teaching Randomization", in *Int. Conf. Electronics, Information and Communication Engineering, Macau (EICE 2012),* ASME, 2012, pp. 67-71. Also, in ASME Digital Library: http://dx.doi.org/10.1115/1.859971.paper14.

[19] http://controlnetworkprogramming.com.

[20] http://msdn.microsoft.com/en-us/library/vstudio/a2c7tshk(v=vs.100).aspx.

[21] http://msdn.microsoft.com/en-us/library/a2c7tshk.aspx.

[22] http://forums.codeguru.com/showthread.php?369066-NET-Framework-IL-What-is-Language-Interoperability.

[23] M. B. Enevoldsen, *Object Oriented Language Interoperability* (Master's Thesis), Uni. Of Aarhus, 2004 (available at http://users-cs.au.dk/beta/eclipse/mbeOOLI.pdf.

[24] http://en.wikipedia.org/wiki/Language_interoperability.

[25] http://en.wikipedia.org/wiki/List_of_CLI_languages.

[26] http://en.wikipedia.org/wiki/List_of_JVM_languages.

[27] http://www.fastcompany.com/3001010/cloud-computing.

[28] http://en.wikipedia.org/wiki/Cloud_computing.

[29] https://c9.io/.

[30] http://www.compileonline.com/.

[31] https://compilr.com/.

[32] https://shiftedit.net/.

[33] http://codepad.org/.

[34] http://pythontutor.com/.

[35] http://ideone.com/.

[36] http://www.onlinecompiler.net/.

[37] http://www.tutorialspoint.com/.

[38] http://www.w3schools.com/.

[39] http://codebender.cc/.

[40] http://cloudcompiling.com/.

[41] http://mbed.org/.

[42] https://ludei.com/.

[43] http://www.silverlightshow.net/items/Windows-Phone-8-Compile-in-the-Cloud.aspx.

[44] http://www.codeproject.com/Articles/199537/What-are-Online-Compilers-Online-IDE-s.

[45] http://controlnetworkprogramming.com/cloud.html.

[46] T. Golemanov, K. Kratchanov, and E. Golemanova, "SpiderCloud – a Cloud-Based Control Network Programming Environment", to appear in *Univ. of Ruse Annual*, 2013 (in Bulgarian).

[47] http://aws.amazon.com/ec2/.

APH-IGP: Gestalt theory, Hybrid Design and Self-Learning with Compass

R. Hussin and A. Mokhtar

Abstract - Through the hybrid design, a variety of geometrics can be created and the process of designing Islamic themed geometrics are made easy. The creativity of earlier artists and sculptors in designing geometrics are extraordinary provided with only a compass. Indeed, the designs of Islamic themed geometrics are unique and have their own aesthetic values. In order to further understand geometrics, self-learning with the approach of hands-on would be appropriate. For this study, Islamic themed geometrics designed and created, concerning only four types are: i). The Square Repeat Unit and Root Two $\sqrt{2}$ System of Proportion, and ii). The Hexagonal Repeat Unit and Root Three $\sqrt{3}$ System of Proportion. The aim of this research is to develop and evaluate a multimedia courseware for APH-IGP, based on the Gestalt theory. The methodology adopted in the development of this courseware was based on the development life cycle method known as the KH-IGP. This method encompassed five phases such as: Analysis, Design, Development, Implementation and Evaluation. This courseware consists of three modules. The motif module enables students to differentiate various types of geometric patterns; and the creativity module, enables students to design 2D colours IGP. Design module on the other hand, helps students acquire skills to identify harmony, balance, and repetition of design that is created. The data was collected using specific tasks, interview and observational checklist. Evaluation of the APH-IPG multimedia courseware was conducted based on the quasi-experimental method to test for usability based on three constructs: effectiveness, learnability, and flexibility towards the courseware. Contributions of the research are: (i) ID model of the multimedia courseware, APH-IGP based on the Gestalt theory; (ii) prototype APH-IGP multimedia courseware; (iii) various research instruments, to test usability of the APH-IGP, and (iv) usability findings of the APH-IGP multimedia courseware.

Keywords - Islamic geometric patterns (IGP), Gestalt, Hybrid Design, Compass.

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I. INTRODUCTION

At present, we can clearly see that the surge of arts and design with the concept of Islamic categorization, was not integrated, regarded or discussed as it once was. There is no denial that the potential and the ability of arts and Islamic designs as the means towards revolution would bring great implications regarding the creativity of ideas and current innovation, concerning; (art & design, engineering, architecture, medical studies, astronomy, science, mathematics and information technology) which has started to be approved and applied. The art of Islamic engravings is indeed of high value, either the arrangements or the composition, the distribution of areas being inscribed in it including the methods or techniques used and how the design is being made and designed according to the precision of the artiste.

The creation of the sky, earth and the world as a whole or the in-between is closely related to the greatness of His creations which also has coincidentally been made the main reference by most designers and Islamic artists once. Ideas inspired from the Creator with the Quran as reference alongside the very existence of the sun, moon and stars is a clear example of the sole source of creating Islamic geometrics. Designing Islamic motives which involve the arabesque motif (flowers, leaves), the geometric motif and the calligraphy motif has positioned Islamic designs at its best worldwide. Moreover, the world of Islamic designs has also gone through a different level where the achievement of Islamic designs was at its highest not to mention worldwide recognition as well. However, in Malaysia, Islamic designs is still constant, neglected and of fear from disappearing with time. Few realized that Islamic designs especially geometric themed designs has started to be modified and redesigned by artists and designers with a much more different kind of approach. Still, few Islamic artists and designers in Malaysia are sensitive enough, interested or enthusiastic enough to study or to be conscientious enough to the exquisiteness of the geometrics created previously. Geometric motives of different engravings were done on a multiple surfaces such as of wood, stone, carpet, ceramics, terracotta and metal such as gold infinitely. Technologically, a diversity of new waves has been created including the beginning of new dimensional symbols, new typography, image and word realignments, 3-Dimensions, illustrations, including motives and different types of experimentation process that once needed skilled craftsmen, though now designing conventionally was not needed and was

not even continued by the new generations. The main advantage of designing Islamic geometrics is that, at an earlier time it was created with only a compass. "Referance [1] shows, Muslim artists developed geometric patterns to a degree of complexity and sophistication previously unknown. These patterns exemplify the Islamic interest in repetition, symmetry and continuous generation of design.

II. ISLAMIC GEOMERIC ISLAM (IGP)

[2], geometry became highly important in the Islamic world as its figures and constructions were permeated with symbolic, cosmological and philosophical significance. Geometrical designs based on a grid system and broken down into identical units which are repeatead in regular sequence. Basically very simple, constructed with only a compass and a rule and the knowledge of certain procedures which produce triangles, squares, hexagons, stars, etc [3], Geometric Patterns - "...the structure of architectural design concepts and town planning were the domains where his forte and enigma lay. This involvemet developed alongside his understanding of the essence, beauty, perfection and harmony found in the Islamic arts and architecture, irrespective of region or era to reconstruct their elements." [4], the principle of Islamic geometric patterning as a system whereby geometrical grids from the framework of identical units that are regularly repeated.

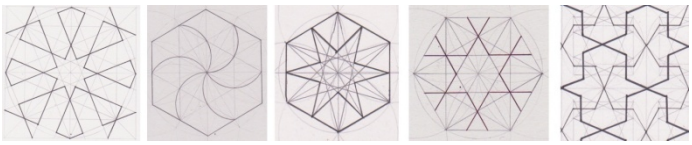

Fig. 1.0 Islamic Geometric Patterns through Compass of both Group X_1 and X_2

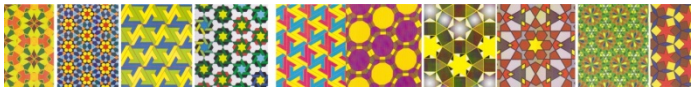

Fig. 2.0 Islamic Geometric Patterns through Gestalt (Similarity) of both Group X_1 and X_2

III. OBJECTIVES

This study was performed in order to develop an interactive multimedia courseware in self-learning hands-on process of the Islamic Geometric Patterns. The courseware is known as APH-IGP (**A**ddie **P**rototyping **H**ybrid – **I**slamic **G**eometric **P**atterns). This study will also assess the usage of the APH-IGP interactive multimedia courseware amongst the students. On the whole, this study comprises of two main purposes as of below:

1 To develop an interactive multimedia courseware (APH-IGP) in four types of Islamic geometric i). The Square Repeat Unit and Root Two $\sqrt{2}$ System of Proportion ii). The Hexagonal Repeat Unit and Root Three $\sqrt{3}$ System of Proportion,

2 To assess the interactive multimedia courseware (APH-IGP) based on three concepts: effectiveness, learnability, and flexibility towards the courseware.

IV. METHODOLOGY OF STUDY

This study identifies and analyses the complexity of measuring as well as the usage and its relationship with mathematics and architecture regarding the structure of designing Islamic geometric designs through the assembling of images and redesigning of Islamic geometric designs available. This study analysis involves two hybrid designs which is done conventionally (with a compass) and with the use of APH-IGP. On the other hand, the gathering of geometric designs on field is to assemble designs as much as possible which can be seen in mosques in Malaysia, as a guide or reference of existing geometrics available. A study on 34 mosques resulted in 36 different Islamic geometric designs taken from researchers within twelve states in Malaysia. This study involves the researcher and arts & design students directly and through hands-on, in the computer laboratory according to the graphic design subject. Two groups of sample study which consists of group X_1 (19) and group X_2 (21) of 40 students.

V. STUDY OUTCOMES

The outcome of this study being discussed will involve: the development of the Islamic Geometric Patterns for self-learning effectiveness in order to answer inquiries regarding this study as of below:

Qi What is the appropriate methodology in designing an APH-IGP (Islamic Geometric Patterns) for the visual arts & design?

Qii What is the process design, appropriate to design an APH-IGP?

Qiii Were there any significant differences on the design used digital (APH-IGP) methods compared to the use of compass?

Qiv Were there any significant difference in the ability to learn (based on specific tasks: create their own patterns or re-create classic patterns) on (Square Repeat Unit and Root Two $\sqrt{2}$, or Hexagonal Repeat Unit and Root Three $\sqrt{3}$?

Qv Were there any significant difference in the flexibility of APH-IGP (based on the establishment of creative values, aesthetics, and innovation) compared to the use of conventional method (compass)?

Qvi Will this APH-IGP be able to aid students in performing their visual arts & design activities of Islamic Geometric Patterns design considering the efficiency?

VI. FINDINGS

"In order to understand the mathematical basis of Islamic pattern one must consider most carefully those primary moves of geometry which are all too frequently passed over lightly, or simply taken for granted." [5]."

Problem Statement 1 ($H_0$1):
Were there any significant differences in the ability to learn (based on three specific tasks of Islamic Geometric Patterns) APH-IGP compared to the use of compass method?

Table 1: Data outcomes from 3 assignments types of IGP of both study Group X_1 and X_2

Sampel study group X_1	1. Square Repeat Unit	Assignments (10% each) 2. Hexagonal Repeat Unit	3. Combination Geometric Unit	Total score (30 %)	Sampel study group X_2	1. Square Repeat Unit	Assignments (10% each) 2. Hexagonal Repeat Unit	3. Combination Geometric Unit	Total score (30 %)
A1	5	7	8	20	B1	8.5	5	8	21.5
A2	7.5	8	7.5	23	B2	8	7	8	23
A3	5	8	7.5	20.5	B3	8	7.5	8	23.5
A4	4	7	8.5	19.5	B4	8	7	8	23
A5	8.5	8	8	24.5	B5	8	7	8.5	23.5
A6	7	7	8	22	B6	8.5	8	8	24.5
A7	7.5	8	8	23.5	B7	8	6	8	22
A8	6.5	7	7	20.5	B8	8	7	8.5	23.5
A9	6.5	7	7.5	21	B9	5	7	8	20
A10	8.5	8	8	24.5	B10	8	9	5	22
A11	7	9	8	24	B11	8.5	7	8	23.5
A12	6	9	8	23	B12	8	8	8	24
A13	5	8	8	21	B13	8	7	8	23
A14	5.5	7	8	20.5	B14	8	7.5	8	23.5
A15	6.5	7	7	20.5	B15	8.5	7	8	23.5
A16	7.5	9	7.5	24	B16	8	8	8.5	24.5
A17	5.5	8	8.5	22	B17	8.5	7	8	23.5
A18	5	8	8	21	B18	5	7	5	17
A19	4.5	8	8	20.5	B19	5	7	5	17
A20	5	8	8	21					
A21	8	8	7	23					
		Average		21.8					19.97

Study outcomes in Table 1.0 shows the marks assignments types of Islamic Geometric Patterns of both study Group X_1 and X_2 . This case study data analysis shows that the self-learning process which utilises the APH-IGP courseware has suceeded in increasing the test marks of both group for IGP tasks. From Table 1, the highest marks of group X_1 from samples: A5 and A10 = 24.5, in comparison to the highest marks of group X_2 from sample: B6 and B16 = 24.5. There was a significant difference considering the ability to learn of APH-IGP based on the three assignments types of IGP. Results from the One-Sample T-Tests shows a significant difference between group X_1 ($mean_1$ = 4.8571 ± 0.1250) and mean group X_2 ($mean_2$ = 4.9474 ± 0.1202) from Table 2. Mean X_2 exceeds mean X_1. This shows that APH-IGP succeeds in increasing their skills in designing three assignments types of Islamic Geometric Patterns.

Table 2: One-Sample statistics T-Test

Group Research	N	mean	sp	df	t	sig.
Group (X_1)	21	4.8571	0.1250	18	-0.622	0.542*
Group (X_2)	19	4.9474	0.1202			

* $p > 0.05$

Table 3: Data outcomes from the (based on specific tasks square repeat unit) APH-IGP compared to compass method of both study Group X_1 and X_2

Sampel study group X_1	Compass	APH-IGP Square repeat unit	Total score (20%)	Ascending	Sampel Study group X_2	Compass	APH-IGP Square repeat unit	Total score (20%)	Ascending
A1	7	9	16	2.0	B1	7	8	15	1.0
A2	6.5	7.5	14	1.0	B2	7	8	15	1.0
A3	8.5	9	17.5	0.5	B3	7	7.5	14.5	1.5
A4	7.5	8	15.5	0.5	B4	7	8	15	1.0
A5	7	9	16	2.0	B5	8	8	16	0.0
A6	7	10	17	3.0	B6	7.5	7	14.5	-0.5
A7	7.5	9	16.5	1.5	B7	8	8.5	16.5	0.5
A8	9	10	19	1.0	B8	7.5	7.5	15	0.0
A9	8	8	16	0.0	B9	6	9	16	3.0
A10	8	8	16	0.0	B10	7	9	16	2.0
A11	7.5	8	15.5	0.5	B11	7	7	14	0.0
A12	8	8	16	0.0	B12	8	8	16	0.0
A13	7	8.5	15.5	1.5	B13	7	8	15	1.0
A14	7	7.5	14.5	0.5	B14	7	8	15	1.0
A15	7	8	15	1.0	B15	7	8	15	1.0
A16	7	8.5	15.5	1.5	B16	7	7	14	0.0
A17	7	8.5	15.5	1.5	B17	7	7	14	0.0
A18	6	7	13	1.0	B18	7	7	14	0.0
A19	6	8	14	2.0	B19	8	9	17	1.0
A20	5	7	12	2.0					
A21	6	7	13	1.0					

From Table 3, the highest marks of group X_1 from samples: A8 = 19.5, in comparison to the highest marks of group X_2 from sample: B19 = 17.0 and Table 4 also showed the marks mean highest for both group. Therefore, there was a significant difference considering the ability to learn of APH-IGP based on the assignments types of Square repeat unit compared to Compass. Therefore, hypothesis Nol 1 ($H_0$1) was not accepted.

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Table 4: A summary of variations in the mean marks of both study Group X_1 and X_2

Group	N	Marks of Mean Compass	Marks of Mean APH-IGP Square repeat unit	Marks mean difference
Group (X_1)	21	2.2632	2.8421	0.5789
Group (X_2)	19	2.2105	2.6316	0.4216

Problem Statement 2 ($H_0$2):
Were there any significant differences on the effectiveness of (APH-IGP) based on Pre-Tests and Post-Tests before and after systems are used by sample studies through Gestalt theory?

Table 5: Data outcomes from the Effectiveness Test (based on specific tasks-creativity) APH-IGP compared of both study Group X_1 and X_2

Sample study group X_1	Marks Pre-Test (10%)	Marks Post-Test (10%)	Ascending %	Sample study group X_2	Marks Pre-Test (10%)	Marks Post-Test (10%)	Ascending %
A1	9	10	1.0	B1	8	8	0.0
A2	7.5	8	0.5	B2	8	8	0.0
A3	9	9	0.0	B3	7.5	9	1.5
A4	8	9	1.0	B4	8	9	1.0
A5	9	10	1.0	B5	8	9	1.0
A6	10	10	0.0	B6	7	9	2.0
A7	9	10	1.0	B7	8.5	10	1.5
A8	10	10	0.0	B8	7.5	9	1.5
A9	8	9	1.0	B9	9	9	0.0
A10	8	9	1.0	B10	9	9	0.0
A11	8	9	1.0	B11	7	8	1.0
A12	8	9	1.0	B12	8	9	1.0
A13	8.5	10	1.5	B13	8	9	1.0
A14	7.5	9	1.5	B14	8	9	1.0
A15	8	9	1.0	B15	8	10	2.0
A16	8.5	10	1.5	B16	7	9	2.0
A17	8.5	9	0.5	B17	7	8	1.0
A18	7	9	2.0	B18	7	8	1.0
A19	8	9	1.0	B19	9	9	0.0
A20	7	9	2.0				
A21	7	8	1.0				

Table 6: Paired-Sample T-Test Results for ($H_0$2)

Group	Mean ± S.E.	t value	p
Group X_1 Tasks 1: Pre-Test	2.7619 ± 0.9524	-2.5000	0.005**
Group X_2 Tasks 2: Pre-Test	2.6316 ± 0.1137		

S.E = Std. Deviation, N = 40, df = 18. ** p < 0.01

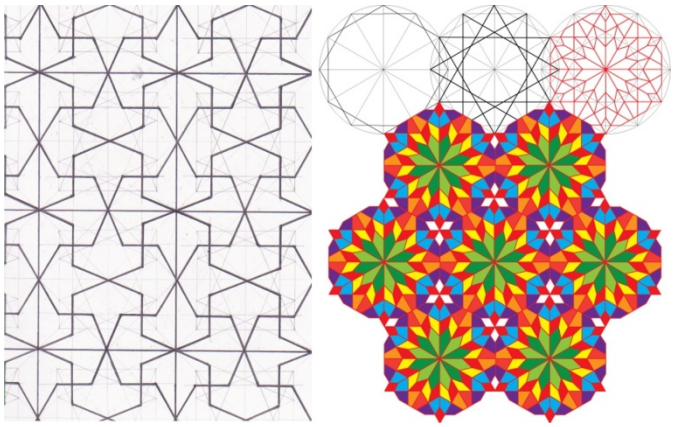

Fig. 3.0 Islamic Geometric Patterns through Compass and Gestalt

Table 7: Paired-Sample T-Test Results for ($H_0$2)

Group	Mean ± S.E.	t value	p
Group X_1 Compass & Square Repeat Unit	2.5263 ± 0.1176	1.714	0.104**
Group X_2 Compass & Square Repeat Unit	2.3158 ± 0.1095		

S.E = Std. Deviation, N = 40, df = 18. ** p > 0.01

Results from the Open Paired-Sample T-Tests shows a significant difference (t =-2.500 ; df 18 ; p < 0.01) between group X_1 ($mean_1$ = 2.7619 ± 0.9524) and mean group X_2 ($mean_2$ = 2.6316 ± 0.1137) from Table 6. Mean X_1 exceeds mean X_2. This shows that APH-IGP succeeds in increasing their skills in designing an Islamic Geometric Patterns.

This case study data analysis shows that the self-learning process which utilises the APH-IGP courseware has succeeded in increasing the marks of group X_1 ($mean_1$ = 2.5263 ± 0.1176) and group X_2 ($mean_2$ = 2.3158 ± 0.1095) students for The Square Repeat Unit and Root Two $\sqrt{2}$ System of Proportion geometric. The mean achievement of group X_1 in comparison to group X_2 as stated in Table 7. There was a significant difference considering the effectiveness of (APH-IGP) based on the Pre-Tests and Post-Tests before and after systems are used by the sample studies. Therefore, hypothesis Nol 2 ($H_0$2) was not accepted.

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V. CONCLUSION

Research findings showed that there was a significant difference in the achievement of students from both group. On the whole, research findings also showed that the use of APH-IGP multimedia courseware, was effective in the self-learning process of the Islamic Geometric Patterns, as compared to the use of compass method. Evaluation of the APH-IPG multimedia courseware to test for usability based on three constructs: effectiveness, learnability, and flexibility towards the courseware.

(i) There was a significant difference between group X_1 which uses the APH-IPG software compared to group X_2 of constructive effectiveness by means of Pre-Test and Post-Test conventionally.

(ii) There was a significant difference based on constructive learnability by means of three specific tasks.

(iii) There was a significant difference between the utilisation of software APH-IPG based on contructive flexibility by means of creativity, compared to the compass method.

The marvels of Islamic patterns the most recognizable visual expression of Islamic art and architecture? are not just beautiful accident. Traditional Islamic craftsmen weren't mathematicians, their tools for making geometrical designs were a compass and a ruler, often based on the repetition of a single pattern. The intricacy and artistry of the patterns can seem almost beyond the powers of human ingenuity [6].

Regarding to [7] “geometry is one of the gates that lead us to the essence of the spirit that lies at the root of every form of knowledge. Geometry a discipline to which the Islamic mind applied itself with extraordinary pertinacity, expresses this concept through the point, that simplest of all geometrical entities.

REFERENCES

[1] A. R. Hamzah, “Islamic Inscription in Mosques: The Forms and Meanings,” Johor Bahru: Penerbit UTM Press. 2011.

[2] E. Wilson, “Patterns Book of IslamicDesign,” London: The British Museum Press, 1988.

[3] I. El-Said, “Islamic Art and Architecture. THE SYSTEM OF GEOMETRIC DESIGN,” Reading: Garnet Pub. Ltd, 1993, pp. 6.

[4] M. Danby, “Moorish Style,” London: Phaidon Press Limited, 1995.

[5] C. Keith, “Islamic Patterns. An Analytical and Cosmological Approach”. London: Thames and Hudson, 1995.

[6] E. Brough, “Islamic Geometric Patterns,” London: Thames and Hudson, 2008.

[7] L. Mozzati, “Islamic Art,” London: Prestel Pub. Ltd, 2010, pp. 24.

[8] B. O’Kane, “Treasures of Islam. Artistic Glories of The Muslim World,” London: Duncan Baird Publishers Ltd, 2007.

[9] R. C. Sheila, “Islamic Art in Detail,” London: The British Museum Company Ltd, 2005.

[10] G. Valerie, “Beauty and Islam. Aesthetics in Islamic Art and Architecture,” New York: I.B, 2001.

[11] E. Wilson, “Patterns Book of Islamic,” Design. London: The British Museum Press, 1998.

[12] P. Evans, and M.A. Thomas, “Exploring the Elements of Design,” New York: Delmar, 2013.

[13] W.A.Kadir & H. Awang, “*Seni dan Kosmologi Islam dalam Kesenian Melayu*,” Kuala Lumpur: Akademi Pengajian Melayu, 1997.

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Dr. Hussin future plans are to create, redesign and incorporate Islamic Design Patterns, Calligraphy and Arabesques motif for Islamic World and continue research in the field of Islamic Arts. He teaches courses in Graphic Design and emphasizes on an area of Typography, Printing Technology, Islamic Art, and Multimedia in Art & Design Education.

Sample and Summary of Audit Data of Mathematics Teacher Training in Russia

E.I. Smirnov, V.V. Afanasev

***Abstract*—**In this paper we have analyzed the methodology, results and recommendations of mathematics teacher training in Russia. This activity was started from international project of ten countries in 2007-2011 under managing of Exeter University and professor David Burghes as the leader of Project.

***Keywords*—**Teacher training, mathematical audit, good practice, international cooperation, primary and secondary schools.

I. Introduction

RUSSIA is a large country and our efforts in educational area should be directed to looking and understanding of good practice in the training of (primary and secondary) teachers of mathematics using international cooperation and a longitudinal study to provide recommendations for effective training. The main aims were to have a sample of new qualified teachers (trainees) taken from different regions and Pedagogical Universities with different educational programs. The information sought from the trainees includes (* means computer-based): (a) mathematical audit* at the start of the last year of the training course; (b) personal details* including attitudes towards mathematics and teaching;(c) questionnaire* on all aspects of their training, including school-based work;(d) progress report on training, including interviews with a subsample of trainees, teacher trainers and school mentors. The following Table 1 shows the percentage of trainees (NQT) from three Russian regions (Yaroslavl, Vologda, Perm), which actually go into teaching directly after training and also information about where and what type of schools or job in education area they choose. All information has been concerned with 2010-2011.

The best results of Primary trainees (82,5% in education area) have been explained by these professional activity as part time ‘s good practice in kinder gardens or primary schools during training period at University. We also remark that a half of Primary graduates come to University after Pedagogical College. However Secondary trainees have higher level of scientific thinking (5% continue education) and managing skills (30% from “Teachers area “opposite to 17% of primary graduates). If we look on percentage of trainees who are teaching directly (TD) so 33% of secondary trainees opposite to 63,5% of primary one. It is tradition in Russia educational system to appoint the school mentors for every trainees TD, which help to defining the area of NQT’s methodical activity and diagnostic of initial teaching experience: skills, evaluation, problems and so on. Moreover some of TD teachers become qualified teachers (nominated on first or second category) during their first year of teaching. All trainees was involved in International Project on Comparative study of Mathematics Teacher Training under managing of Exeter University (ICSMTT) [1]. The aim of this study, funded by CfBT-Education Trust, was to seek an understanding of good practice in the training of (primary and secondary) teachers of mathematics. It is based on evidence from a variety of mathematically high performing countries around the world, and uses a longitudinal study to provide recommendations for effective training. The main problem of this paper is to define and discuss the comparative data of mathematical audit in Russia as well as recommendations for the support of Newly Qualified Teachers (NQTs) in their first year of teaching.

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II. METHODOLIDY AND RESULTS

Since 2011 the introduction of Standards of the general education of the second generation and the National State Educational Standards (NSES) of higher education of the third generation defines innovative activity of the teacher as a decisive factor in the improvement of quality and results of training, personal development of participants’ educational process.

Features of vocational training of the mathematics teacher in Russia

Design of innovative technologies of training (especially, to science disciplines and mathematics) in professional activity of the teacher unites itself the following components: theoretical (experience acquisition), procedural and activity (acquisition and experience transformation) and personal (development of personal characteristics and intellectual qualities), which are developing in a context of professional and pedagogical activity [2].

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Table 1

	Yaroslavl			Vologda			Perm		
	Number of NQT	Teachers area	Details	Number of NQT	Teachers area	Details	Number of NQT	Teachers area	Details
Secondary			3 (PG)			-			3(PG)
∑ 111	49	28	5 (ME)	32	17	9(ME)	30	18	5(ME)
56,7%		**57,1%**	20 (TD)		**53,1%**	8(TD)		**60%**	10(TD)
Primary			1(PG)			-			-
∑ 63	20	18	1(ME)	32	23	6(ME)	11	11	4(ME)
82,5%		**90%**	16 (TD)		**71,8%**	17(TD)		**100%**	7(TD)

Notes: **PG** – Post Graduate Students; **ME** – Manager of Education; **TD** – Teaching directly

Moreover, the Standards of the general education (second generation) define universal character, a common cultural and fundamental orientation of the general education, focus on mastering by knowledge of essence and features of objects and the reality phenomena (natural, technical and so forth), understanding of cause and effect, functional and other communications and interdependence of the subjects, the generalized ways of activity. Achievement of these purposes is impossible without deep mastering of disciplines of mathematics and science profile.

What basic educational and professional values are determined by the professional standard of pedagogical activity of V. Shadrikov [2], National Standard and innovative ideas of the founding concept of this research [3]?

• Priority in educational process to development and self-development of the pupil's identity , his personal qualities and features (motivational, cognitive, communicative, metacognitive, creative, emotional and strong-willed) against the expansion of subject activity by personal experience ;

• Mastering by receptions of scientific thinking, science and education integration, enrichment of the content of mathematical activity by modern achievements of science (mathematics, physics, biology, etc.) in the interaction with educational tasks;

• Variability of education as a structure-forming paradigm and widespread introduction of information and communication technologies as the necessary attribute of educational process (distance learning, elements of computer algebra and dynamic geometry, e-learning, small means of informatization, etc.) against updating of personal meanings and experience;

• The competence-based and practice-focused approaches, support of self-updating and self-realization of the personality, the problem solving of formation and development of pupil's universal educational actions;

• Updating and development of professional motivation, individual style and diagnostic activity in innovative activity of the teacher;

• Formation and development of cognitive independence of the pupil on the basis of didactic dialogue design, intersubject integration, variability of tasks and situations, generalized ways of receptions and actions.

Different opportunities of continuous professional development

Vocational training of mathematics teacher in Russia opens essential opportunities for personal and professional growth of the personality. Teacher training in Russia historically has different opportunities for serving teachers up to CPD. The following drawing gives the range of possible opportunities that are usually available for teachers in Russia. Ministry of Education and Local (Region) Administration pay for CPD work. According to National Law the teacher should be CPD in different ways: in-service once for 5 years; participating in School Professional Society; getting of 1, 2, H – Professional Categories; applying to Research Grants; Competitions (Local or National); Didactical Seminars at University or Local Education Centre; participating in Conference (National or International) and publication of articles; participating in Research Projects (National or International) and so on. In common CPD work takes approximately 20 days per year. Every school in Russia has School Professional Society (SPS), which collects for didactical and research activity all serving teachers at school. The Council of SPS consists of teachers of high qualification, school administration, heads of problem groups and methodical groups. The main tasks: diagnostic work concerning methodical resources at school; developing of new educational technologies; creating and managing of creative groups of teachers (including the special activity of school mentors with young teachers); defining the forms, methods and contents of CPD of teachers; planning, managing, regulation of professional activity of teachers (lesson study, methods of teaching, evaluation, clubs, competitions, Meetings, Scientific seminars and Conferences and so on), analysis and assessment of results; learning and adapting of New National Standards and Curriculum; 6 stages of good practice: learning and evaluation of educational practice , analysis and generalization, improving and dissimilation of good practice, support of teacher's individual style of development; diagnostic and statistic of educational process and pupil's attainments. Results of School-Based professional development of teachers (in common): High PC – 15-50%, 1 PC -- 25-40%, 2 PC -- 20-30%, NO -- 0 -25 %. University Centre of Education organizes the in-service for

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regional teachers. The same activity is typical for Local Education Authority, but teachers have a choice of Institutes. Local Centre of Educational Quality and Assessment manage the process of getting of teachers professional categories (1,2,H), quality of pupil's attainments, made of monitoring, statistic and diagnostic of educational process in primary and secondary schools. Institute of Education Development organizes Seminars, Conferences, Open Lessons, Competitions, Local Grants for good practice for regional teachers. Ministry of Education defines Competitions, Research grants for teachers and schools, the nomination Teacher of a Year, manages passing for International and National Projects and Assessment companies. Generally speaking teachers have some small addition to salary for receiving professional category (from 10% to 25%) or Master degree; opportunity to prepare and realize the Open Lesson; improving in educational practice of school new forms , methods and technologies; involving of teachers in creative, managing work on Curriculum, diagnostics, analysis of educational process in problem groups.

The essence of diagnostic procedures are the Questionnaires from Exeter University (created by Prof. D. Burghes [4]) and distributed on testing of Primary and Secondary NQT teachers. For Primary we have Part A: 40 marks on relatively straightforward skills and knowledge questions and Part B: 20 marks on mathematical concepts and understanding; for Secondary: Part A: This is identical to Part B on the primary audit; Part B: 20 marks on more advanced mathematical topics. This is illustrated below for both Primary and Secondary samples in the following three bar charts.

Testing Results

For Primary Mathematics Audit NQT teachers have 60 minutes to complete this test. Some Part A questions show the good skills of Russian trainees (data in percentage):

A6: What is the value of 2^5 ?

China - 90.0; Czech Rep -50.0; England- 50.0; Finland- 84.7; Hungary - 93.8; Ireland - 68.2; Japan - 92.0; Russia - 92.5.

A8: What is the lowest common multiple of 40 and 140 ?

China - 83.8; Czech Rep -51.1; England - 20.0; Finland- 1.5; Hungary - 58.3; Ireland - 36.4; Japan - 90.7; Russia - 77.4.

A11: Simplify as far as possible 8x + 3y – x + 3y

China - 97.5; Czech Rep - 55.4; England - 70.0; Finland- 80.2; Hungary - 97.9; Ireland - 81.8; Japan - 100; Russia - 96.2.

It is very important for Russia to explain low results of responses on questions (problem's questions): A1b, A1d, A5b, A7, A16b and A20c (data is lower than 40%). Here is the content of these questions:

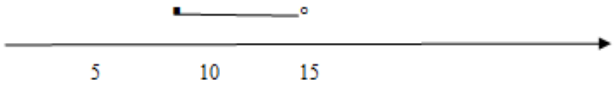
A1: Look at the ten numbers below. Tick the boxes under all the numbers in the list which are: (listing of 10 numbers)

b: rational numbers

d: integers

A5b: Look at the number lines below. Work out what inequality is presented on each number line.

b:



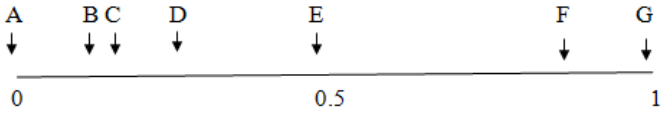
A7: Complete the table below, showing the equivalent values for each number. To fill in the fractions, put the numerator in the top box and the denominator in the botton box. You should leave all fraction answer in their simplest form.

Fraction	*			*			*		
Decimal		*			*			*	
Percentage			*			*			*

A16b: Study the fix triangles in the diagram below. How were the transformations listed beside the graph carried out? Tick the relevant transformation from each list.

b) D is obtained from B by: reflection, rotation, translation

A20c: The probabilities of several events are marked on the probability scale below.



Which letter on the scale corresponds to the probability of each of these events?

b) A card picked at random from a normal pack shows a black diamond.

Analysis of real situation with Primary student's skills (tutor's interview, exams, applications and correlation) has defined the problem points: real numbers should be learned more deeply with different kinds of representations (R. Dedekind, G. Kantor, K. Weierstrass) and using the practical skills; our students have very small ability to solve problems in nonstandard situation (relative reflection of invisible points, limiting theorems of probability and so on).

Problem questions for Part B: B5, B8, B9, B10, B11 and B13a (data is lower than 40%). It is interesting to remark that we have the repeating and expansion of area's difficulties: modeling of real process, operation with integers, nonstandard situations. On the other hand the volume of unstable zone 40%-75% of question responses for Primary: Part A (understanding) – 15%; Part B (calculating and algorithms) – 45%. It means that the quality of mathematical skills and competence of future teacher will be higher if special attention paid to algorithms and calculating procedures in teaching mathematics. Here are the problem questions:

B5: The graph of y=f(x) is shown below. The graph is translated to give the graph below. Which of these expressions is the equation of the new graph?

A: f(x)-1 B: f(-x) C: f(x)+2 D: f(x-2) E: -f(x) F: f(x+2)-1

B8: An arithmetic series has 20 terms. The first term is 2 and the last term is 44. Calculate the sum of the series.

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B9: How many solutions does the equation below have in the interval $0 \leq \theta \leq 360°$?

B10: Which of the statements below is true for all values of x?

A: $e^{-x}<o$ B: $e^{-x} > 1$ C: $e^{-x} < e^{x}$ D: $e^{-x} < -1$ E: $e^{-x}>o$

B11: Simplify $\log_3(3^4)$

Responses on Primary (Part B) and Secondary (Part A) common questions may be classified as the basic part of mathematical culture of teacher: we see that unstable zone 40%-75% for Secondary is 20%, which opposite to 45% for Primary. Moreover there are no problem questions (lower than 40%) for Secondary: it seems that data are under the strong influence of fundamental knowledge and best scientific thinking of trainees for Secondary. So we should look at 4th question responses from unstable zone for Secondary: A6, A9, A11 and A14. Some difficulties concerned with such questions, we relate to insufficiency of creativity and modeling skills of trainees.

Secondary audit data

For Secondary we have Part A: This is identical to Part B on the Primary audit and Part B: 20 marks on more advanced mathematical topics. The overall data for the participating countries shows that: China, Japan, Russia and Singapore outperform other three countries; there is little difference between the performance of the Czech Republic, England and Hungary; England has the highest standard deviation of all the participating countries, showing that we have great variation in our sample; perhaps as expected, China has the smallest variation.

On Part B, the more advanced mathematical questions, there are more significant differences with China, Japan, Russia and Singapore all performing far stronger than England, the Czech Republic and Hungary. It is important to note this characteristic and we have summarized below the responses to some of these questions that indicate the weakness of the England sample. Question responses of Russian students for Secondary (Part B), mostly characterizing vocational habits, have shown high level of mathematical training and professional skills. However question responses B7a, B7b and B8 are drawn up in unstable zone. We think this situation show some problems of links actualization between school and high mathematics in teaching process. The concept of "limit" is not studied in secondary school (infinite geometric series is limiting process), but pupils know the concept of "geometric progression" and sometimes - the formula of "sum of this series". This moment will become half forgotten if during of studying the concept "limit of function" in high school we do not fix links with concepts of "geometric and arithmetic progression" on high level and details of generalization. Another reason of problem is presence of the "invisible subjects" as "…" in signs of geometric and arithmetic progression:

$5 + 2.5 + \ldots + \ldots$ or $2 + \ldots + 44 + \ldots$

It requires the development of theoretical thinking of students and efforts in this direction should be defined and concreted.

III. INTERPRETATION OF DATA

In Russia mathematical training of Primary and Secondary teachers strongly differs [5]. National standard of Primary mathematics does not include high sections of mathematics usual for Secondary, concerned with high levels of abstraction (functions of several variations, differential equations, functional analysis, theory of complex functions). On the other hand the level of scientific thinking of Primary students really is much lower than Secondary one. These two factors most influence difference of mathematical cultures of Primary and Secondary trainees. In 2009 Russia has introduced new National standard of Primary education based on competence approach. National standard is based on three blocks of requirements: to contents of educational program, to conditions of applying (resources, techniques, finances, etc), to competences of pupils. The main directions of mathematical education: personal development (logical, geometrical and symbolical thinking, proving skills, information search), methodology (universal actions of learning, modeling and analysis of real situation, planning, assessment), mathematical habits (numbers, operations, geometrical figures, data analysis) [6]. There should be difference between means of Primary and Secondary mathematical cultures.

The comparison with other countries is best illustrated through the means of Primary (Part B) and Secondary (Part A):

Table 2

	Secondary Audit Means (Part A)	Primary Audit Means (Part B)	Means	Difference
China	16,6	13,0	**14,8 ***	**3,6 ***
The Czech Republic	14,9	7,7	11,3	7,2
England	14,1	6,8	10,45	7,3
Hungary	14,8	8,4	11,6	6,4
Japan	16,3	**15,9 ***	**16,1 ***	**0,4 ***
Russia	**17,3 ***	11,2	**14,25 ***	6,1

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At first sight, the data of Russian Secondary Audit is the best, but for Russian Primary Audit it is not so good (one of the first three positions). As we mark some problems in Russia for Primary trainees concerned with special attention which should paid to algorithms and calculating procedures, modeling of real process, operation with integers, nonstandard situations in teaching mathematics [7]. We think that data of China and Japan in these Parts does not look typical for teacher training and can be explained by very special conditions, concern with traditions in these countries.

IV. ISSUES AND REFLECTION

Russia signed the Bologna Declaration in 2003, and until 2010 it should have become part of the European educational area. In short, we must move towards a multilevel system of education (Bachelor and Master degrees) that includes teacher training. It is a problem for Russia. Most teachers of Primary and Secondary schools are prepared in Pedagogical Universities and Institutes (more than 80%). As we saw on table 1 about 60% of Secondary NQT's and 80% Primary NQT's go into teaching directly after training. It is true that only 5-10% of classical Universities trainees become teachers. New approach will lead to late motivation on teacher profession (after Bachelor degree) and shorter period of vocational education (one year). Some problems of such approach can be compensated by much longer period of trainees under supervision of qualified mentors. However historical analysis states hypotheses about weak creativity of such NQT's. It will be very interesting to compare these positions looking on Russian and European teachers because it seems that European teachers are prepared using such approach. Now our Ministry of Education does not have detailed program to modernization of teacher training, but Pedagogical Universities try to hold the most positive tradition of Russian teacher training.

However the testing inside ICSMTT shows that there are positive and negative points in our educational system of teacher training.

There are the positive positions:

- Our strong conviction which is supported by Russian responses on TAQ that NQT's should have the first priority as "to manage mathematical knowledge" in teaching process. It is confirmed by the best results of Russian Secondary Mathematics Audits;
- School administration tries to create for trainees conditions forming the individual style of teaching and wide opportunities for career advancement. We systematically remark sustainable percentage of teachers who try to be Ph.D. and make scientific research;
- It is tradition in Russia educational system to appoint the school mentors for every trainee TD, which help to define the area of NQT's methodical activity and diagnostic of initial teaching experience: skills, evaluation, problems and so on. Moreover some of TD teachers become qualified teachers (nominated on first or second category) during their first year of teaching. All trainees very positively evaluate the role of school mentors in their adaptation and career advancement;
- The best results of Primary trainees (82,5% are involved in education area) have been explained by this professional activity as part time's good practice in kinder gardens or primary schools during training period at University. Also we remark that a half of Primary graduates come to University after Pedagogical College.

There are some problems concerned with teacher training in Russia which appeared in analytical way from trainees' responses:

- It is true that at this moment we have strange situation when future teachers can enter the University without suitable motivation, mathematical abilities and special thinking. We think this situation will arise problems of links actualization between school and high mathematics in teaching process;
- Analysis of real situation with Primary student's skills (tutor's interview, exams, applications and correlation) has defined the problem points: real numbers should be learned more deeply with different kinds of representations (R. Dedekind, G. Kantor, K. Weierstrass) and using the practical skills; our students have very small ability to solve problems in nonstandard situation (relative reflection of invisible points, limiting theorems of probability and so on);
- It seems that the quality of mathematical skills and competence of future Primary teacher will be higher if special attention is paid to algorithms and calculating procedures in teaching mathematics. So it is very important for NQTs to observe some lessons of other successful trainees;
- Trainees do not feel confident in "Probability" – 32,0% and "Statistics" – 30,8% because stochastic line in school mathematics was involved only some years ago in Russia and learning of stochastic require from pupils a good potential skills in modeling of real process which has always been a problem for Russia;
- Student's responses show that special activity in teaching mathematics really must be created using some integrative courses and constructs, research activity in vocation area following to student's interests and experience. Trainee teachers lack the desire to use new methodologies and new mathematical knowledge to strengthen the efforts of their teaching. Knowledge and methodological skills are formal and have little application in real life;

V. CONCLUSION

In Russia mathematical training of Primary and Secondary teachers strongly differs. National standard of Primary mathematics does not include high sections of mathematics usual for Secondary, concerned with high levels of abstraction (functions of several variations, differential equations, functional analysis, theory of complex functions). There are

some breaks between fundamental training and vocational study, especially when mastering methods of teaching mathematics and elementary mathematics. On the other hand the level of scientific thinking of Primary students is really much lower than Secondary one. These two factors mostly influence difference of mathematical cultures of Primary and Secondary trainees. In 2009 Russia has introduced new National standard of Primary education based on competence approach. National standard is based on three blocks of requirements: to contents of educational program, to conditions of applying (resources, techniques, finances,..), to competences of pupils. The main directions of mathematical education: personal development (logical, geometrical and symbolical thinking, proving skills, information search), methodology (universal actions of learning, modeling and analysis of real situation, planning, assessment), mathematical habits (numbers, operations, geometrical figures, data analysis). There should be difference between means of Primary and Secondary mathematical cultures.

REFERENCES

[1] D. Burghes, *International comparative study in Mathematics teacher training*. Perspective, CfBT: Education Trust, 2008.

[2] E. Smirnov, and V. Bogun, " Information and Communication Technology in Science Learning as a Tool for "Scientific Thinking" in Engineering Education," *Scientific Research (Natural Science Journal)*, vol. 2, no.12, pp. 1400-1406, Dec. 2010.

[3] E.I. Smirnov, *Founding of experience in vocational training and innovative activity of teacher*. Kanzler, Yaroslavl, 2012.

[4] D. Burghes, *International comparative study in Mathematics teacher training. Enhancing the training of teacher of mathematics*. Perspective, CfBT: Education Trust, 2011.

[5] E.I. Smirnov, V.V. Bogun, and V.N. Ostashkov. *Visual modeling in teaching mathematics: Theory and practice.* Kanzler, Yaroslavl, 2010.

[6] E.I. Smirnov, and Y.P. Povarenkov, " Real state of mathematical preparing and diagnostics of the affective sphere of the teacher personality in Russia," *Modern scientific research and their practical application*, vol. 24 , pp.3-25, Dec. 2013.

[7] E.I. Smirnov, and V.V. Bogun, " Problems and Prospects of Remote Teacher Training in Unifrom E-learning Environment (Published Conference Proceedings style*)," in Proc. of Int. Conf. Time-2010*, Malaga, Spain, 2010, pp. 67-76.

Significance of software models in estimation of state of nutrition in pre-school children

Momčilo Pelemiš, Dragan Martinović, Vladan Pelemiš, Nebojša Mitrović and Danimir Mandic

Abstract**—**The aim of the research was to analyse the state of nutrition in pre-school children. The sample enrolled 325 children, among which 196 boys and 129 girls. Height and weight were measured during May 2013. The data were analysed by descriptive statistics methods and multivariate (MANOVA) variance analyses for $p \leq 0.05$. It was established that boys and girls of pre-school age significantly differ in statistical terms as far as nutrition state is concerned. Univaried (ANOVA) variance analyses pointed to differences also in following variables *Body Mass*, *Ideal Body Mass* and *Body Mass Index* in favor of girls and *Relative Body Mass* in favor of boys. The percentage of undernourished children was extremely high (31.76%), at the same time there were 13.54% of overweight children. 54.70% of children were found to be of normal nutritional status.

Key words**—**Detection, differences, nutrition, pre-school age.

I. Introduction

By information software development it has become fairly easy and quick to obtain information on level of nutrition, basal metabolism, heart rate and calorie consumption. Information technologies (IT) or Information and Communication Technologies (ICT) play an important role in many areas of present-day society. Those particular technologies contribute to development and circulation of business related information, education, knowledge, experience and ideas all around the world [1], [2]. Therefore, the software applications have found their place in detection of nutrition status of children, youngsters and adults. Primarily the fitness calculators or bioelectrical impedance which contain calculation software within their programs [3]. Information technologies offer a number of innovative and exciting possibilities for engaging the children and changing the physical activities that can help in obesity prevention and maintenance of weight loss [4]. Obesity is a chronic disease revealed through over accumulation of fat tissue in body and weight gain [5]. Whether a person is obese or not can be established without delay by measuring their actual weight and height and entering details into computer program. Obesity has been on a rise in past 20 years and with the present rise rate it is reaching a global epidemic scale. It has been verified that inactivity can negatively reflect the BMI of pre-school children [6]. According to information provided by World Health Organisation more than one billion of world population suffers from overweight and three million people are obese [7]. Obesity is commonly described as over-accumulation of fat tissue in a body, clinically expressed by *Body Mass Index* – BMI, but, there are other methods in use [8]. Body Mass Index (BMI) is a number calculated from a child's weight and height [9]. BMI is a reliable indicator of body fatness for most children and teens. BMI does not measure body fat directly, but research has shown that BMI correlates to direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry (DXA) [10]. BMI can be considered an alternative for direct measures of body fat. Additionally, BMI is an inexpensive and easy-to-perform method of screening for weight categories that may lead to health problems. For children and teens, BMI is age- and sex-specific and is often referred to as BMI-for-age. After BMI is calculated for children and teens, the BMI number is plotted on the CDC BMI-for-age growth charts (for either girls or boys) to obtain a percentile ranking. Percentiles are the most commonly used indicator to assess the size and growth patterns of individual children in the United States [11]. The percentile indicates the relative position of the child's BMI number among children of the same sex and age. The growth charts show the weight status categories used with children and teens (underweight, healthy weight, overweight, and obese) [12].

BMI-for-age weight status categories and the corresponding percentiles are shown in the following table.

Weight Status Category	Percentile Range
Underweight	Less than the 5th percentile
Healthy weight	5th percentile to less than the 85th percentile
Overweight	85th to less than the 95th percentile
Obese	Equal to or greater than the 95th percentile

BMI is used as a screening tool to identify possible weight problems for children. CDC and the American Academy of Pediatrics (AAP) recommend the use of BMI to screen for overweight and obesity in children beginning at 2 years old. For children, BMI is used to screen for obesity, overweight, healthy weight, or underweight [13]. However,

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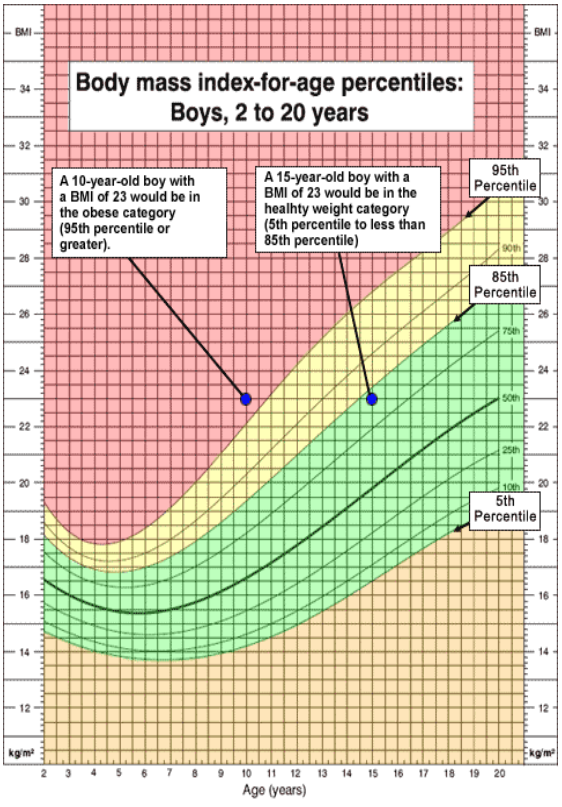
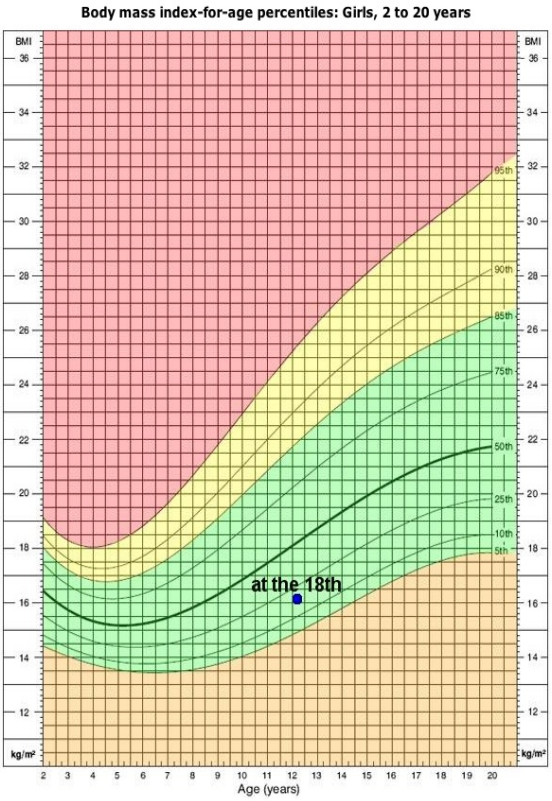
BMI is not a diagnostic tool. For example, a child may have a high BMI for age and sex, but to determine if excess fat is a problem, a health care provider would need to perform further assessments. These assessments might include skinfold thickness measurements, evaluations of diet, physical activity, family history, and other appropriate health screenings. Although the BMI number is calculated the same way for children and adults, the criteria used to interpret the meaning of the BMI number for children and teens are different from those used for adults. For children and teens, BMI age- and sex-specific percentiles are used for two reasons:

- The amount of body fat changes with age.
- The amount of body fat differs between girls and boys.

The CDC BMI-for-age growth charts take into account these differences and allow translation of a BMI number into a percentile for a child's sex and age. For adults, on the other hand, BMI is interpreted through categories that do not take into account sex or age. See the following graphic for an example for a 10-year-old boy and a 15-year-old boy who both have a BMI-for-age of 23. (Note that two children of different ages are plotted on the same growth chart to illustrate a point. Normally the measurement for only one child is plotted on a growth chart).





The most significant factors for setting off of obesity are believed to be genetic and metabolic factors; unhealthy living accompanied by diet inapt to body needs (food high in energy value, disproportionate servings, emotional eating). The children of pre-school age suffer more often from overweight and obesity than undernourishment [14]. There should also be mentioned socio-cultural, psychological and neuroendocrine factors (high level of cortisone, lower levels of thyroid gland hormones, polycystic ovaries, growth hormone deficiency and others). The main risk factors for obesity are: genetics 5-70% ; intake of excessive calories and/or ill-assorted food (basic carbohydrates combined with concentrated fats or protein); insufficient physical activity (70%); social factors – flour, sugar and fats are cheaper food products than fruit and vegetables that are much more expensive (contain less calories and are not as filling); cultural factors – cult of fat foods; other factors – individual sensitivity, some medications, pregnancy, pre-school age, adolescence [15]. By employing computer applications it become possible to establish the correlation between the overall quantities of energy produced by food intake, fat, carbohydrates, proteins and the percentage of bodily fat in children. The relation between fats intake and bodily fat can be developed with time and is not be evident in children. The energy consumption and specific levels of physical activity mayhave greater influence to body composition in early childhood [16]. Among children who were obese at the age of 7 (ITM>95. percentile) 43% of girls and 63% of boys remain obese at the age of thirty [17]. In Serbia 54% of population are overweight with highest prevalence in Vojvodina where 34.5% are overweight and 23% obese [18]. In view of higher frequency of obese children, the aim of this paper was to establish the nourishment

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state of pre-school children in Belgrade, and also to determine the quantitative analyses of differences between boys and girls of pre-school age by application of software models.

II. RESEARCH DESIG

The sample was selected from pre-school children population of both genders from Belgrade municipality. The children, aged 5 to 6, were attending preschool The 11th of April in Novi Beograd and were from different social backgrounds. The sample consisted of 325 children, among which 196 boys (97 of 5-year-olds and 66 6-year-olds) and 129 girls (99 of 5-year-olds and 63 6-year-olds). Estimate of anthropometrical dimensions included measuring of:

1) *Body height* and
2) *Body weight* with standard instrument adhering to IBP for every measure, based on those two dimensions calculations were made for
3) *Ideal Body Mass* (kg)
4) *Relative Body Mass* (%) and
5) *Body Mass Index* (kg/m^2) by following formulas:

$$\text{ITM (De mole)}\ for\ girls = BH - 100 - \frac{BH-150}{2,5} - \frac{A-20}{4} = kg$$

$$\text{ITM (De mole)}\ for\ bozs = BH - 100 - \frac{BH-150}{4} - \frac{A-20}{4} = kg$$

$$\text{RBW} = \frac{REAL\ BW}{IBW} * 100 = \%$$

$$BMI = \frac{\text{BW (kg)}}{\text{BH (m}^2\text{)}}$$

For classification of nourishment level Harison's classification cited by [19] for BMI and RBW was used.

The descriptive statistics of body composition variables have been calculated for the arithmetic mean (M) and standard deviation (S), while the application of the multivariate (MANOVA) and univariate (ANOVA) analysis provided the statistically significant differences between respondent groups formed on the basis of sexually dimorphic differences.

III. INTERPRETING THE RESULTS

Analyses of descriptive statistics (table 1) pointed to homogeny of male and female sub-sample subjects only for the skeleton length variable, *Body Height*, while increased differences have been noticed in other variables. Such results are consequence of disproportional development of children, the fact that body weight is influenced by not only genetics but furthermore by socio-economical factors, way of living and level of physical activity.

Comparing the two sub-samples the average normal level of nutrition is evident, as concluded based on BMI, while based on RTM the normal level of nutrition can be assumed in case of boys and underweight in case of girls. Such results point to well balanced diet that corresponds to the needs of pre-school children and a satisfactory degree of physical activity of children of opposite sex. In the view of ITM values it can be concluded that subjects from both sub-samples are deficient in *Ideal Body Mass*, in average about 4 kilograms.

Based on multivariate variance analyses significant differences in nutrition state of pre-school boys and girls were established.

By individual analyses statistically significant differences were verified for variables *Body Weight*, *Ideal Body Weight* and *Body Mass Index* in favor of girls and *Relative Body Mass* in favor of boys.

Table 1. DESCRIPTIVE STATISTICS AND DIFFERENCES

Variable	Boys (N=196)		Girls (N=129)		f	p
	M(AS)	SD(S)	M(AS)	SD(S)		
BH (mm)	1187,81	64,28	1183,77	66,23	0,30	0,58
BW (kg)	28,07	5,01	30,10	4,93	12,89	**0,00**
IBM(kg)	32,21	4,75	34,65	3,91	7,86	**0,01**
RBM(%)	94,61	19,77	87,75	16,14	10,80	**0,00**
BMI(kg/m^2)	19,97	3,64	21,63	3,94	15,03	**0,00**
F=24,501; P=**0,000**						

Key: AS – arithmetic mean; S – standard deviation; f – unvaried f test; p – level of statistical significance of f test; F – multivariate Wilks' F test; P - statistical significance of multivariate F test.

For the purpose of easier understanding of the results at the index of nutrition the *Body Mass Index* was sorted by sex.

Three classifications were taken into consideration: underweight, normal and overweight.

Table 2. THE DISTRIBUTION OF BODY MASS INDEX BY SEX.

Body Mass Index	Boys (N=196)		Grls(N=129)		Total	
Percentile	n	%	n	%	n	%
<30 (<18,5 kg/m^2) Underweight	75	38,27	28	21,71	103	31,76
30-85 (18,5-24,9 kg/m^2) Normal	99	50,51	79	61,24	178	54,70
>85(>25 kg/m^2) Overweight	22	11,22	22	17,05	44	13,54
Total	196	100	129	100	325	100

The results presented in table 2 point out to a high percentage of children with low body mass, undernourished (38.27% of boys and 21.71% of girls which makes total of 103 children). Normal body mass values were found in 178 subjects (99 boys and 79 girls), and overweight were 22 boys and 44 girls, a total of 13.54%. The high percentage of undernourished children should raise certain concern.

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IV. CONCLUSIONS

The diversity of nutrition status of preschool children was explored on a sample of 325 subjects. The research pointed out to a remarkably high percentage of undernourished children within sample group (31.76%), while the percentage of overweight children is 13.54%. Normal nutrition level was found in 54.07% of sample. It is obvious that general overweight prevalence of 13.54% is still fairly low compared to countries of Western Europe and USA [20]. As far as Eastern Europe is concerned contrasting results were noted in Georgia [21]. General prevalence of undernourishment amongst the subjects is 31.76%. In an attempt to compare those findings with the results of other similar studies we found quite vague details. Our findings exceed by almost double the data provided by [22], who claimed that in one region of Serbia (Sumadija) 17.7% of children were undernourished.

By applying adequate formulas to software of modern apparatus quick and precise insight into the nourishment state of children was made possible. That is the path for application of information technologies in kinesiology (sport and physical education). Today the best results of children's body composition assessment and physical development monitoring are achieved by the new technology such as *Bioelectrical Impedance*. [23]. The large number of factors that influence obesity in children has been recognized and divided into several groups: feeding habits, physical (in) activity (length of physical activity during a day, type of activity, hours of sleep, type and duration and others), factors related to parents (obesity of mother or both parents, mother's weight during the pregnancy, mother's smoking habits during the pregnancy, education level of family, family size and others) as well as factors related to the educational institutions [24].

The results of multivariate variance analyses indicated significantly different levels of nourishment status of gender dimorphic pre-school age sample subjects from Belgrade. Both sub-samples were noted for aberration from ideal body mass, in average about 4.1 kg (boys) and 4.5 kg (girls). Biological, psychological and sociological (environment) factors are important in development and state of nutrition of children. This result corresponds with the findings of research conducted by Western authors who have established that information on bodily composition are used very often but they also recognized existing gap in standards and an extensive lack of understanding of problems related to *Body Mass Index* [25]. Namely, it has been established that children who train sport have increased levels of continuous and acute energy loss of weight. The research results are in accordance with the results of nourishment state, that is to say the constitution affiliation, gained in AP Vodvodina (Republic of Serbia) which is defined by the undernourishment state followed by associated values which point to week physical constitution [26].

The results of this study have pointed out the evident underweight of pre-school children of both sexes. There is a small number of overweight children but it can not be expected that such trend will continue at later stages of their life. Prevention of underweight should include increase of physical activity, reduction of energy intake, adjustment of factors rooted in environment that influence body mass and also parental education.

Considering that results of severe weight disorders treatments, especially overweight and underweight, are by and large unsatisfactory, most authors agree that prevention should take lead [27], [28]. We would like to add that early detection, monitoring and supporting, not only the children, but a family as a whole, to change the life style, level of physical activity and the diet quality may provide an answer.

REFERENCES

[1] Mandić, D., Martinović, D., & Stamatović, M.: *Informational technology in measuring motor characteristics of elementary school pupils*, 9th WSEAS Int. Conf: on ARTIFICIAL INTELLIGENCE, KNOWLEDGE ENGINEERING and DATA BASES (AIKED '10), University of Cambridge, UK, February 20-22, 2010, ISBN: 978-960-474-154-0, ISSN: 1790-5109, pp. 226-230.

[2] Mandić, D., Lalić, N., & Bandjur, V.: Menager Innovetions in Education, in the book 9th WSEAS International Conference. on ARTIFICIAL ANTELLIGENCE, KNOWLEDGE ENGINEERING AND DATA BASES (AIKED ; 10), ISBN: 978-960-474-154-0, ISSN. 1790-5109, University of Cambridge, Cambridge, United Kingdom, 2010, pp. 231-237.

[3] Martinović, D., Pelemiš, V., Branković, D., Živanović, V., & Pelemiš M.: *Software Tools for the Bioelectrical Impedance Method of Children Selection in Sport*, 4th WSEAS EUROPEAN CONFERENCE OF COMPUTER SCIENCE „Recent Advances in Information Science `13", North Atlantic University Union, Paris, 2013, ISBN: 978-960-474-344-5, ISSN: 1790-5109, pp. 283-288.

[4] Baranowski, T., Frankel, L.: Let's get technical! Gaming and technology for weight control and health promotion in children. *Childhood Obesity;* 2012, 8 (1), pp. 34-37.

[5] Gibney, M. J., Vorester, H. H., & Kok, F. J.: *Introduction to human nutrition*. Oxford: Blackwell Science Ltd. 2002. pp. 125-224.

[6] Jago, R., Baranowski, T., Baranowski, J.C., Thompson, D., & Greaves, K.A.: BMI from 3-6 y of age is predicted by TV viewing and physical activity, not diet. *International Journal of Obesity;* 2005, 29 (6), pp. 557-564.

[7] World Health Organization Europe *The challenge of obesity in the WHO*. 2005, pp. 17-21.

[8] Tsigos, C., Hainer, V., Basdevant, A., Finer, N., Fried, M., Mathus-Vliegen, E., Micic, D., Maislos, M., Roman, G., Schutz, Y., Toplak, H., & Zahorska-Markiewicz, B.: *Management of Obesity in Adults*. European Clinical Practice Guidelines Obesity Facts. 2008, pp. 202-213.

[9] Mei, Z., Grummer-Strawn, L.M., Pietrobelli, A., Goulding, A., Goran, M.I., & Dietz, W.H.: Validity of body mass index compared with other body-composition screening indexes for the assessment of body fatness in children and adolescents. *American Journal of Clinical Nutrition;* 2002, 7597–985.

[10] Freedman, D.S., Dietz, W.H., Srinivasan, S.R., & Berenson, G.S.: The relation of overweight to cardiovascular risk factors among children and adolescents: The Bogalusa Heart Study. *Pediatrics;* 1999; 103, 1175–1182.

[11] Must, A., & Anderson, S.E.: Effects of obesity on morbidity in children and adolescents. *Nutrition in Clinical Care;* 2003, 6(1):4–12.

[12] Whitaker, R.C., Wright, J.A., Pepe, M.S., Seidel, K.D., & Dietz, W.H.: Predicting obesity in young adulthood from childhood and parental obesity. *New England Journal of Medicine;* 1997, 37(13):869–873.

[13] Ferraro, K.F., Thorpe, R.J. Jr., & Wilkinson, J.A.: The life course of severe obesity: does childhood overweight matter? *Journal of Gerontology: Social Sciences* 2003; 58 (2):110–119.

[14] Silveira, J.A., Colugnati, F.A., Cocetti, M., & Taddei, J.A.: Secular trends and factors associated with overweight among Brazilian preschool children: PNSN-1989, PNDS-1996, and 2006/07. *J Pediatr (Rio J).* 2013, 13, pp. 210-216.

[15] Eveleth, P.B., & Tanner, J.M. (1990). *Worldwide variations in human growth*. 2 edition. Cambrige: Cambrige University Press. 1990. pp. 3-90.
[16] Atkin, L.M., Davies, P.: Diet composition and body composition in preschool children. *American Journal of Clinical Nutrition;* 2000, 72 (1), pp. 15-21.
[17] Power, C., Lake, J. K., & Cole, T. J.: Measurement and long-term health risk of child and adolescent fatness. *Instytuial Journal Obesity*; 1997, 21, pp. 507-526.
[18] Grujic, V., Martinov-Cvejin, M., Ac-Nikolic, E., & Niciforovic-Surkovic, O.: Obesity epidemiology of adult population of Vojvodina. *Medical View;* 2005. XVIII (5-6), pp. 292-295.
[19] Kristoforovic-Ilic, M.: *Hygiene-textbook with practicum.* Novi Sad: Medical University, 2004. pp. 26-34.
[20] Yajnik, C.: Interactions of perturbations in intrauterine growth and growth during childhood outhe risk of adult-onset disease. *Proc Nutr Soc;* 2000. 59, pp. 257-265.
[21] Kherkheulidze, M., Nemsadze, K., Kavlashvili, N., Kandelaki, E., & Adamia, N.: The parameters of physical growth in 5-6 years old children in Tbilisi. *Georgian Medical News;* 2010, (178), pp. 52-60.
[22] Markovic, S., Igrutinovic, Z., Kostic, G., & Vuletic, B.: Stet of nutrition and possible factors of etiopathogenesis of obesity in school children. *Medical Journal;* 2008. 1, pp. 7-14.
[23] Goran, M. I., Kaskoun, M. C., Carpenter, W. H., Poehlman, E. T., Ravussin, E., & Fontvieille, A. M.: Estimating body composition of young children by using bioelectrical resistance. *Journal of Applied Physiology;* 1993, 75(4), pp. 1776-1780.
[24] Jovanović, R., Nikolovski, D., Radulović, O., & Novak, S.: The influence of physical activity to nutrition state of pre-school children. *Acta Medica Medianae* (2010), Vol.49 (1), pp. 17-21.
[25] Meyer NL, Sundgot-Borgen J, Lohman TG, Ackland TR, Stewart AD, Maughan RJ, Smith S, & Müller, W.: Body composition for health and performance: a survey of body composition assessment practice carried out by the Ad Hoc Research Working Group on Body Composition, Health and Performance under the auspices of the IOC Medical Commission. British Journal of Sports Medicine; 2013, 47(16), 1044-1053.
[26] Vasić, G., & Jakonjić, D.: Somatic status of preschool children in Autonomous region of Vojvodina. *Medicina danas;* 2009. Vol.8, (4-6), pp. 125-130.
[27] Koplan, J.P., Liverman, C.T., & Kraak, V.A.: eds. Preventing childhood obesity: Health in the balance. Committee on Prevention of obesity in children and Youth. Washington DC, Institute of Medicine, 2004. pp. 117-119.
[28] Goldman, L., Bibbins-Domingo, K., Coxson, P., Pletcher, M.J., & Lightwood, J.: Adolescent overweight and future adult coronary heart disease. *NEJM*, (2004). 357. pp. 2371-2379.

ICT as a motivational tool in the learning of foreign languages

Blanka Frydrychova Klimova, Petra Poulova

***Abstract*—**Motivation undoubtedly is the key in any learning. This article particularly focuses on the learning of foreign languages and the role of information and communication technologies (ICT) in the learning process with respect to learner's motivation. Firstly, the issue of motivation and the role of ICT in the foreign language learning are outlined. Secondly, the author describes specific examples of the ICT implementation in foreign language classes in order to raise student's motivation to learn a foreign language, in this case English.

***Keywords*—** english**,** foreign language, learning, ICT, motivation, multimedia, students. university education, .

I. Introduction

Motivation is an important factor in the learning of foreign languages. And every teacher of English as a foreign language (EFL) looks all the time for different ways how to raise student's motivation. [1] sets several conditions for teachers so that they might make motivation in classes possible:

- Create a pleasant and supportive atmosphere.
- Promote the development of group cohesiveness.
- Increase the students' expectation of success in particular tasks and in learning in general.
- Make learning stimulating and enjoyable by breaking the monotony of classroom events.
- Make learning stimulating and enjoyable by increasing the attractiveness of tasks.
- Make learning stimulating and enjoyable for learners by enlisting them as active task participants.
- Present and administer tasks in a motivating way.
- Provide students with regular experiences of success.
- Build your learners' confidence by providing regular encouragement.
- Increase student motivation by promoting cooperation among the learners.
- Increase student motivation by actively promoting learner autonomy.
- Increase learner satisfaction.
- Offer rewards in a motivational manner.

And some of the conditions mentioned above can be fulfilled by using ICT since ICT have a positive impact on learning [2]:

- learning concentrates rather on the learner than a teacher;
- learning becomes more personalized;
- learning becomes on the one hand more independent, on the other more collaborative and interactive;
- learning can happen at any place and any time;
- learning is enriched with more up-to-date materials, which can be tailored according to students' immediate needs;
- thanks to multimedia activities, learning becomes more varied and dynamic;
- learning requires critical thinking;
- learning becomes more culture conscious.

ICT are nowadays part and parcel of everyday life. Especially young people cannot imagine being deprived of them. For them ICT are as natural as breathing. Therefore they are also widely exploited in education, including second language learning and teaching [3]. Moreover, the English language teachers attempt to involve ICT in their teaching in order to make students' learning more effective and motivating [4], [5] or [6]. In the learning and teaching of English ICT can be used in the following ways:

- using various websites sites for developing language skills (see Appendix 1 for examples);
- communicating with native and non-native speakers via e-mail, Skype, chat, twitter, blog and other Web 2.0 applications;
- using online courses;
- using online reference tools, e.g. online dictionaries; and
- creating and publishing one's work, for instance, *wikis* [7].

II. Specific examples of the implementation of ICT in raising learners' motivation in EFL classes

This section depicts two specific examples of the exploitation of ICT in EFL classes, both at elementary and secondary schools in order to raise students' motivation for learning English. The first example is an illustration of the project *On-line teaching of English language at elementary schools in the Czech Republic*, which ran from November 2011 till December 2012. At six elementary schools located in the city of Hradec Kralove and in Hradec Kralove region of the Czech Republic, teachers of English introduced in their conversation classes videoconferences with teachers from

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abroad, in this case from the Philippines. The age of pupils spanned from the year of 9 to 15, from the fourth up to ninth grades. These videoconferences were run via Skype. The provider and creator of the web application was company OPEN-IT. The whole project was financed by the European Social Fund and from the budget of the Czech Republic. Also four teachers of English from the Department of Applied Linguistics of the Faculty of Informatics and Management in Hradec Kralove participated in the project as professional advisors, coaches and creators of methodological worksheets that were used during the English conversation classes by the Philippine teachers (see Appendix 2 for an example of a lesson plan).

The English conversation classes were held once in two weeks for 45 minutes (regular duration of English classes in the Czech Republic). The topics of their conversation classes were varied, for example:

- *Introducing oneself,*
- *Things around us,*
- *Family,*
- *Seasons of the year,*
- *Christmas,*
- *Culture,*
- *Environment …..*

During the English conversation classes pupils were sitting in different classes, computer laboratories or in school corridors and working in groups of 3-4 at one laptop. All the technical equipment for learning English via Skype, including the portable computers, was financed from the project. Students were communicating with the Philippine teachers or were doing different interactive activities with one another. Most often four Philippine teachers entered the conversation classes in order to work with individual team of pupils (see Fig. 1 below). Their Czech counterparts acted as facilitators or advisors to their pupils during these lessons.

Figure1. An example of a conversation lesson

Responses after the completion of the project were completely positive. Children thoroughly enjoyed these conversation classes. In addition, most of them had not had any chances to speak with a foreigner in English before the project started. Therefore, they felt quite enthusiastic about being understood by a foreign speaker and being able to understand him/her. As one parent said, *it is very motivating for kids because they can apply the language they learn during the lesson with their Czech teacher in talking with a foreign person who speaks that language, too. Moreover, they are happy when the foreign teacher understands them and they understand her/him. They can see that without knowing a foreign language, particularly English, they would not be able to make themselves understood in the present world. It is a big asset to know and speak English nowadays.*

Obviously the project generated more benefits for students such as a co-operation among the pupils themselves. They learned how to work in a team, how to delegate tasks, how to make a compromise and concessions or how to take on a responsibility for their tasks. They became more autonomous in their learning. Furthermore, besides enhancing and practicing the language skills (listening, reading, writing and speaking) they acquired during the lessons with their Czech teacher, they learned the skills of rhetoric since they had to speak clearly and loudly. They practiced pronunciation and intonation of individual words or phrases, too. When they worked on a computer, they also expanded their computer skills. In addition, they discovered different culture and perhaps they started to realize what their own culture is like and what they value in their own culture and in their life.

In addition, their Czech teachers of English said that *the idea of the project was great, most of my pupils improved their communication in English; for some of them it was the first opportunity to use spoken English with a foreigner. Moreover, they stopped being afraid of speaking with someone else in English* (www.netlektor.cz/elektor/c2p/cont/o_projektu/zkusenosti)

The second example is based on Slovak EFL teachers' experience with using multimedia in their classes at elementary and secondary schools in Slovakia. Multimedia as one of the areas of ICT have an enormous impact on the learning of any language since they affect more senses at a time. In the winter semester of 2013 17 Slovak teachers were given questionnaires in order to express their opinions on using multimedia in their English classes. These teachers study English part-time at the University of Constantine the Philosopher in Nitra to extend their teaching qualification.

All teachers but one claimed that they implemented multimedia at least once a week since they can see that their pupils really like working with them. Moreover, they emphasized the following benefits of multimedia for their teaching:

- lessons are more interesting for students;
- students get more involved into learning; they are more motivated and active;
- lessons offer a bigger variety of teaching;
- students develop real-life communication;

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- students can develop four basic language skills, grammar, realia and intercultural communication;
- students develop their remembering and thinking skills;
- students are exposed to real English;
- multimedia affect more students' senses;
- both students and teachers have an easier access to authentic materials; and
- multimedia can support different learning styles.

Most of the teachers (67%) wrote that they used web pages in their teaching. Six respondents (55%) stated using CD ROMs; three people 27%) an interactive board; two respondents (18%) video and the same number (18%) DVDs. See Fig. 2 below.

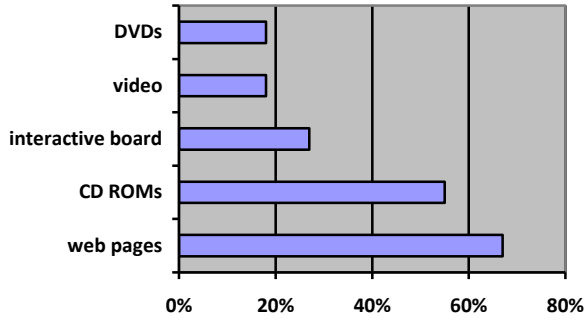

Figure 2. Types of multimedia used in English classes in Slovakia

In addition, most of the respondents also stated that they particularly used multimedia aimed at the development of listening (nine teachers/ 82%) and speaking skills (eight people/ 73%) in order to have up-to-date authentic material for their English lessons. In this way they use, for example, podcasts to develop pupils' listening skills. These skills were then followed by the multimedia focused on the development of vocabulary (six teachers/ 55%) and the same number of teachers (55%) used multimedia for teaching realia. The last group of multimedia was then evenly concentrated on the development of writing skills (three teachers/ 27%) and grammar (three teachers/ 27%). See Fig. 3 below.

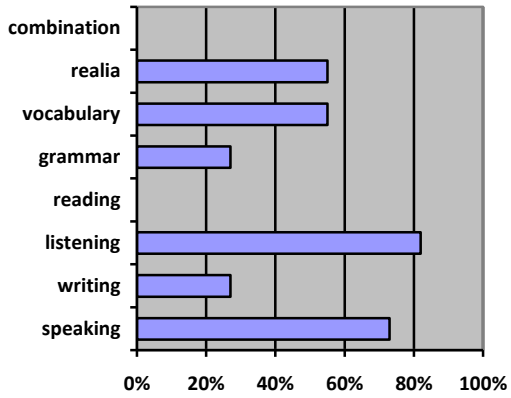

Figure 3. Exploitation of multimedia in the development of language skills and structures

Furthermore, in the subject *Multimedia in the teaching of English* the Slovak teachers of English presented different ways of using multimedia in their classes. One teacher came up with a brilliant idea. If the school does have enough computers, he suggests using a wireless mouse which is then passed from one student to another when they are, for example, involved in playing an interactive game for developing grammar structures on a computer.

III. CONCLUSION

Thus, one can see that ICT really have a very positive and motivating effect on students' learning. Teachers should take advantage of this fact and implement ICT into their teaching of English because ICT are stimulating and appealing for students. Moreover, they affect more senses at a time and thus, they could expand students' memory to remember things in an easier way. ICT can also develop more language skills and raise intercultural awareness in students. Although ICT have a positive effect on the development of L2 language acquisition, they must be carefully chosen to suit a particular teaching situation and to meet specific needs of students because not all kinds of multimedia are relevant for teaching or learning situations [8]. In addition, if teachers want to use some specific websites, they should evaluate them thoroughly in advance.

Finally, potential research in this area should further continue in the exploitation of ICT in education with respect to learners' motivation.

APPENDIX 1

A list of tested and evaluated websites with a short description for the learning of English:

Youtube.com (http://www.youtube.com) is a website which is widely used by English teachers because it affects most of student's senses and develops all four language skills at a time: listening, reading, writing and speaking.

TeachingEnglish.org.uk (http://www.teachingenglish.org.uk) is a website which was developed by the British Council and BBC. Besides teacher training, teacher development, exams in English, and various events, this site also serves as a valuable resource for L2 English teachers. It offers plans and activities, completed with worksheets to download, for primary, secondary and adult teachers.

HelpForEnglish.cz (http://www.helpforenglish.cz) is a website developed by a Czech teacher of English. It again focuses on all age levels and offers a great number of teaching resources, such as tests, grammar and vocabulary exercises, pronunciation, reading and listening activities, quizzes, and many more tips.

BusyTeacher.org (http://www.busyteacher.org) is another website which supplies ready-made worksheets on different every day and seasonal topics for English teachers. In addition, it provides ESL (English as a second language) articles, classroom management worksheets, flashcards, classroom posters and other materials. Once again this website covers all

age groups.

ListentoEnglish.com (http://www.listentoenglish.com) is a podcast website for the intermediate and advanced learners of English, mostly aimed at adult learners. The podcasts on this site help to improve English vocabulary, pronunciation and listening skills. They are quite short (5 or 6 minutes) and delivered in clearly spoken English. Many are linked to grammar and vocabulary notes, exercises or quizzes.

APPENDIX 2

An example of a lesson plan for a conversation class

CHRISTMAS (4 and 5 grades)

Activity 1

Materials: lyrics of Jingle bells song

Procedure:

You can start your lesson with singing ***Jingle bells*** or playing the song on the CD recorder in order to introduce the topic of Christmas. At the same time you can show your pupils the lyrics or a picture to demonstrate the song. Please see the attached File 1. Ask your students to try to sing it with you.

Timing: 5 – 10 min

Activity 2

Materials: a picture/ flashcard, a pen

Procedure:

Show your pupils a flashcard of a Christmas tree, typical of the Czech Republic (see File 2) and prepare in advance a picture of the Christmas tree used in your country. Practise saying with your pupils: Christmas tree, Christmas decorations, Christmas presents by pointing at individual items. Finally, draw a picture of the present you wish to get for Christmas. And ask the students to do the same. Name each present and practise saying:

I wish…… a car, a book…..

Timing: 10 – 15 min

Activity 3

Materials: a picture, a piece of paper, a pen, crayons

Procedure:

Prepare in advance on a piece of paper a very simple picture of what you eat and drink at Christmas. Then, during the lesson tell pupils about it. Afterwards, ask them to tell you what they have for their Christmas dinner. (*Note: in the Czech Republic the traditional Christmas dinner consists of fish soup, fried carp and potato salad*).

Timing: 10 - 15min

REFERENCES

[1] Z. Dörnyei, *Motivational strategies in the language classroom*. Cambridge: CUP, 2001.

[2] B. Frydrychova Klimova, "Impact of ICT on foreign language learning, " *AWER Procedia Information Technology and Computer Science*, vol. 2, pp. 180-185, 2012..

[3] A. Fitzpatrick, and G. Davis. (2003). The impact of ICT on the teaching of foreign languages and on the role of teachers of foreign languages, EC Directorate General of Education and Culture [Online]. Available: http://www.camsoftpartners.co.uk/docs/ICC_Grahams_Report_Final.htm

[4] S. S. C. Young, "Integrating ICT into second language education in a vocational high school," *Journal of Computer Assisted Learning*, vol.19, pp. 447-461, 2003.

[5] S. C. Yang, "Integrating computer-mediated tools into the language curriculum," *Journal of Computer Assisted Learning*, vol. 17, pp. 85–93, 2001.

[6] M. Cerna, "Activation and motivation in the language e-course," *Proceedings of the Conference Distance Education: Prospects and Problem*,Prague: VSMIE, pp. 71-78, 2007.

[7] B. Frydrychova Klimova, "Exploiting students' digital literacy in writing classes," *Proceedings of the Conference eLearning* 2010, UHK: Gaudeamus, pp. 90 95, 2010.

[8] R. E. Mayer, R. Moreno, R., "Aids to Computer-based Multimedia Learning," *Learning and Instruction*, no. 12, pp. 107-119, 2002.

The state of civil political culture among youth: goals and results of education

I. Dolinina

Abstract - Political culture is viewed as a phenomenon of social reality. Attitudes toward it (its meaning or significance) are historically conditioned. This research studies enduring presuppositions about (dispositions toward) society and the state, and how these are reflected in conscious stereotypes and cognitive structures among young people within the sociocultural mechanisms that form and modify the basic characteristics of political culture.

Keywords-youth • political culture • preparedness for political participation

I. INTRODUCTION

The necessity of forming a civic political culture among youth[1] arises, on the one hand, out of a need for a qualitatively new kind of education that will meet the contemporary development needs of society, and, on the other, out of an understanding that past approaches to political education lack promise in this regard, and out of an awareness that inadequately effective education has negative consequences: the danger that young people will become alienated and asocial; passivity and absenteeism; counterproductive political interests on the part of citizens; conflicts of values; the prospective development of asocial and antisocial groups; opportunities for the manifestation of intolerance and social radicalism among youth; the danger of alienation and gravitation to the bottom rungs of society; passivity; and counterproductive developments in the political interests of young people and their participation in civil politics.

II. THE NATURE OF POLITICAL CULTURE

The problems of public relations, interaction between the government and society, the political behavior of people - that currently define the term "political culture" - considered by many thinkers of the past: Plato, Aristotle, John Locke, T. Hobbes, N. Machiavelli, Sh. Montesquieu, A. Tocqueville, N. Berdyaev, M. Weber, but rather represent the intellectual roots of the concept.

[1] The empirical basis of this research was conducted in 2012-2013 among upper secondary and college students in Perm. Sample size = 1800 persons.

The notions “culture” and “politics,” which are partially constitutive of human experience, are not statically *a priori*, but rather are historically variable.

The term “political culture” acquired categorical status in the Western literature in 1956, in the works of American political scientists Gabriel Almond and Sidney Verba. In their works, political culture is a particular type of orientation toward political activity that reflects the specifics of a political system. Broadly construed, political culture is a component of culture as a whole, an indicator of political experience, of level of political knowledge, of models of political behavior and of how political subjects operate; it is a characteristic of a state, of a social group, and of individuals. Political culture is not the same thing as political activity; instead, it is the basis on which preparedness for civic participation is formed, and the basis for activities of a sociopolitical nature.

III. POLITICAL CULTURE IN THE FORMATION OF RUSSIA

Specific situation in the Russian education. The political culture is rarely considered in research on pedagogy (IA Tyutkova, SY Trofimov), and in spite of the demand for the concept, fragmentary reflected in the regulations of the Russian Federation Ministry of Education, is not present either in the newly adopted standards and the law "On Education the Russian Federation".

“Formation of political culture” is a category in Russian academic research; nevertheless, it remains imprecisely conceptualized; its content and its corresponding principles are not, in fact, defined. A retrospective analysis of the theoretical literature permits us to assert that political culture should be formed in youth following a civic model; doing so comports with Russian traditions and contemporary sociopolitical conditions.

As a result of the discovery that the origins of scholarly views on “political culture of students” expose differences in its meaning, we shall define its essence.

“Political culture of students” is the aggregate result of upbringing and instruction; it is that part of the individual’s total character that is marked by the appropriation of institutional experience, by developed political awareness, and by conventional political behavior, with the following dominant features: interest in solving significant sociopolitical problems, preparedness to participate in the political life of society, and a capacity for interacting with social and governmental institutions.

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According to data from a Public Opinion Fund survey, 37% of young people are interested in politics, while almost two-thirds of our young fellow citizens (62%) show no interest in this area. However, despite their lack of interest in politics, a majority of those representing the younger generation are certain that their life depends on politics: 51% consider this dependency to be strong, 23% weak, and only 15% believe that their life does not depend on politics at all. Among those who consider their lives to depend heavily on politics, less than half (47%) are interested in politics. The essential factors that shape political culture are the condition of the country, the media, educational institutions, immediate surroundings, and the family.

The National Federal Educational Standard for Secondary (Full) Public Education[2] [FGOS, 2012] requires that a graduate be "aware of and accepting of the values of Russian civic society."

Is this how we look at this in real life, based on research? A content analysis of the political culture of youth was conducted using seven questionnaires from the author's methodological toolkit of instruments.

IV. THE POSSIBILITY OF CIVIC PARTICIPATION

In the course of the research, 949 10th-grand and 11th-grade students were surveyed. This revealed that the political sphere is not an object of interest to these upper-grade students. Students in the upper grades, as a reference group, were selected in order to determine the level of political culture of future college students. Only 11% of the upper-grade students always followed national politics; 39% of the upper-grade students follow politics from time to time; 35% do so sometimes; 10% just as often follow politics as not; and 5% of the upper-grade students do not follow national politics. How these students conceptualize sociopolitical life was monitored with a view toward establishing the personal traits of graduates.

We developed the test entitled "I, Citizen" to study the self-definition and self-identification of upper-grade students. Respondents rated the significance of sociopolitical life on a scale of 1 to 5 according to the parameters. We grouped the respondents' responses into three basic types of self-definition and self-identification: strong individualistic tendency; poorly definition tendency; and socially active civic stance.

About 20% of those surveyed showed the highest results in a socially oriented context. What the present diagnostic tool does not explain is their principal motive — pragmatism and personal success, or the success and development of Russian society as a whole. The largest group (up to 70% of those surveyed) is made up of boys and girls whose sociopolitical orientation is not yet completely defined. Representatives of this group do not intend to participate in sociopolitical activities; when asked about their preparedness for civic participation chose the response "Difficult to say"; and lack a sense of sharing in their country's fate. Unfortunately, only about 10% of those surveyed expressed love for their Homeland, humanism, patriotism, and a sense of responsibility for what happens in their country.

V.THE RATIO OF THE MOTHERLAND

Asked to consider the destiny of their Homeland, young people's thoughts were associated first with their own family, and secondly, with the place where they were born and grew up, their friends, and their immediate surroundings. "The State" was associated with thoughts about Homeland least of all.

Observations show that a conscious disinclination to participate in national political life is alarmingly widely distributed among youth, which testifies to a crisis of legitimacy for the political system, its norms and values. Absenteeism as a sociopolitical phenomenon is in evidence, part of a general crisis in popular consciousness, a sense of alienation on the part of the population from the authorities, and a lack of trust in structures of authority. For young people, the question whether politics is a "dirty business" or "high art" is not an idle one.

VI.ATTITUDE TO POLYTEC

In this situation, as it has developed, education should be oriented toward preparing young people for civic participation in sociopolitical life, and also toward the inferential principle that the interests of all layers of society should be represented in the political process and taken into account when making decisions. This means engaging citizens in discussing and developing political, socioeconomic, and cultural programs and projects; it means influencing decisions and monitoring their implementation; and it means self-government at the local level.

The individual preferences of college students were identified on a scale of 1 to 10.

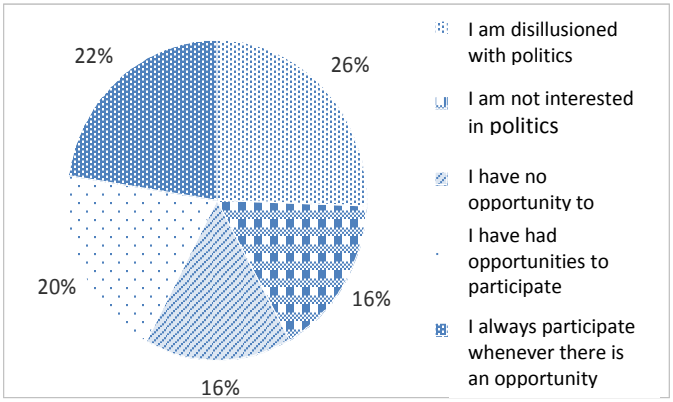

Fig. 1. Monitoring of college student attitudes towards politics and opportunities for civic participation *(percentage of those surveyed).*

[2] National Federal Educational Standard for Secondary (Full) Public Education (10-11 grades) (promulgated by Decree № 413 of the Ministry of Education and Science of Russia, May 17, 2012)

Twenty-six percent of respondents reported disillusionment with politics; 16% reported indifference; 16%, lack of opportunity; 20% opportunity to participate to the extent of education acquired; and 22% reported always participating in sociopolitical life whenever the opportunity is available.

These indicators reflect that 80% of the respondents do not share the "active civic stance." This is, in its own way, a sort of welfare mentality, which raises the question: what is the quality of the education these students are receiving?

VII. THE NATIONAL IDEA

Some years ago, the Russian public was talking about the problematic lack of a "national idea" and the need to acquire one as a means of overcoming the illegitimacy of ideology and as a means of consolidating society.

Seeking a positive version of how Russian could develop, and in so doing to acquire a definite symbolic, mobilizing idea of societal goal-setting, we gave students the opportunity to define themselves.

The questionnaire "Ideas rule the world ... what ideas does Russia need?" offered students a list of ideologemes from which they selected those that they considered most promising and definitive of the direction of Russia's development: wealth, prosperity, stability, freedom, a decent standard of living, a strong state, entering the modern world, equality and justice, law and order, strong family, orthodoxy, communism, and preserving patrimony. The students placed priority on the values of justice and equality, morality, and national health. Patriotism (required by the FGOS as a personality trait resulting from education) was not highly valued by the young people themselves.

Perhaps because they did not understand the idea and its meaning, a small number of students in technical specializations reported "social security."

VIII.ATTITUDE TO THE BASICS CONSTITUTIONALISM

The legitimacy of the Russian Federation Constitution adopted in 1993 is with some frequency challenged in the media by citing the fact of low participation in elections and the resultant positive outcome of the voting.

We performed a sort of reduction of the basic principles of the Russian Federation Constitution that are also Western democratic values: "Each nation has the government it deserves" and each nation has the right to promote its ideal political system and to consider it most acceptable to itself. Experience shows that adopting the best models in the world is ineffective if it does not take into account the national peculiarities of its political culture. To what extent are the words of Samuel Huntington apt: "Western ideas of individualism, liberalism, constitutionalism, human rights, equality, liberty, the rule of law, democracy, free markets, the separation of church and state, often have little resonance in Islamic, Confucian, Japanese, Hindu, Buddhist or Orthodox cultures."?

Given the question "Do you agree that the principles of western democracy are incompatible with Russian traditions?", respondents answered as follows: fully agree: 31%; somewhat agree: 60%; somewhat disagree: 11%; completely disagree: 3%; hard to say": 5%. Thus we see a significant rejection of western ideas in these answers, and consequently also of the basic ideas and principles of the Constitution.

Clearly there is a contradiction here, born of disenchantment with the mechanisms by which constitutional foundations are implemented. Obviously, we must agree with Pyotr Chaadayev: "We are still discovering truths that are commonplace among other peoples".

IX. IMPORTANCE OF HUMAN RIGHTS

The rights and liberties of citizens defined in the Constitution of the Russian Federation elicit from young people a skeptical response by virtue of the fact that they do not see them honored in real life. "It's not who's right that's right, it's who has more rights".

Students expressed their impressions of the importance of human rights in contemporary Russia, and the extent to which they are honored, as follows. Students considered the right to life and safety, the right to property, and the right to free education and medical care, to be the most significant. In their opinion, however, it is precisely the right to life and safety that is least honored, which indicates a high degree of social anxiety on the part of young people. The right to travel to a foreign country is more significant to them than the right to elect public officials, which demonstrates their attitude toward elected authorities.

The results obtained spawned new questions. Toward what educational results must we be oriented, and according to what criteria do we determine the quality of education?

The criteria for the preparedness of college students for civic participation are as follows: an attitude of interest in political realities and processes; an ability to participate in regular events permitted by the political system; and an ability and desire to interact with society and with the state. Correlating with these criteria are indicators of individual development: knowledge of political science, well-developed awareness, a certain level of dogmatism, general human values and civic values, and toleration [10]. Data collected on these criteria and indicators allow us to assess the degree of preparedness of college students for civic participation in the life of society. The data collected show that the students rate themselves predominately positively; however, these same students express a negative attitude toward authority and the people who wield it.

X. CONCLUSION

In our opinion, the latent problem expressing itself here has to do with the results of education, their incomplete awareness, and the need for further modernization.

The problem consists, not in a lack of, or the quality of, our institutions of democracy or their legal basis, but the non-assimilation of democratic

attitudes and of general human and democratic values and ideas.

The facts adduced in these materials state the problem of preparedness on the part of young people for civic participation. Within the Russian educational system, the problem must be addressed both at the level of standards and methodology, as well as through the humanities curriculum and extracurricular work.

REFERENCES:

[1] Silbey, J. The State and Practice of American Political History at the Millennium : The Nineteenth Century as a Test Case / J. Silbey // J. of Policy History. I. 1999. - P. 8.

[2] Almond, G. The Civic Culture. Political attitudes and democracy in five nations / G. Almond, S. Verba. – Princeton, 1963. - P. 5, 8, 19.

[3] Almond, G. A Discipline Divided : Schools and Sects in Political Science / G. Almond. - L., 1990. - P. 143.

[4] Formisano R. The concept of political culture.http://www.carnegie.ru/ru/pubs/procontra/67120.htm.

[5] Conference Proceedings: Dolinina I. G. The Activity of Student Public Organisations in the Formation of Civic Political Culture. Russian Sociology on the Move: Abstracts & Papers of Russian Sociologists for the 17 World Sociological Congress Sociology on the Move in Gothenburg, Sweden, Yuly 11-17, 2010 – Moscow – Gothenburg, 2010 - C. 582 - 584.

[6] Battistoni, R. Public Schoolinq and the Education of Democratic Citezens / R. Battistoni. - Jacson : University Press of Mississippi. -1985. P. 187.

[7] Condliffe Lagemann E. Renewing Civic Education. Time to restore American higher education's lost mission // Harvard Magazine. March-April 2012. Pages: 42-45. http://harvardmagazine.com/2012/03/renewing-civic-education

[8] *Barber, B.* Strong democracy : Participatory politics for a new age / B. Barber // University of California Press. – 1984. - P. 117.

[9] *Etzioni, A.* The New Golden Rule. Community and Morality in a Democratic State / A . Etzioni. - New York, 1996. - P. 4.

[10] Dolinina, I. G. The formation of political culture: an experiment in methodological construction. Perm, 2011, p. 366.

[11] McMurray A. Building bridging social capital in a divided society: The role of participatory citizenship education. // Education, Citizenship and Social Justice July 2012 7. Pages: 207-221. http://esj.sagepub.com/content/7/2/207.abstract

[12] *Hahn, C.* Becoming Political : Comparative Perspectives on Citizenship Education / C. Hahn. - SUNY Press. - 1998. - P. 179.

[13] *Battistoni, R.* Public Schoolinq and the Education of Democratic Citezens / R. Battistoni. - Jacson : University Press of Mississippi. 1985. P. 187.

[14] *Gutman, A.* Democratic Education / A. Gutman // Princeton Univercity Press, 1994. - P. 51.

[15] Learning the Ways of Democracy : A Case Book of Civic Education // Educattional Policies Commission. - 1996. - P. 67.

[16] *Goodlad, J.* Democracy, education and commynity / J. Goodlad, R. Soder (Ed.) Democracy. Educational and schools. – Jossey-Bass, 1996. - P. 70.

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Computer Supported Changes in Education

Danimir Mandic, Ezzadeen Kamuka, Nenad Lalic, Mirko Dejic, Dusko Parezanovic

***Abstract*—**Changes and information are the two key characteristics of the modern society. The society is rapidly changing. One change comes right after another. New knowledge comes quickly into existance, and becomes obsolete even quicker. Even changes in the area of education are going slow, school system cannot be indolent, faced towards the past, but an institution of the fast, rapid changes facing the future. Managing these changes and innovations is one of the extremely important questions School, the creator of knowledge, must transform from an institution that was late and lagging behind the changes in the past into the leader of changes. The efficiency of managing the changes is about using the new information technology, various models of innovation from the powerful web-portals as the source of fresh, not bygone knowledge and didactic innovations. The modern information technology becomes more and more miniature, powerful, cheaper and available to schools. It makes possible to have a teaching process organized according to new, more effective information paradigm instead of the traditional one. Traditionaл teaching practice can hardly be overcome without more profound realizing needs of scientific approach to the problems of training teachers for using modern technologies, and one of the contributions of this work would be to point out importance and need for scientific approach to research on this problem.

***Keywords*—** development, changes; иnformation technology; web-portals, teaching, learning.

I. INTRODUCTION

Companies give their products, almost, for free. Electronic products and expenses of their delivery are meaningless. Mobile phones are offered for one euro. The best products get cheaper every year. Wealth is obtained directly from innovations, and not from an optimization of a finished product; this means that wealth is not gained by adopting the already known but discovering the unknown. The future is no longer in computers but in connections. In other words, a drastic twist from products to services is taking place in front of us. The services follow the growing demands of the consumers. "Sony" is getting more and more involved in the chain of services instead of focusing on products. It is building a sort of integrated chain of value in order to meet the consumers' demands. The media chain covers everything from content of services (music, moves, computer games) to reproduction equipment (TV sets, mobile phones, etc.)

The need for knowledge is increasing by geometric progression. Without specialized, inovative knowledge it is impossible to offer services with extra value. Many companies are joining together in order to combine their specific knowledge in a better way. There is an increasing demand for consulting companies and agencies that have specialized and innovative knowledge at their disposal. Consulting business is expanding in a rapid and explosive manner. Managers get more and more insecure when it comes to handling complicated tasks and projects. Today, the consulting companies are the ones being established and expaned in the fastest way. Knowledge has become the most wanted commodity, and will get even bigger.

It is believed that the intelectual property in this century will be more valuable than the physical resources. Companies will more and more present thier value in intelectual capital, such as: patents, knowledge about processes, skills for governing the knowledge, information, competition records, licenses, ideas for process improvement, knowledge for constant supervision, and so on. An important factor in this issue is obtaining the knowledge that increases the value. Potential of a company for generating extra value is called KnoV. It's the factor of knowledge. This potential in the economy of knowledge depends on two elements: 1) level of services provided by a company and the intensity of knowledge utilization by the company; 2) level of knowledge utilization needed for the company to make a product or offer a service [2]. Using the knowledge alone is not enough since there has to be a value growth. Namely, it is necessary to have a two-way influence, attack on increasing the level of services and increasing the level of knowledge in order for the company to reach greater results.

Many companies and agencies expand the scope of their services by offering training, seminars, setting up schools and academies for potential candidates. Teams for increasing the factor of knowledge value are being established within the companies. Even the most creative ones must learn. They try to provide knowledge that increase the value (KnoV fakctor).

The school system of a society seeking for knowledge and the knowledge that increases the value, cannot remain the same, be as before, be kept aside, even though storm winds of changes and innovations pass by it. School, a home of knowledge in which knowledge is created and innovated, needs to be changed from its foundation. If not, it will become obsolete in the course of time, and similar new institutions offering fresh, usable,value increasing knowledge will be set up. It not only has to change, but to take over the leading role, step by step, becoming a leader in

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spreading the innovative knowledge, the knowledge that will be a factor of a greater productivity in the industry of knowledge and services. Knowledge cannot serve profit only, but the increase of human potentials. [3].

The knowledge management or how to run value increasing knowledge is one of the key issues and tasks of a school management. Computer-supported management of development innovative changes is surely one of the most important issues a school management has to deal with.

II. KNOWLEDGE MEANS CHANGE

The two basic characteristics of today's society are change and information. They often come tightly connected. If we percive an information as a news of something new, and that's the way it should be, then the information is a news on change. Today's era is an era of information. There is a growing number of people in economy earning their livings by creating, processing and distributing information, and in developed countries high incomes come from these areas. The real economy growth will be impossible without development of a technological know how. During the time, the share and importance of knowledge in business activities has increased. The role of the grey supstance (the brain) today is bigger and more important than the role of a financial capital and natural resources. Japan is poor in natural resources, and has become the world's ecomony power thanks to skilled personnel, respectivelly knowledge.

This brings us to the question: what is the true knowledge today? According to the UNESCO's report (Deloro's commission), knowledge should be based on four pillars: learn how to know, learn how to work, learn how to live, learn how to exist. Concept of knowledge has evolved. Once the knowledge was considered to be a set of memorized facts and information which, when needed, can be applied. This is how the supporters of material theories explain the idea of knowledge. If this was understandable to a certain point in the 19th century when a set of scientific facts was realtivly stable (even though during this period the knowledge once obtained was not sufficient for the whole period of employment), it is completely unacceptable. The thing actual today tomorrow will be archaic. The true knowledge is that forming a foundation for the new one, and a good school is the one providing solid basis for the future learning, preparation for critical thinking, i.e. analisys, argument interpretation, asking the right questions. The modern business activities are more and more intelectualized, demanding for more universal labor, more creativity than ruotine. [4].

III. CHARACTERISTICS OF A INNOVATIVE SCHOOL AS THE INDICATORS OF CHANGES

We could emphasize two basic styles of a teacher's work – bossiness (giving orders) and managing. The first one means repression, penalty threats, imposed authority, force application so the students perform because they have to, and not due to an inner need. The managing style is based on a cooperation during the education process, directing and encouragement. The boss always addresses with the 1st person singular (I), and the managing teacher with the 1st person plural (we). The boss intimidates and puts blame on others, while the managing teacher creates a relationship of trust and corrects. The work is done under the pressure with the first one, and beacuse it's fun with the second one.

The six criteria, according to W. Glasser, a school should meet in order to be a quality one [2]:

1. Pleasant and encouraging atmosphere in the class. The total outcome depends on a climate in the classroom. If the social climate is bright and a relatioship between the teacher and the students is warm and full of trust, if a student can complain to his/her teacher for not understanding something without being afraid of a negative consequences for his/her mark, the success will be very high. The students' potentials will be fully used during the teaching process.

2. Students should do something useful. The frequent reason for weaker students' results is that they don't understand why they learn something. A teacher who gives them no explanation on why it is necessary to go through a ceratin topic hasn't successfully accomplished his/her task. If a student is forced to learn a number of facts by heart, and at the same time sees no need for it and the purpose in life, he/she will quickly forget them. Process that is targeted will be successful..

3. Students should be asked to give their best. A good school is the one where students achieve results in accordance with their intelectual and other capacities.

4. Students should give marks and improve their performance. Self-evaluation is very boosting. If a student sets his/her knowledge on a scale independently, he/she will have a clear picture of whether his/her work is hard enought. Teacher should use every opportunity to ask a student whether he/she could have achieved more. If the reply is "yes", he/she should be asked to say why he/she hasn't achieved as much as he/she could have. In this way a cause the student needs to eliminate will be revealed. The starting point should be that there is no upper quality limit. If a student has solved a matematical problem correctly, he/she should be given those more difficult in order to have his/her upper limit moved upwards.

5. Quality performance is always pleasant. Even after a hard work, if successful, a student will feel satisfaction. A moderate praise will be motivating. Logically, there is no quality performance if students don't give their maximum. Only after such efforts and success one can say that the work has been pleasant. The greater the difficulties coped by a student, the greater the satisfaction due to achieved results. There is no pleasant work without putting the maximum efforts in it.

6. Quality performance is never destructive. This means that the students' efforts should be directed towards the benefits of the human kind, teach them to use the gained knowledge for noble purposes, advise them that it is not a rare case to have the scientific and technical achievements used against the human kind (wars, destruction of enviroment, distinction of certain animal varieties). W. Glasser has listed the criteria for detecting a quality school, which are listed below in the shortest form:

Focusing on success (all factors – teachers, students, parents – strongly focused on success help each others

altruistically, the key preoccupation of all is the better performance of a school, teachers giving thier best to lead each student to success). Pedagogic engagement and motivation of teachers (student comes first, and then a theme, teacher is more focused on a student and less on a subject, teacher knows each student well and his/her family background, teacher constantly communicates with parents). Readiness for application of didactic inovations (teachers have a strong need to innovate the educational performance, they critically revise their work, gladly attend seminars, use pedagogic periodicals, and are personally subscribed to many magazines). Multimedia classroom offers possibilities for carrying out traditional, semiprogrammed and programmed teaching, for testing and making conditions for research work. By use of this classroom better conditions for maximal visuality in teaching are made, rational usage of resources, time, staff, permanent testing and verification of pupils knowledge, naturally, electronic classroom for programmed learning contributes more to solving the above mentioned problems in case its advantages have been used to a maximum, if it is strongly connected with other aspects of organization and carrying out teaching and if its program work is adjusted to needs and interests of young people to a maximum.

Fig.1. Multimedia classroom

We could say that electronic classroom for programmed teaching, as a perfect and automatized device, offers new possibilities and facilities in acquiring knowledge, and on the program quality, way of its use, degree of motivation and pupils way of work, depends what kind and how much educational effects it will give. We shall measure its effects same as with other innovations, with how much it contributes to realization of our educational aim in schools, at universities and other institutions for education of young and adult people.

Fig.2. Software for selfevaluation

It is certain that in future electronic classrooms will find their place in our schools, as one of the modern teaching aids, forms of teaching; and learning, and it will have influence on change of his pedagogical function, modification, enrichment and fitting into up-to-date courses. [5]

High teaching standards – optimisation of a teaching process in accordance with the standards of knowledge, students' optimism and readiness for learning, help students understand and evaluate the well mastered issues and give a constant feedback so the students always know their position.

IV. TEACHERS ATITUDES ABOUT INNOVATIONS

Intensive development of information technology, improvement of the existing and constant appearance of new systems require permanent following of innovations and adequate training of teachers for their application. Problem of didactic-methodical training for application of information technology is specially visible with teachers who did not study teaching subjects in the field of didactic-methodical sciencies during their schooling. Subject matter of this research is establishing degree of teachers being informed, about new information technology, as well as establishing needs and possibilities training teachers for adequate application of modern information technology with the aim of increasing quality of pupils knowledge and more efficient work of school as a whole on one side, and, based on received data on being informed, needs and possibilities of teachers, establishment of program base (model) of education and professional training of teachers in educational information technology.

Level and structure of needs are constantly being developed and they depend on personal affinity for studying modern technology, character of working position, degree of professional training, length of service, previous pedagogical training, work conditions, etc. Therefore, it is very important for program of training future teachers to satisfy scientific criteria, needs of teaching practice as well as individual) needs and interests of teachers.

Table 1. General teachers relation towards didactic-information innovations

Attitude intensity	**Scale value**	f	%
1. distinctly negative	to 1,50	4	.54127
2. moderately nega-tive	from 1,51 to 2,50	30	4.05954
3 hesitant	from 2,51 to 3,50	263	35.58863
4. moderately posi-tive	from 3,51 to 4,50	407	55.07442
5 distinctly positive	from 4,51 to 5,00	34	4.60081

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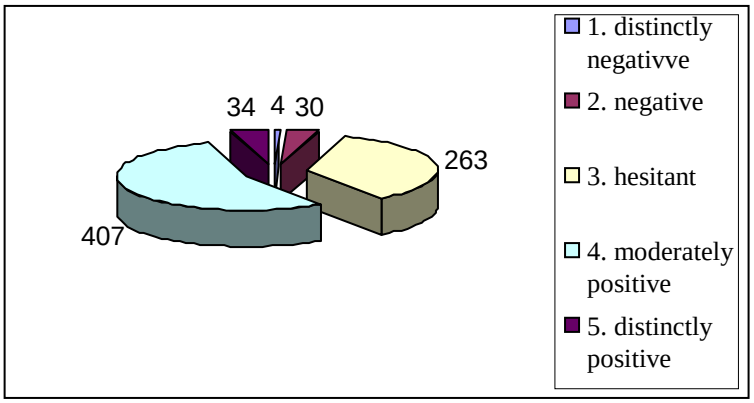

Graph 1. General teachers relation towards didactic-information innovations

The above quoted results of teachers relation towards didactic-information innovations indicate positive general relation of teachers at the level of being convinced, which is expressed through evaluation of certain aspects of didactic-information innovations. However, such relation does not rive possibility of making conclusions whether teachers with positive attitude are at the same time also better trained for their application (cognitive component) and better prepared for quality teaching or not (conative component), as well as what are their previous experiences like in the application of those innovations in the direct teaching work, what is, also, very important for making conclusions on teachers relation towards didactic-information innovations in teaching. Overcoming this problem involves active participation in seminars for teachers' training and using new technologies in life-long learning.

V WEB PORTALS IN EDUCATION

Development of information technology and an easy access to materials on the internet surroundings have made the pre-conditions for modelling the educational portals that would contain materials assisting teachers, advisers and principals. School management as one of the most complexed tasks can be made easier by using analitic-plan documentation, implemented models of the annual work plans, and large number of examples from the principal's working experience.

Educational web-portals represent the significant sources for disimmination of teaching innovations into school pedagogy performance. It is not possible to manage the changes (innovations) in a modern school effectively without using the powerful electronic sources of innovations that can be used in the teaching process. [4].

Educational web portals would have various models of materials for the individual innovative teaching models, instructions and examples of programming - plan and evaluation documentation for implementation of school management various functions. Web portals would be a strong basis of a more effective management of development changes in a modern school. However, it is necessary to form powerful educational portals that would have selective and expert prepared didactic models of material for implementation of individual teaching innovations. Web portas are a condition for a systematic approach for implementation of didactic innovations into the pedagogic performance of a school. The educational web-portals would contribute to a later more efficient management of development changes in the moderm school system. They would make possible to have the school work based on systematic changes. Namely, it would allow the using of evaluating materials for constant gathering of information on performance and improvement of each student. [3] We created Web portal at the adress www.edu-soft.rs.

Fig 3. Web portal for teachers

The successful governing, with using the new technologies, also means an adequate skills of a principal for using the information technology. Principals acting as leaders of the innovative changes must posses the basic knowledge from the educational informatics (know the inovative models of work). However, they also must be well-versed in using IT since no managing of development changes exists in a modern school without it.

The basic informatic literacy is one of the key criteria for working in a modern school, as well as a condition for effective governing of school innovative changes.

VI CONCLUSION

Changes and information are the two basic characteristics of the modern society. These two categories are firmly connected. The value of knowledge has significantly increased. It represents the key value (resource) that the social-economic development and prosperity depend on. The society is going through constant, rapid development changes. One change comes after another. Change generates knowledge. Knowledge is a change. Today one of the most important questions frequently asked is how to run changes and innovations in order to have them applied in the most effective way and result in boosting and starting the new social-economic changes. There is no effective managemenet of changes without knowing and using the powerful IT. . Using modern media, better quality of teaching is evident, dynamic and interesting, with good organization can continue to provide greater activity, better quality and durability of students' knowledge. Using modern media teacher could satisfactorily adapt teaching style, cognitive styles and learning styles of students, could meet their diverse needs and encourage curiosity and motivation for learning and ensure that each student demonstrated the specific way to search for specific teaching materials and to overcome their own pace. In recent years intensively

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developing didactic materials in the Web environment gives the opportunity of better study of certain areas, which corresponds to the individual interests of students (pupils) and all others who use these teaching materials for formal or informal education. We need also to be made permanent evaluation of e-learning systems and their development in accordance with the changes taking place in developed countries of the world, and based on the experiences and attitudes of teachers and students in practice. Web-portals are one of the most significant sources of fresh knowledge and beneficial innovations. It is important to create the powerful sources of knowledge and innovations, make teachers skilled for the their application in the teaching process, as well as to train the principals for applying the IT while governing the development changes in a modern school.

REFERENCES

[1] Mandic, D Lalic, N., Bandjur, V..: **Managing Innovations in Education, in the book 9**th WSEAS Intenational Conference. on ARTIFICIAL INTELLIGENCE, KNOWLEDGE ENGINEERING AND DATA BASES (AIKED '10), , University of Cambridge, Cambridge, United Kingdom, 2010, pp.221-226

[2] Mandic, D.: **Knowledge Based Multimedia System for Teacher's Education, in the book 9**th WSEAS Intenational Conference. on ARTIFICIAL INTELLIGENCE, KNOWLEDGE ENGINEERING AND DATA BASES (AIKED '10) University of Cambridge, Cambridge, United Kingdom, 2010, pp.221-226

.[3] Mandić, D., Lalić, N., & Bandjur, V.: Menager Innovetions in Education, in the book 9th WSEAS International Conference. on ARTIFICIAL ANTELLIGENCE, KNOWLEDGE ENGINEERING AND DATA BASES (AIKED ; 10), ISBN: 978-960-474-154-0, ISSN. 1790-5109, University of Cambridge, Cambridge, United Kingdom, 2010, pp. 231-237.

[4] Mandic, D, Lalic, N., Lalić, S...: **Decision Support System in Educational Technology, in the book 7th WSEAS International Conference on APPLIED COMPUTING (ACC '10)**, ISBN: 978-960-474-236-3, ISSN: 1792-5908, Timisoara, Romania, 2010, pp.102-107

[5] Glasser, W: The Quality School, Harper &Rov, New York, 1999.

[6] Vilotijevic, M. . The reform of education has to be based on the conception of the school of the future. In the Annual Issue of the Serbian Academy of Education for 2009. Belgrade, 200

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Experiential Learning and Pro-Environmental Behavior

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Abstract— This paper examines the implementation of a guided learning and behavioral enhancement to predict and explain observed pro-environmental behavior (PEB) in an eco-tourism experiential study. The development, implementation, and maintenance of nature-based experiences as part of higher education learning have significant effects on PEB. The authors employ the ordered probit model to predict the variables under study. The research suggests that personal norms and affective evaluation of behavior account for variances in behavioral intentions. The results also indicate that attitudes toward the behavior; perceptions of subjective norms; and perceptions of behavioral control, personal norms, and affective evaluation significantly predict PEB.

***Keywords*—**experiential learning, experiential trip, ordered probit model, pro-environmental behavior.

I. Introduction

Environmental education is education about the world [1]. It impacts on climate change, biodiversity, and nature [2]. To exert sustainable behavior, changes to the patterns of behaviors adopted by the public are called for [3]. According to [4] and [5], a common premise to promote sustainability is an increase in awareness and education amongst the public.

The concept of education for sustainable development gained momentum and exposure through the United Nations Decade of Education for Sustainable Development (2005–2014), which advanced the notion that challenges of environmental sustainability in developing countries were inextricably connected with higher education and learning [6]. The widespread interest in environmental sustainability in developing countries has put pressures on higher education to undertake the responsibilities for leadership in environmental sustainability [7]. Because of the high density of environmental properties in developing countries [7] and [8], this agenda stressed the prominence of environmental sustainability on them.

II. Research Context

The traditional concept of learning among higher education students is on rote learning and memorizing in favor of student-centered and task-based approaches [9]. With the increased tension in creating competitive students (not restricted to classroom learning alone) and promoting the adoption of progressive education practices, including a more holistic approach that focuses on individual students' needs and self-expression, more higher education programs are now geared toward the dimensions of experiential learning [10]. Given this orientation, [11] stipulated that because learning is both a process and a product, the process of learning and understanding what is happening outside textbooks should be built into the curriculum.

[12] defined PEB as behaviors that consciously seek to minimize the negative impact of one's actions on the natural built world. Behaviors refer to the actions people take and the choices they make to consume products and services or to live in certain ways [13]. The literature on PEB consists of two major streams: one focused on social-psychological constructs and the other focused on socio-demographic variables [14]. Experiential learning experience is a stimulus to the natural environment because it leads to greater appreciation of nature, thus promoting environmentally responsible behavior [15], [16], [17].

This paper employs an eco-tourism study trip as a case study in an attempt to examine the extent to which experiential learning influences PEB and sustainability behavior among higher education students using an ordered probit model. The experiential trip was a three-day two-night stay at an eco-tourism resort located in the northern part of Malaysia. During the trip, students visited one of the oldest tropical rainforests in Malaysia to understand the challenges and prospects of sustainability. All students were encouraged to participate in the experiential trip and participated in seminars and forums on survival skills. The students were also asked to conduct additional research on their own after the trip as part of their assessment.

III. Research Framework and Propositions

[18] found that attitudes toward behavior were positively related to environmental awareness and that the type of information provided had direct implications in shaping the attitudes to perform the targeted behavior [19], [20], [21], [22], [23]. Prior research has shown that experiential learning emphasizing self-discovery, participation, and sensory involvement leads to greater awareness and subsequent promotion of the attitude to perform PEB [24] and [22].

H1. Environmental awareness has a positive impact on PEB.

A person who is energized or stimulated to perform certain behavior is characterized as being motivated [25]. [26] asserted that the level of self-determination for one's behavior

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can be either intrinsic or extrinsic motivations. Intrinsic motivation refers to the satisfaction a person gains from performing certain actions [27]. Extrinsic motivation exists when a person acts mainly to receive rewards or to avoid feeling guilty [28]. [29] further agreed that activity-based teaching, such as experiential learning, is valuable and productive because students attain more extrinsic motivation to perform environmental actions.

H2. Intrinsic motivation has a positive impact on PEB.
H3. Extrinsic motivation has a positive impact on PEB.

[30] suggested that people who embrace a strong internal locus of control tend to believe that they possess the ability to drive the outcomes. [31] further claimed that locus of control can lead to participation in environmental activities. Some studies suggested that in the presence of experiential learning, a shift occurs in a person's locus of control [32], which leads them to attempt to change the environment [33].

H4. A person's internal locus of control has a positive impact on PEB.

Moral norms are a person's perception of the moral correctness or incorrectness of performing a behavior [34]. In general, [35] and [36] suggested that the more favorable a person's perception of the moral correctness and moral norm of a certain behavior, the stronger is his or her intention to perform the behavior. [37] agreed that experiential learning can provoke people's negative feelings of regret and their moral correctness or incorrectness, which serve as a positive catalyst for their conservation behaviors [38] and [39].

H5. A person's moral norm has a positive impact on PEB.

[40] suggested that a person's feelings regarding a behavior outweigh the rational assessment of his or her evaluation of the costs and benefits of performing the behavior and cause the person to behave environmentally. People who are more affectionate tend to perform PEB. [41] suggested that anticipated regret is an important predictor of behavioral expectations in the context of environmental behavior. [42] indicated that the affective evaluation of PEB allows for the supposition that the decision to act environmentally is not purely based on a rational decision but also on affective feelings regarding the behavior.

H6. Affect has a positive impact on PEB.

In the second stream, three demographic variables that might affect PEB: gender, urban upbringing, and exposure to nature. Women are more attentive and tend to have more knowledge about "green" issues than men, and thus they are more likely to have higher levels of PEB [43] and [44] and stronger levels of concern [45].

In contrast, [46] stated that environmental concern is developed at early stages in life—that is, environmental concern and behaviors are highest among the young, as well as educated people residing in urban areas [47]. High levels of environmental problems (e.g., industrial activities), which tend to be prevalent in cities, provide first-hand experience to urban residents, which in turn leads to greater environmental concern [48] and [49]. Therefore, in general urban communities are more supportive in environmental protection [50].

H7. Women have higher levels of PEB than men.
H8. Urban upbringing has a positive impact PEB.
H9. People who are exposed to nature at a younger age have higher levels of PEB than those who are not.

IV. Methodology

Non-probability purposive sampling was employed to examine the effect of experiential learning on student's behavior. The respondents were students who participated in an experiential study trip. A self-administered drop-off survey method was employed to collect responses from 100 students who visited eco-tourism sites as part of their learning curriculum at the end of the semester.

An ordered probit method was used to assess both the independent measures of behavior and behavioral intention and other alleged cognitive precursors of behavior on PEB. Ordered probit analysis was employed for the study. This method is more beneficial than the commonly used regression because it allows the predictors to translate into the probability of observing a particular ordinal outcome (i.e., the strength of PEB). Another advantage is that the model can produce a reading on the marginal effects. Marginal effect refers to the strength and direction of an independent variable; that is, the extent to which it can explain the dependent variable while holding all other variables constant. The estimation is performed using the ordered-response model [51] and [52] under a variety of assumptions about the latent error distribution.

Ordered probit is a generalization of the popular probit analysis in case there are more than two outcomes of an ordinal dependent variable (performance of PEB can be classified into weak, neutral, or strong). The independent variables in the study are the social psychological variables and the control variables, including age and exposure to nature. The dependent variable is ranked from the following list: strong, moderate and weak. The predictors were translated into the cumulative estimated probability of observing a particular ordinal outcome (ordered categories: performance of PEB).

The questionnaire items were obtained through reviews of the extant literature on PEB and environmental awareness [53] and [54], self-determined motivation [55], perceived behavioral control [31], [32] and [33], moral norms [56], affective evaluation [57], exposure to nature, upbringing environment [58], and gender.

A. Model Specification

The analysis focused on identifying and measuring the marginal impacts of variables that may condition a person to perform different levels of PEB after an experiential study trip.

The dependent variable for PEB is a composite index of various environmentally responsible behaviors. This index was computed as the sum of responses on the individual questions regarding frequency of performing pro-environmental actions, including refusing excess packaging, using biodegradable packaging and double-sided printing, reusing or recycling plastic bags, conserving energy, not harming the fauna and flora, being concerned about biological and cultural diversity and heritage; and educating others about the importance of environmental conservation.

An ordered probit model was employed to analyze the ordered outcomes (in this case, the strength of PEB (weak, moderate and strong) and its impact on the independent variables) and to capture the marginal effects from different levels of behaviors. The general estimation of the model is as follows:

$$y^*_i = \beta x_i + \varepsilon_i, \quad (1)$$

where y^* is the dependent variable (PEB), x_i is a series of independent variables, and ε_i is the error term. The estimation that the dependent variable will fall into a j + 1 interval (weak, moderate, and strong) is expressed as follows:

$$\text{prob}\ (y = j|x)\ , \quad (2)$$

where j is the different levels of the PEB. The estimation of ordered choice models is based on the maximization of the likelihood function, which is expressed as follows:

$$\log L = \sum_{j=1}^{J} \log Prob\ (y = j|x) \quad (3)$$

A positive coefficient signals a positive shift in the distribution of responses, implying a drop in the probability of weak PEB and an increase in the probability of strong PEB. The sign and magnitude of the changes in the probabilities cannot be inferred from the estimated coefficients alone. To obtain the results, a preferred basis for comparison is calculated (category-specific marginal effects). The marginal effects for a given variable will always sum to zero across the different ordinal categories [59].

Cronbach's alpha as a measure of the coefficient of reliability and internal consistency was used to access the items of PEB. Cronbach's alpha for the 10 PEB items was 0.881, which is within the acceptable range of reliability [60] Nunnally 1967). According to [51], to capture the marginal probability effects of psychological behaviors and factors affecting behavior, the data must be recoded into three categories: 0 = weak, 1 = neutral, and 2 = strong (range = 0, 1, 2; $\bar{X}$ = 1.59, σ = 0.53). The dependent variable (PEB) is idealistically assessed using a three-point scale based on the individual frequency of actions, because behavior cannot be captured by dummy but rather by frequency of actions [61] Barr 2003). Therefore, a PEB index was computed to serve as the dependent variables for the PEB model.

B. Empirical analysis

As an expansion of equation 1, the following model expresses the model under study:

$$Y = \alpha + \beta X_1 + \beta X_2 + \beta X_3 + \beta X_4 + \beta X_5 + \beta X_6 + \beta X7 + \beta X_8 + \beta X_9 + \varepsilon,$$

where Y is the PEB index, X_1 is environmental awareness, X_2 is the locus of control, X_3 is self-determined motivation, X_4 is moral norm, X_5 is affective evaluation, X_6 is exposure to eco-tourism (1 = yes, 0 = no), X_7 is childhood upbringing environment (1 = urban, 0 = suburban), and X_8 is gender (1 = women, 0 = men).

As the ordinary regression results show (see Table 1), in terms of the goodness-of-fit model (R^2 = 0.32), the F test for independent variables are jointly significant at the $p < .01$ level. A potential dilemma from using five psychological and behavior variables in a model is the possibility of multicollinearity and normality assumption in the ordinary regression model. According to [51] and [59], these problems can be addressed using the ordered probit model with interaction terms, following a cumulative density function. Thus, the analysis computes the ordinary regression, basic ordered probit model, and improved ordered probit with interaction terms (Table 1) to compare the results and variation explained.

According to the basic ordered probit and improved ordered probit model (see Table 2), the pseudo-R-square showed an increase from 0.28 to 0.42. When the childhood upbringing environment index and urban and suburban variables are included as interaction terms in the PEB model, the model collapses. This indicates that there is no reading for the childhood up bringing environment and urban and suburban coefficients in the improved model. This could be due to the close nature between these two variables, and thus a singular matrix problem could be present.

The rationale for including an interaction term of exposure to eco-tourism (AFF × EXP, AWA × EXP, LOCUS × EXP, MOR × EXP, and MOT × EXP) into the ordered probit model is to identify the interactivity of the extra effect caused by exposure to eco-tourism on the five psychological and behavior variables of PEB. As the improved ordered probit results show, the interaction term of self-determined motivation and exposure to eco-tourism (MOT × EXP) is significant at $p < .01$. That is, for two people with the same level of self-determined motivation, the extra effects of PEB could be associated with past exposure to nature. As a result, on average, people exposed to nature would have a 34.47% stronger PEB than those not exposed (a computation based on the coefficient value of 8.57, using equations 2 and 3), all else being equal.

Table 1. Ordered probit estimation model: basic model and interaction terms

	Ordinary Regression	Basic Ordered Probit	Improved Ordered Probit
AFF	0.01	0.09	47.46**
AWA	-0.56	-1.51	18.22
LOCUS	0.01	0.07	30.97**
MOR	2.25**	5.83**	-67.86**

MOT	1.36**	3.52**	33.51**
CHILD	-0.04	-0.05	
GENDER	0.26**	0.69**	0.80**
URBAN	0.03	0.06	
SURBAN	0.19	0.54	
EXP		-0.08	4.92**
AWA × AFF			-36.52**
LOCUS × AFF			-12.24
MOR × AFF			37.09**
MOT × AFF			-46.88**
LOCUS × AWA			-0.25
MOR × AWA			-6.00
MOT × AWA			15.10
MOR × LOCUS			27.77
MOT × LOCUS			-56.35**
MOR × MOT			43.21**
AFF × EXP			-0.46
AWA × EXP			-0.96
LOCUS × EXP			-3.69
MOR × EXP			-3.57
MOT × EXP			8.57**
R^2	0.32		
Pseudo-R^2		0.28	0.42
Akaike information criterion	1.64	1.68	1.59
p-value (LR test)	0.00	0.00	0.00

**$p < 0.01$, * $p < 0.05$.

To understand the marginal effects of an increase in behavior on the independent variables, Table 2 was computed (using equation 2), where (H) equals high, (M) equals moderate, and (L) equals low levels of PEB (the marginal effect from the moderate PEB). From the marginal effect, moral norms have the highest positive impact on strong PEB compared with exposure to eco-tourism (which has the lowest impact on strong PEB). For example, a 1% increase in both moral norms and exposure to nature, moral norms have a higher probability (9%) to have strong PEB than exposure to nature, all else being equal.

Table 2. Marginal effects for the ordered probability model

	Probability toward category of:		
1% increases in Index	Weak PEB	Moderate PEB	Strong PEB
Environmental awareness	0.02	0.07	0.12
Locus of control	0.04	0.26	0.30 (M)
Self-determined motivation	0.05 (M)	0.31	0.37
Moral norm	0.09 (H)	0.57	0.67 (H)
Affective evaluation	0.07	0.40	0.46
Exposure to ecotourism	0.01	0.04	0.05 (L)
Gender	0.01 (L)	0.07	0.08

V. Discussions and Managerial Implications

This paper investigated how social-psychological factors influence PEB through the marginal effect based on the ordered probit model.

Although prior research has found that environmental awareness is a dominant factor in predicting PEB [62] and [22], this was not the case in the current study; therefore, H1 is rejected. This finding is in line with [63], who found that a positive attitude toward behavior (positive awareness) is not a sufficient motivation to instigate action; thus, the measurement of ethical or moral behavior responses is subjected to social desirability bias.

Accordingly, prior research has also found that though people might be aware of the effects of their behavior, this awareness will not necessarily translate into positive behavior [64], [65] and [66]. [65] claimed that overt behavior is influenced by a multitude of factors beyond the particular attitudes of interest.

The findings from this study support H2 and H3; that is, intrinsic and extrinsic motivations have a positive impact on PEB. This finding is in line with [67], [38], [68] and [39], who asserted that intrinsic motivations of behavior can be strengthened by fostering feelings of personal responsibility to sacrifice time and effort for the environment. Intrinsic motivations enable people to keep motivated and act proactively rather than to obtain material or extrinsic rewards [69] and [70] and to feel pleasure about and satisfaction with the well-being of their community [71].

The results also support H4, which suggests that the belief in one's ability to drive positive environmental outcomes plays a critical role in PEB. In a similar vein, according to [33], students who had greater internal locus of control were more likely to participate in PEB. Similarly, the propensity to affect outcomes tends to increase students' participation in environmental behaviors [42] the feelings of personal control and obligation to participate in environmentally responsible activities carry significant positive coefficients in the PEB model.

The results from the ordered probit suggest that personal norms and affective behavior are significant at the $p < .05$ level, in support of H5 and H6. [36] and [35] suggested that the more favorable a person's perception of moral correctness and moral norms with respect to behavior, the stronger is his or her intention to perform the behavior. Studies have found that beliefs about moral norms and anticipated affective reactions play a substantial role in amplifying environmental beliefs and behavior, which in turn promotes medium to moderate environmental attitudes and behavioral intentions [38] and [39].

The findings also support H7—that women have higher levels of PEB than men. The knowledge that demographic characteristics and contextual features facilitate PEB is crucial

in implementing strategies for environmental education and preservation [72]. Women are considered more vigilant and careful than men. Similarly, it is more common for women to attend meetings and lead activities in their neighborhoods than men [73].

The findings also support H8—that urban upbringing has a positive impact on PEB. As a result of lost green and sustainability properties in urban areas, society overall and urban dwellers in particular have come to realize that more efforts should be given to sustainability [74] and [75]. [14] suggested that there is increasing social pressure at all societal levels, including marketers, to develop and implement programs and measures that will help convince people to become more sustainable. This pressure is in line with the modernity ecological theory of social change, which suggests that the shift in society's behavior from being less environmentally conscious to having greater PEB is due to the deterioration of modern ecological environments [76].

Finally, the findings support H9, which posited that respondents exposed to nature during a younger age would have higher levels of PEB than other age groups. Educating people from an early age and the transferable values and knowledge which they developed play a significant role in establishing PEB [77]. Accordingly, [78] found that as populations age, they begin to play a larger role in contributing to environmental problems.

REFERENCES

[1] M. Brody, "Learning in nature," *Environmental Education Research*, vol. 11, no. 5, pp. 603–621, 2005.

[2] A. C. Hurlimann, "Responding to environmental challenges: an initial assessment of higher education curricula needs by Australian planning professionals,' *Environmental Education ResearchI*, vol. 15, no. 6, pp. 643–659, 2009.

[3] G. Miller, K. Rathouse, C. Scarles, K. Holmes, and J. Tribe, "Public understanding of sustainable tourism," *Annals of Tourism Research*, vol. *37* no. 3, pp. 627–645, 2010.

[4] G. Saxena, and B. Ilbery, "Integrated rural tourism, a border case study," *Annals of Tourism Research*, vol. 35, no. 1, pp. 233–254, 2008.

[5] E. Amendah, and J. Park, "Consumer involvement and psychological antecedents on eco-friendly destinations: Willingness to pay more," *Journal of Hospitality Marketing and Management*, vol. 17 no. 3&4, pp. 262–283, 2008.

[6] IUCN, International Union for the Conservation of Nature, "Recovery from Indian Ocean Tsunami: Guidance for Ecosystem Rehabilitation: Incorporating Livelihoods Concerns," *International Union for Conservation of Nature*, March 25. www.iucn.org/info_and_news/press/tsunami-guidance-info.pdf (accessed September 25, 2013), 2004.

[7] S. M. Bekessy, T. Burgman, W. L. F. Wright, and M. Smith, *Universities and sustainability*. Carlton, VIC: Tela Papers, Australian Conservation Foundation, 2003.

[8] J. Clifton, and A. Benson. "Planning for sustainable ecotourism: The case for research ecotourism in developing country destinations," *Journal of Sustainable Tourism*, vol. 14, no. 3, pp. 238 -254, 2006

[9] G. C. I. Tan, Changing Perspectives of Geographical Education in Singapore: Staying Responsive and Relevant,' *Journal of Geographical Research*, no.59, pp. 63-74, November 2013.

[10] K. McKinney, K. Vacca, M. Medvedeva, and J. Malak, "Beyond the classroom: An exploratory study of out-of-class learning in Sociology," *Teaching Sociology* vol. 32, pp. 43-60, 2004.

[11] L. J. Rennie, E. Feher, L. D. Dierking, and J. H. Falk, "Toward an agenda for advancing research on science learning in out-of-school Settings," *Journal of Research in Science Teachin*g, vol. 40, no. 2, pp. 112–20, 2003.

[12] A. Kollmuss, and J. Agyeman, "Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behaviour?," *Environmental Education Research* vol. 8, no. 3, pp. 239–260, 2002.

[13] N. Beaumont, "The meaning of ecotourism according to...is there now consensus for defining this "natural" phenomenon*?*," *An Australian perspective. Pacific Tourism Review* 2: 239–50, 1998.

[14] T. Dietz, P. C. Stern, and G. A. Guagnano, "Social structural and social psychological bases of environmental concern," *Environment and Behavior* vol. 30, pp. 450-471, 1998.

[15] R. D. Green, and F. A. Farazmand, "Experiential learning: the internship and live-case study relationship," *Business Education and Accreditation*, vol. 4, no. 1, pp. 13-23, 2012.

[16] R. Mittelstaedt, L. Sanker, and B. VanderVeer, "Impact of a week-long experiential education program on environmental attitude and awareness," *The Journal of Experiential Education* vol. 22, no. 3, pp. 138-148, 1999.

[17] N. Beaumont, "Ecotourism and the conservation ethic: recruiting the uninitiated or preaching to the converted?," *Journal of Sustainable Tourism* vol. 9, no. 4, pp. 317-341, 2001.

[18] D. Pelletier, I. Green-Demers, K. Lafleur, "Students' Motivations For Voluntary Remedial Learning In High School" "The Clute Institute International Academic Conferences Key West, Florida USA, 159-164, 2013

[19] R. De Young, "Exploring the differences between recyclers and non-recyclers: The role of information," *Journal of Environmental Systems* vol. 18, pp. 341–351, 1989.

[20] L.A. Dieker, and J. A. Rodriguez, "Enhancing secondary cotaught science and mathematics classrooms through collaboration," *Intervention in School and Clinic*, vol. 49, no. 1, pp. 46-53, 2013.

[21] P. Hartmann, and V. Apaolaza-Ibáñez, "Consumer attitude and purchase intention toward green energy

brands: the roles of psychological benefits and environmental concern," *Journal of Business Research*, 65, pp. 1254–1263, 2012.

[22] J. L. Meinhold, and A. J. Malkus, "Adolescent environmental behaviors: Can knowledge, attitudes, and self-efficacy make a difference?," *Environment and Behavior* vol. 37, pp. 511–532, 2005.

[23] R. M. Ryan, N. Weinstein, J. Bernstein, K. W. Brown, M. Louis, and M. Gagné, "Vitalizing effects of being outdoors and in nature, *Journal of Environmental Psychology*, vol. 30, pp. 159–168, 2010.

[24] H. Hungerford, and T. Volk, 1990. "Changing behavior through environmental education," *Journal of Environmental Education*, vol. 21, no. 3, pp. 8-21, 1990.

[25] R. M. Ryan, and E. L. Deci. "Self-determination theory and the facilitation of intrinsic motivation, social development, and wellbeing," *American Psychologist* vol. 55, pp. 68-78, 2000.

[26] E. L. Deci, and R. M. Ryan, *Intrinsic Motivation and Self-determination in Human Behavior.* New York, NY: Plenum Publishing Co, 1985.

[27] R. De Young, "Some psychological aspects of recycling: The structure of conservation satisfaction," *Environment and Behavior* vol. 18, pp. 435–449, 1986.

[28] R. Osbaldiston, and K. M. Sheldon, "Promoting internalized motivation for environmentally responsible behavior: A prospective study of environmental goals," *Journal of Environmental Psychology* vol. 23, no. 4, pp. 349-357, 2003.

[29] A. Kollmuss, and J. Agyeman, "Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior?," *Environmental Education Research*, vol.8, no.3, p*p. 239-260, 2002.*

[30] I. Ajzen, "The theory of planned behavior," *Organizational behavior and human decision processes* vol. 50, pp. 179-211, 1991.

[31] L. J. Trigg, D. Perlman, R. P. Perry, and M. P. Janisse, "Anti-pollution Behaviour: A function of perceived outcome and locus of control," *Environment and Behaviour* vol. 8, no. 2, pp. 307-309, 1976.

[32] R. B. Huebner, and M. W. Lipsey, "The relationship of three measures of locus of control to environmental activism," *Basic and Applied Social Psychology* vol. 2, no. 1,, pp. 45-48, 1981.

[33] J. M. Hines, H. R. Hungerford, and A. N. Tomera, "Analysis and synthesis of research on responsible environmental behaviour: A meta-analysis," *The Journal of Environmental Education* vol. 18, pp. 1-8, 1987.

[34] I. Ajzen, "Nature and Operation of Attitudes, *Annual Review of Psychology*, vol. 52, pp. 27-58, February 2001.

[35] A. Eagly, and S. Chaiken. *The Psychology of Attitudes.* Fort Worth, TX: Harcourt Brace Jovanovich, 1993.

[36] D. M. Randall and A. M. Gibson, "Ethical decision making in the medical profession: An application of the theory of planned behavior," *Journal of Business Ethics*, vol. 10, no. 2, pp 111-122, February 1991.

[37] J. Higham, and A. Carr, "Ecotourism visitor experiences in Aotearoa/New Zealand: Challenging the environmental values of visitors in pursuit of pro-environmental behaviour," *Journal of Sustainable Tourism* vol. 10, no. 4, pp. 277-294, 2002.

[38] P. C. Stern, "New environmental theories: toward a coherent theory of environmentally significant behavior," *Journal of Social Issues*, Vol. 56, NO. 3, pP. 407–424, Fall 2000,

[39] J. De Groot and L. Steg, "General Beliefs and the Theory of Planned Behavior: The Role of Environmental Concerns in the TPB," *Journal of Applied Social Psychology*, vol. 37, no. 8, pp. 1817–1836, August 2007.

[40] D. Parker, S. Manstead, and S. Stradling, "Extending the theory of planned behaviour: The role of the personal norm," *British Journal of Social Psychology*, 34, pp. 127–38, 1995.

[41] R. Richard, J. van der Pligt and N. de Vries, "Anticipated affective reactions and prevention of AIDS," *British Journal of Social Psychology*, vol. 34, no. 1, pp. 9–21, March 1995.

[42] R. Lawton, D. Parker, A. S. R. Manstead, S. G. Stradling, "The Role of Affect in Predicting Social Behaviors: The Case of Road Traffic Violations," Journal of Applied Social Psychology, vol. 27, no. 14, pp. 1258–1276, July 1997

[43] M. J. Kealy, M. Montgomery and J. F. Dovidio, "Reliability and predictive validity of contingent values: does the nature of the good matter?," *Journal of Environmental Economics and Management*, vol. 19, no. 3, pp. 244-263, 1990.

[44] C. Xiao, and D. Hong, "Gender differences in environmental behaviours in China," *Population, and Environment* vol. 32, no.1, pp. 88-104, 2010.

[45] A. Uitto, K. Juuti, J. Lavonen, R. Byman, and V. Meisalo, "Secondary school students' interests, attitudes and values concerning school science related to environmental issues in Finland," *Environmental Education Research* vol. 17, no. 2, pp. 167–186, 2011.

[46] L. Chawla, "Children's concern for the environment," *Children's Environment Quarterly* vol. 5, no. 3, pp. 13-20, 1988.

[47] F. X. Bogner, and M. Wiseman, "Environmental perception of rural and urban pupils," *Journal of Environmental Psychology*, vol. 17, no. 2, pp. 111-122, 1997.

[48] J. L. Berg, and J. Wehby, "Preteaching strategies to improve student learning in content area classes," *Intervention in School and Clinic*, vol. 49, 1, pp. 14-20, September 2013.

[49] K. D. Van Liere and R. E. Dunlap, "The Social Bases of Environmental Concern: A Review of Hypotheses, Explanations and Empirical Evidence," *Public Opinion Quarterly*, vol. 44, no. 2, pp. 181-197, 1980.

[50] G. D. Lowe, and T. K. Pinhey, "Rural-urban differences in support for environmental protection," *Rural Sociology*, vol. 47, no. 1, pp. 114-128, 1982.

[51] J. Aitchison, and S. Silvey, "The generalization of probit analysis to the case of multiple responses," *Biometrika*, vol. 44, 131-140, 1957.

[52] R. Zavoina, and W. McKelvey, "A statistical model for the analysis of ordinal level dependent variables," *Journal of Mathematical Sociology* vol. 4, pp. 103-120, 1975.

[53] A. Grob, "A Structural Model of Environmental Attitudes and Behaviour," *Journal of Environmental Psychology*, vol. 15, pp. 209-220, 1995.

[54] W. H. Lee, and G. Moscardo, "Understanding the impact of ecotourism resort experiences on tourist's environmental attitudes and behavioural intentions," *Journal of Sustainable Tourism*, vol. 13, no. 6, pp. 546-565, 2005.

[55] R. Osbaldiston, and K. M. Sheldon, "Promoting internalized motivation for environmentally responsible behavior: A prospective study of environmental goals," *Journal of Environmental Psychology*, vol. 23, no. 4, pp. 349-357, 2003.

[56] F. G. Kaiser, S. Wolfing, and U. Fuhrer, "Environmental attitude and ecological behaviour," *Journal of Environmental Psychology*, vol. 19, pp. 1-19, 1999.

[57] J. Nerb, and H. Spada, "Evaluation of environmental problems: A coherence model of cognition and emotion," *Cognition, and Emotion*, vol. 15, no. 4, pp. 521-551, 2001.

[58] L. Chawla and D. F. Cushing, "Education for strategic environmental behavior," Environmental Education Research, vol. 13, no. 4, 437-452, 2007.

[59] W. H. Greene, *Econometric Analysis*, 3rd ed. Upper Saddle River, NJ: Prentice Hall, 2003.

[60] J. C. Nunnally, 1967. *Psychometric Theory*, 1st ed. McGraw-Hill, New York, 1967.

[61] S. Barr, "Strategies for sustainability: Citizens and responsible environmental behaviour," *Area* vol. 35, no. 3, pp. 227-240, 2003.

[62] R. Gamba, and S. Oskamp, "Factors influencing community residents, Participation in commingled curbside recycling program," *Environment and Behavior* vol. 26, no. 5, pp. 587-612, 1994.

[63] J. Davies, "A test of multi-attribute models in the context of recycling behaviour," PhD dissertation, Keele University, 2001.

[64] R. Batra, A. Ahuvia, and R. Bagozzi, Brand love, *Journal of Marketing*, vol. 76, pp. 1–16, 2012.

[65] A. Wicker, "Attitude versus actions: The relationship of verbal and overt behaviour responses to attitude objects," *Social Issues* vol. 25, pp. 41–78, 1969.

[66] A. Böhler, S. Grischkat, S. Haustein, and M. Hunecke, "Encouraging environmentally sustainable holiday travel," *Transportation Research Part A*, vol. 40, pp. 652–670, 2006.

[67] M. L. De Natale and A. M. Klevay, "The Humanbecoming Connection: Nursing Students Find Meaning in the Teaching-Learning Processes, Nursing Qcience Quarterly, vol. 26, no. 2, pp. 125-129, 2013.

[68] P. W. Schultz, V. V. Gouveia, L. D. Cameron, G. Tankha, P. Schmuck, and M. Franěk, "Values and their relationship to environmental concern and conservation behavior," *Journal of Cross-Cultural Psychology*, vol. 36, no. 4, pp. 457-475, 2005.

[69] P. Gill, and R. Remedios, "How should researchers in Education operationalise on-task behaviours?," *Cambridge Journal of Education*, vol. 43, no. 2, pp. 199-222, 2013.

[70] J. M. Twenge, S. M. Campbell, B. J. Hoffman, and C. E. Lance, "Generational differences in work values: Leisure and extrinsic values increasing, social and intrinsic values decreasing," *Journal of Management*, vol. 36, no. 5, pp. 1117-1142, 2010.

[71] M. Villacorta, R. Koestner, and N. Lekes, "Further validation of the motivation towards the environment scale," *Environment and Behavior*, vol. 35, no. 4, pp. 486-505, 2003.

[72] V. Corral-Verdugo, R. B. Bechtel and B. Fraijo-Sing, "Environmental beliefs and water conservation: An empirical study," *Journal of Environmental Psychology*, vol. 23, no. 3, pp. 247-267. 2003.

[73] R. Mckeown, "Using rubrics to assess student knowledge related to sustainability a practitioner's view," *Journal of Education for Sustainable Development*, vol. 5, no. 1, pp. 61–74, 2011.

[74] M. Alberti, "Urban patterns and environmental performance: What do we know?," *Journal of Planning Education and Research*, vol. 19, pp. 151-163, 1999.

[75] J. Videras, A. L. Owen, E. Conover, and S. Wu, "The influence of social relationships on pro-environment behaviors," *Journal of Environmental Economics, and Management*, vol. 63, no. 1, pp. 35-50, 2012.

[76] G. Spaargaren, and A. P. J. Mol, "Sociology, environment and modernity: Ecological modernization as a theory of social change," *Society and Natural Resources*, vol. 5, no. 4, pp. 323-344, 1992.

[77] E. Gurel, L. Altinay, and R. Daniele, "Tourism students' entrepreneurial intentions," *Annals of Tourism Research*, vol. *37*, no. 3, pp. 646–669, 2010.

[78] K. Pillemer, N. M. Wells, L. P. Wagenet, R. H. Meador, and J. T. Parise, "Environmental sustainability in an aging society: A research agenda," *Journal of Aging and Health*, vol. 23, no. 3, pp. 433-453, 2011.

Towards an adaptive e-learning system based on individualized paths in a competency-based approach

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***Abstract*—** This paper presents our vision of an adaptive e-learning system based on individualized paths, in a Competency-Based Approach (CBA). First of all, we discuss student and competence modeling mechanisms, and then we present our proposal of an ontology-based representation, capable of defining the competency-based approach, reducing its misinterpretation, in order to open possible ways of its operationalization within an adaptive e-learning system.

***Keywords*—**Individualization, Ontology, Competency-Based Approach, Adaptation, Student modeling, Competency modeling.

I. Introduction

Nowadays, e-learning has seen significant advances taking advantage of the use of information technology and communication (ICT) as well as the progress achieved in the education and training area. Yet, e-learning systems still encounter several problems when compared to traditional face to face learning, due to absence or lack of individualized support that match with each case of leaner. Recently, various researches has been conducted around the adaptation of learning and new types of adaptive e-learning systems are emerging and aim to fit the growing need for individualization based on the characteristics of each learner. A glaring fact: since learners proceed with different rhythms, abilities, prerequisites, motivations, it's important to take into account the profile of the learner, and its progress to adapt constantly its learning path and to assist the learner step by step in the acquisition of a competence.

The main sight of this article is to propose an adaptive e-learning system based on individualized paths in a competency-based approach in which we plan to implement individual and collaborative learning. (1)Individual learning to let each learner progresses along an optimal path, taking into consideration its characteristics, and (2) collaborative learning to develop cooperation and communication skills, each student belongs to a group of learners whom some characteristics are shared. However, in order to conceive this system, we must consider some several questions: (1) how to adapt the learning path to the specificities of each learner (experiences, skills, prerequisites, rhythms)? (2) How to combine between individual and collaborative learning environment? (3) How to subdivide tutor's activity into tracking, monitoring and assisting learners. (4) Finally, how to increase learner autonomy, its engagement and responsibility in an online e-learning system?

The remainder of this paper is organized as follows: in section II, we present our research highlights. In section III, we define the adaptation of learning in a competency-based approach, in which (1) some competency definition, (2) commonly student and competency modeling methods are discussed; also (3) our ontology-based representation is shown. In section IV, we describe our vision of an adaptive e-learning system. Section V aims to synthesize our work so far. Finally, we draw some conclusions and present new lines of future work.

II. Research highlights

Taking individualized paths is worthwhile for learners so they can progress according to their educational needs while supporting their interest and motivation [1]. Furthermore, standards learning paths can rarely be optimal for all kind of learners. For these reasons, adaptive e-learning systems aim to propose a specific path for each learner, this led to the idea of static, or dynamic learning paths [10]. Static learning paths are used for limited adaptations, dynamic ones for deep individualizations. Still, the individualization supposes a good comprehension of the learner and its performances, compared to a referential [2]. This made of student modeling, and evaluating a priority of our work. We believe that a clear representation of the learner and its level is the way to develop an adaptive e-learning system, capable of understanding its needs and supporting him/her throughout his/her activities. We suppose also that an optimal learning path for a learner is not necessarily for another. Moreover, collaborative learning is essential. Communication skills, sharing efforts to solve problems, increase the learner motivation, engagement and autonomy [19] as wells as some skills can only be developed through a collaborative learning. So, the problem is how to classify or categorize learners in homogeneous groups to receive appropriate learning, combining both individualized and collaborative learning?

We consider that a placement test is important for the initialization of the learner path, which should be refined as possible as the learner progresses, based on its actions, evaluations, results, traces, etc. In this sense, the aim of our work is to (1) conceive standard paths for groups of learners (2) initialize the learner profile and its path with an evaluation

of its competences (3) assign the learner to an optimal group according to the results of the evaluation (4) individualize the learner path within a group according to its progress, prerequisites and preferences in order to acquire a competence.

III. ADAPTATION OF LEARNING IN A COMPETENCY-BASED APPROACH

At present, there is a whole branch of literature that focuses on the notion of competence, which led to various definitions and different approaches. First of all, we try to give a definition to a competence, we make also a difference between competency-based approach and goal-based approach, and then we expose some considerable research work about student and competency modeling. Afterwards, we present our ontology-based representation to cover the competency-based approach.

A. Competency-Based Approach (CBA)

A competence is linked to knowledge because ultimately a competence mobilizes a set of knowledge [7]. It implies that a student can acquire knowledge and skills but can't implement them, in a timely manner and in a specific situation that requires the mobilization of a learned skill. The competence is abstract, broader and intellectual [2]. It's manifested through an action and not invented immediately [6]. In this line of thought, developing a competence is developing a collection of abilities like (1) Learning to know: general knowledge or related to a particular environment (2) Learning to do: operational, relational and cognitive (3) Learning to be: personal qualities. Aggregate them in view of mobilization in a specific context. Boterf[6] perceives competence as a result of combination of (1) knowing how to act: in order to be capable of implementing knowledge, calling for adequate resources in response to a given situation or problem. (2) Wanting to act: to ensure that the person is motivated (3) Being able to act because a competence can only come out in a situation within conditions. Paquette Gilbert [9], defines a competence as association of knowledge and abilities which assure their treatment. Bissonnette and Mario Richard [5] make the difference between, cross-disciplinary competences relative to a discipline and transversal competences such as attitudes, critical thinking, and creativity. Le Boterf distinguishes between individual or collective competences. And Iribarne [20] between Imitation competence as the capacity to repeat learned actions in an automatic way, transposition competence to repeat actions in new contexts and situations, and innovation competence to propose new solutions and concepts based on developed knowledge and skills. Each of these definitions depends on the field it is related to.

B. Competency-Based Approach versus Goal-Based Approach

The competency-Based Approach and the Goal Based Approach are two commons ways to structure and organize pedagogical activities. A goal describes an expected result, the purpose of training, and not the process to achieve it [11]. Therefore, a Goal-based approach aims to describe observable behaviors in terms of achievements and specifies the desired performance. The knowledge acquired through such an approach does not allow the learner to reuse it in other contexts and situations, because the definition of goals under specific conditions limits the learner to particular learning situations. In this case, the competency-based approach is useful so the learner can mobilize the set of knowledge that he has acquired in new situations and in various contexts. For assessments too: the Goal-Based Approach aims to limit learner assessment to the final result compared to the fixed goal. However, the Competency-Based Approach focuses on the learning process, during which the learner is constantly evaluated, to measure the gap between the level of target performance and the current one [2].

We have chosen the first approach which is the Competency-Based Approach for its advantages like acquisition, mobilization and transposition of knowledge in new situations; it's also based on learning process which we plan to use in the learner path to adjust its activities towards the desired competence.

C. Competency modeling approaches

To design a competence, we propose two models that seem to complete each other: The first of Paquette, G [9] and the second of Elena, G[6]. We present each of these models apart to introduce later our proposal of competence modeling.

1) Paquette Gilbert's competency modeling [9]

Paquette, G [9] proposes an approach of modeling competence relying on three basic elements: (l) knowledge, (2) ability, and (3) performance [9][2].The following table [Table 1] illustrates the concept of ability, knowledge and performance according to Paquette, G[9].

Ability	Knowledge	Performance
Receive: pay attention, remember, identify, locate	Concept	Frequency: On occasion, steadily
Reproduce: Apply (Simulate, use), transpose, translate, instantiate, specify.	Procedure	Cover: partial total individual, collaborative
Produce: analyze (deduct, classify, predict, diagnose), repair, synthesize (induce, plan, design)	Principle	Autonomy: with assistance / without help
Self-management: assess, self-discipline, (influence, initiate, adapt, control)	Fact	Complexity: low, medium, high
Example of competence: Synthesize - the concept of communication - without help.		Context : familiar, new

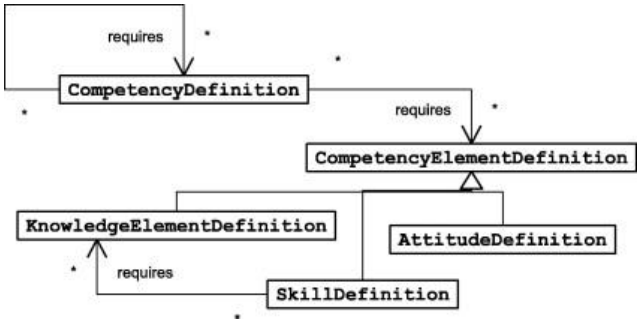
Table 1: Paquette Gilbert's Competency modeling [9]

Paquette , G[9] defines a competence as the association of knowledge and abilities,(1) knowledge may be concepts, procedures, principles or fact (observations, data, and traces) (2) ability describes the processes that can be applied to domain knowledge and (3) the performance describes some

characteristics like the frequency, type of overlay, degree of autonomy, degree of complexity and context. So, in order to acquire a competence, the learner has to acquire a set of abilities determined by a level of performance.

2) Elena's competency modeling

For Elena G [6], competence modeling requires a detailed description. This leads to the concept of competency definition and decomposition. Her conception of the competence is based on UML (Unified Modeling Language).
The following figure [Figure 1] illustrates Elena's competency modeling [6]



[figure1]: Elena's competency modeling

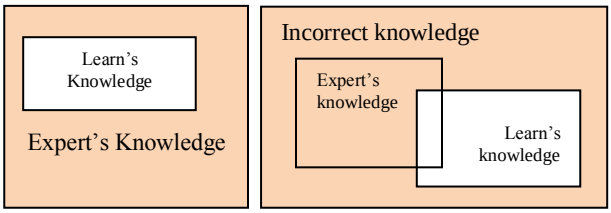
- All the characteristics of a competency must be defined: (1) Knowledge Elements, (2) Skills (3) Attitudes.
- A competence may require the acquisition of other competences. For example, programming skills requires skills in algorithms.
- When a competence requires the mastery of more than a competence. It can be divided to several competency elements.

D. Learner modeling in a spirit of Competency-Based-Approach

An adaptive system is designed to provide learning paths which can be adapted to each learner. This illustrates the need for an approach to learner modeling, essential and effective for designing individualized activities. In order to establish a complete model, we must identify learner characteristics which the system must adapt. The model of the learner is one of the links required that guides instructional decisions, it can be defined as a process of gathering relevant information to infer the current state of the learner. The representation of the learner has to be understandable and accessible by the system [12]. In this stage, we must consider an important question about learner modeling which is: what are the characteristics of the learner that should be represented? According to [13] the characteristics of a learner can take 3 forms: (1) static, such as name, age, address and that are identifiable at the beginning of a learning path, (2) dynamic information extracted from the learner interaction with the system (3) or information relative to domain knowledge or a context. In this sense, the major challenge is to define the dynamic characteristics that are the basis of any adaptation, for example the level of current knowledge and skills, errors and problems, learning styles, etc.

1) Common learner modeling methods

One of the common methods for learner modeling is to identify, in domain knowledge what he knows from what he does not know. The overlay model aims to assess the state of knowledge and skills of a learner to fill the gap. In this purpose, the overlay model compares the learner state of knowledge to a simulated expert.
The overlay model measures the level of knowledge using Boolean measures (yes, no | 0.1), qualitative measures (good, medium, low) or quantitative as the probability of knowing a concept. However, this method is essentially based on the granularity of domain knowledge and does not support learners' errors. It considers that an error is the result of strategic choices and not caused by the learner, and can't explain the behavior of the learner.
The buggy model (b) complete the recovery model, it use the most frequently encountered errors considered as mal-knowledge or incorrect beliefs. Which require a remedial strategy. However, only errors or bugs do not help to determine which types of interventions should be done.
The following figure [Figure 2] illustrates the overlay model (a) and the overlay buggy model (b).

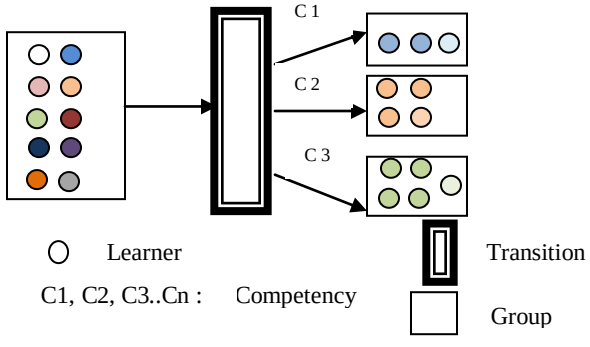


(a)Overlay learner model (b) Overlay Buggy learner model

[figure2]: overlay model

2) Stereotypes

The primary concept of using stereotypes is to gather learners who share the same characteristics in a group. In this modeling approach a group contains learners with common skills and knowledge. as illustrated in the figure [figure3],

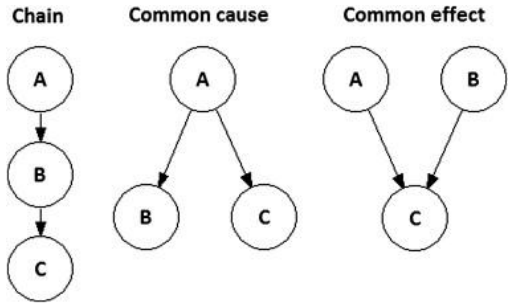


[figure3]: Stereotypes model

Stereotypes are often the solution to the problem of initialization of the learner model, by assigning the learner to an appropriate group and refining its path according to its progresses.

3) Bayesian networks

Bayesian networks [14][15][16] are directed acyclic graphs (DAG) whom nodes represent random variables, and whom structure reflects the conditional dependencies between variables. The figure below [Figure 4] shows an example



[figure4]: Bayesian networks examples

The information shown in these graphs facilitates the sequence of actions to take A, B or C [16] the orientation of the arcs is related to the flow of information in the network [15]. The Bayesians networks can be used to conceive learning activities.

E. Our proposition of an ontology based-representation for the competency based approach

Ontologies are general representations of a domain comprehension mainly based on knowledge extraction [17] which can be easily manipulated by the computer and interpreted by humans. As part of our research, we opted for an ontology-based representation (concepts, properties, relations) in order to (1) identify the complexity of competency-based approach, (2) reduce the terminological confusion that applies (3) provide a shared formalism (4) Ensure interoperability and reusability among actors and between systems.

In what follows, we present our proposal of ontology for the competency-based approach. This ontology aims to complete the one previously proposed by our team [16][18] but it is extended to allow us to extract the outline of our adaptive learning system.

In order to propose an ontology-based representation for the competency-based approach, we have synthesized our domain comprehension in a textual form as follows, while Figure [Figure 5] will give a graphical representation of it:

- A learning situation is the central node of a competency-based approach, and requires mobilization of different resources in a context with an overlay and requires assessments [4].
- A learning situation is also a set of activities in a given context (which can be familiar or new). Example of learning situations: exploration, research, simulation or teaching situation.
- A learning activity uses contents with objectives; contents are grouped into disciplines [14].
- An activity generates traces that could be exploited to generate individualized learning paths, and often used to update the learner profile
- An assessment identifies the current level of a learner.
- A situation overlay depends on chosen learning modalities: individual or collaborative work, it can also be partial or total, with or without assistance.
- A learning situation requires the mobilization of resources of various kinds:(1) External resources which can be human, material or temporal (2) Contextual resources which depend on the context (3) Educational resources that can be, for example, courses, exercises, demonstrations or problems to solve. (4) Internal resources to represent learner abilities, preferences, experiences and intelligence degree.
- In a learning situation, mobilization has performance and frequency which measure learner ability of reproduction, transposition or innovation. Reproduction to reproduce or repeat actions in an automatic way, transposing to mobilize an acquired skill in an appropriate context, and innovation to propose a new solution by using the knowledge and skills developed.
- A mobilization requires a set of knowledge related to a domain: general knowledge, expertise, skills.
- Knowledge can take 4 forms: General knowledge, learn to know, learn to do, and learn to be.
- Knowledge must have a structure for better interpretation, storage, handling and interoperability in e-Learning system.
- A learner progresses in a learning path individually or collaboratively, can join a group and/or participates to a project.
- The trajectory of a learner is a series of learning activities. It can be static or dynamic.
- A competence may require the acquisition of other competences.
- A competence can be transversal or cross-disciplinary.
- Ability is the capacity to reproduce, transpose or innovate.
- A trace is used to feed the learner profile; it is also the result of a learner assessment.
- Etc.

Our ontology can be used as the core of any production in the domain of competences-based approach; in fact this ontology should reduce or even eliminate the conceptual and terminological confusion and ensure a shared understanding to adopt this approach effectively. It also presents our conception of the environment of our future adaptive e-learning system.

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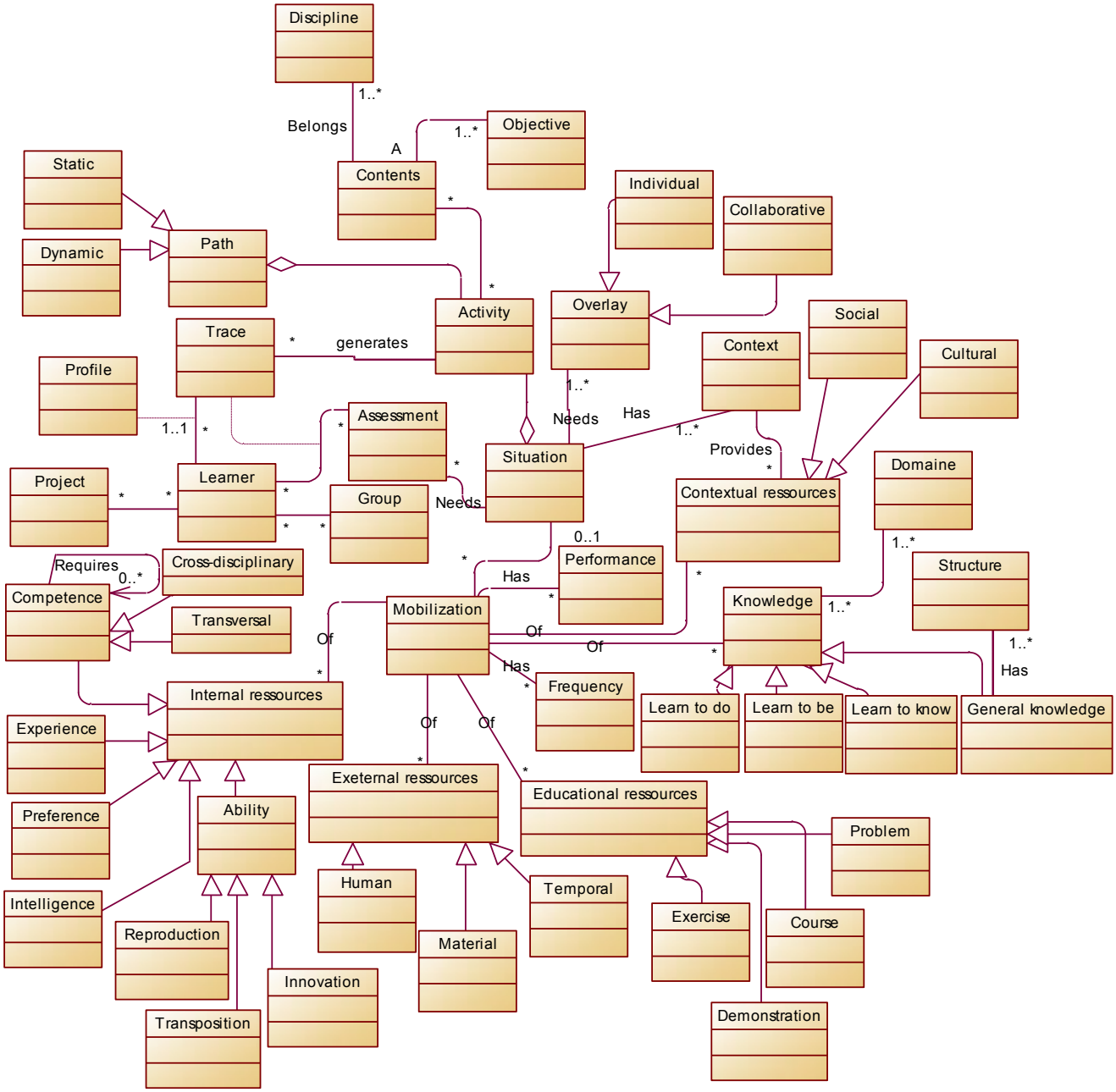

[Figure 5]: Our Ontology-Based Representation for the Competency-Based Approach

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IV. Towards an adaptive e-learning system based on individualized paths in a competency-based approach

A. Adaptation, individualization and personalization

The suffix "tion" in adaptation, individualization and personalization expresses an "action or the result of an action" [8]. In one hand, individualization and personalization are relative to an individual or a person, while the adaptation reflects the action "to adapt or adjust something» regardless the person characteristics or preferences [8]. From this, we can say that the adaptation takes often the form of individualization or personalization. The individualization can be associated to one or more learner, while personalization is directly focused on one and only one learner. For example, an individualized learning path involves only one learner but designed to be used for other learners at the same time but a personalization can cover a single case of learner at a single time and can't be used for another learner.

B. System presentation

We propose an adaptive e-learning system in which the learner can acquire a competence via multiple ways: we plan to conceive a set of optimal and standard paths for groups of learners (classes) (1) Beginner (2) Elementary, (3) Intermediate, (4) Advanced, (5) Very advanced. From theses paths the system would choose the optimal one based on the evaluation of the learner, the paths will be refined as the learner progresses based on actions, evaluations, results, traces. according to (1) its prerequisites: previously measured at the entrance of the system, (2) its current level periodically compared to the competence it should acquire and oriented towards the next learning step forward.

1) Positioning test step:

Check up the learner pre-requisites. For example, in the medical field, a treatment will have no effect in the absence of a relevant diagnosis [3]. In education, individualized paths will have no effect in the absence of assessments, to put the learner in a most appropriate activity relative to its current level.

2) Adaptation step:

From an initial path, the adaptive learning system must orchestrate learner activities in order to achieve the desired competence. In this sense, we distinguish two learner situations:

(1) Learners in the same group whom learning trajectories are progressively adapted.

(2) Learners whose competence level allows them to join other groups, weaker or advanced; we call it migration to a suitable group.

3) *Summative evaluation step:*

Optional step for understanding the learner advancement in the acquisition of a competence.

C. System Goal

(1) Achieve a competence by using a fast and optimal path regardless others learner rhythm.

(2) Combine in a same approach a collaborative and individual learning.

(3) Develop models of learners with common characteristic in order to gather them in a group. It is easier for a teacher to supervise small groups than each learner.

(4) Maximize learner satisfaction by avoiding non-required activities to achieve a competence and minimizing training time.

V. Discussions

We divided our work into two main parts: the first discuss the learner and competence modeling and the second presents our perception of an adaptive e-Learning system. In the first part of this paper, we have asked the following question: how to design a learner and its competences in the spirit of the competency-based approach? And how to design the learner to facilitate the generation of individualized paths? First of all, the methods previously shown do not take into account the internal resources of the learner. However, to individualize the learning path, learner capacities, characteristics and the context are crucial. That's why we have combined in the same representation (1) the characteristics of the learner, static ones as general information (2) dynamic ones as information extracted from the learner and the system interaction, and (3) characteristics related to a domain such as knowledge, skills, or context [13]. We believe that our ontology-based presentation contains the important elements of the competency-based approach as well as the principle of individualization and will form the basis of our adaptive e-learning system.

The second part of this paper, defines the aim of our future system, in which the learner can acquire a competence individually, taking into account its needs, but also in the context of a homogeneous group: as the individual learning is not enough: the course adapts the learner path without isolating him of a group.

VI. Conclusion

In this paper, we have discussed the competency-based approach and the concept of individualization; we have chosen to reduce its complexity through an ontology, which represents the learner as central element, the competence as the result of the e-learning system and the individualized path as a means to achieve it. In the future, we will focus on the assessment of the learner because there is no competence without assessments, in order to put the learner into the most adequate path.

References

[1] Marie Lefevre, Julien Broisin, Valentin Butoianu, Philippe Daubias, Lucie Daubigney, Françoise Greffier, Nathalie Guin, Stéphanie Jean-Daubias , Réjane Monod-Ansaldi , Hélène Terrat, Personalization of learning: A comparison of requirements and approaches through the study of some devices, STICEF, Volume 19, 2012, ISSN : 1764-7223, posted 21/10/2012, http://sticef.org (official language is French).

[2] El Falaki B., Khalidi Idrissi M., Bennani S. Formative assessment in e-Learning : an approach to personalize diagnosis and adapt learning path, IADIS e-Society 2010 (ES 2010) Porto, Portugal, ISBN 978-972-8939-07.

[3] In L. Allal, D. Bain, Ph. Perrenoud, Formative assessment and learning French, Neuchâtel and Paris, Delachaux and Niestlé, pp. 31-50. Reprinted in Perrenoud, Ph., the evaluation of students. From the manufacturing excellence to the regulation of learning, Bruxelles, De Boeck, 1998, chapter 6. (Official language is French).

[4] M.A. Delgado, M.C. Fonseca-Mora, The use of co-operative work and rubrics to develop competences, Education for Chemical Engineers, Volume 5, Issue 3, August 2010, Pages e33-e39, ISSN 1749-7728, http://dx.doi.org/10.1016/j.ece.2010.05.002.

[5] Mario Richard, Steve Bissonnette, How to build classroom skills: tools for reform, Montréal, Chenelière/McGraw-Hill, 2001. (Official language is French).

[6] Elena García-Barriocanal, Miguel-Angel Sicilia, Salvador Sánchez-Alonso, Computing with competencies: Modeling organizational capacities, Expert Systems with Applications, Volume 39, Issue 16, 15 November 2012, Pages 12310-12318, ISSN 0957-4174, http://dx.doi.org/10.1016/j.eswa.2012.02.194.

[7] Perrenoud, Ph. (1998). Building competencies, is it turning its back on knowledge? Monthly review valaisanne: Knowledge and competencies, issue 3, November, pp. 3-7 [1998_34]. (Official language is French).

[8] Eugénie DUTHOIT, Stéphanie MAILLES-VIARD METZ, Chrysta PELISSIER, Aid process in learning context: an adaptation to individualize and personalize, STICEF, Volume 19, 2012, ISSN : 1764-7223, posted14/11/2012, (Official language is French).

[9] Paquette, Gilbert, Pedagogical engineering: to build networked learning, Learning Technologies, ISBN 2-7605-1162-6,1942 (Official language is French).

[10] Najlaa Zniber, Corine Cauvet, Pedagogical adaptive systems: state of the art and Perspectives, University of Paul Cesanne Aix-Marseille3, 2011 (Official language is French).

[11] Diem-Quyen NGUYEN1,Jean-Guy BLAIS2, Objective-Based or Competence-Based Approach: Conceptual Frameworks and Implications for Teaching and Learning Activities and Assessment During Clinical Training, Medical pedagogy 8 (4) 232-251 (2007). DOI: http://dx.doi.org/10.1051/pmed:2007026

[12] Konstantina Chrysa fiadi, Maria Virvou, Student modeling approaches: A literature review for the last decade, Expert Systems with Applications, Volume 40, Issue 11, 1 September 2013, Pages 4715-4729, ISSN 0957-4174, DOI:http://dx.doi.org/10.1016/j.eswa.2013.02.007.

[13] Guangbing Yang; Kinshuk; Graf, S., A practical student model for a location-aware and context-sensitive Personalized Adaptive Learning System, Technology for Education (T4E), 2010 International Conference on , vol., no., pp.130,133, 1-3 July 2010.doi: 10.1109/T4E.2010.5550048.

[14] PEARL, J., Probabilistic Reasoning in Intelligent System, Morgan Kaufmann, 1988.

[15] Eva Millán, Tomasz Loboda, Jose Luis Pérez-de-la-Cruz, Bayesian networks for student model engineering, Computers & Education, Volume 55, Issue 4, December 2010, Pages 1663-1683, ISSN 0360-1315, DOI:http://dx.doi.org/10.1016/j.compedu.2010.07.010.

[16] M. Khalidi Idrissi, S. Bennani, A. Hachmoud ,An Ontology for the formalization on the competencies-Based approach, V International conference on multimedia and ICT in Education (m-ICTE2009), Lisbon (Portugal), 22-24 April 2009.

[17] M. Khalidi Idrissi, S. Bennani, A. Hachmoud, The Educational system and the competencies-Based approach: towards a formalization of the approach, IADIS International conference IADIS e-learning 2009, Volume V II,2, pp 265-268, ISBN 978-972-8924-83-6, 17-20 June 2009, Algarve, Portugal.

[18] Adil Hachmoud, Mohamed Khalidi Idrissi, Samir Bennani, competency ontology based representation: between the constraints of the operationalization and implementation perspectives, WOTIC 2009, AGADIR, MOROCCO, 24-25 December 2009, ISBN : 978-9981-0-2625-5 (Official language is French).

[19] Vandana Singh, Lila Holt, Learning and best practices for learning in open-source software communities, Computers & Education, Volume 63, April 2013, pp. 98-108.

[20] Sellenet, Catherine, A critical approach of the concept of parental competences, The international journal of family education 2 (2010),pp. 95-116. DOI: 10.3917/rief.026.0095(Official language is French).

Next Generation of Internet Collaborative Environments

Matija Pipan, Dušan Gabrijelčič and Julija Lapuh Bele

***Abstract*—**Next generation of Internet collaborative environments are described as multi service platforms linked with other external e-Infrastructures and applications, such as Service clouds, Learning Management Systems (LMSs), Data repositories, P2P distribution, Social networking, Authoring tools etc., which support synchronous and asynchronous cross domain collaboration. The design and development of such environments implies multiple technical challenges related to the problems of efficient human-centric collaboration, adequate security and privacy of users and the use of services, interoperability of included infrastructures, optimal storing and distribution of large amounts of data, interoperability with different technologies (e.g. mobile technologies), etc.

***Keywords*—**Collaboration environment, Content Delivery, Educational Technologies, Future Internet, On-line Communication, Privacy and Security, Skills and Competences.

I. Introduction

THE Internet, electronic mail, and the Web have revolutionized the way we communicate and collaborate - their mass adoption is one of the major technological success stories of the 20th century. The field of networking is facing a qualitatively different problem, information overload, that necessitates smarter and more fine-grained computer support user-centered and with high quality regarding the human factors demand in communicating and exchanging the networked information.

Different pieces needs to interact and provide the necessary collaborative services based on new design based on the architecture for the next generation future internet. According to the 2020 Collaborative Working Environments (Vision CWE2020) [15] this way of working will be based on collaborative systems that include both the general collaborative infrastructures and specific applications for supporting the requirements for human-centric applications and services [6]. The collaborative infrastructures will be based on seamlessly integrated context-aware flexible support for distributed collaboration among individuals and will provide service-oriented reference models for massive collaboration. Pro-active support for pervasive human collaboration within their own communities and with other virtual communities is one of the goals to be pursuit. Collaborative infrastructure consist of system components that comply with the Service Oriented Architectures (SOA) allowing specific applications for group-driven composition of systems for provision of synchronous and asynchronous teamwork freeing users from routine and enabling the focus to be on creativity [19].

In accordance with the Vision of CWE2020 next generation collaborative environments/platforms are expected to increase the effectiveness of the service in both directions: horizontally among individuals and within communities and vertically among communities and different infrastructures. In that direction, several requirements and research challenges are indicated:

- Service composition and integration where the collaborative functions are offered as services (generic services, domain-specific services and context-specific services) either to the user or to the application developer.
- Incorporation of existing Web 2.0/3.0 social network platforms and collaborative tools (e.g. authoring tools, tagging, ranking, ontology, wikis, blogging etc.).
- Integration between synchronous & asynchronous cross domain communication / collaboration.
- Proactive collaboration aware artifacts and objects needed to transform static data so that the entire life cycle of shared artifacts is also a property to be supported.
- Since context information can be aggregated from many sources, it is a challenge to build a highly distributed context management environment in the paradigm of the Future Internet, where all relevant sources are taken into account.
- Building scalable collaborative working environments includes a multitude of architectural approaches that should be taken in account e.g. P2P, Cloud computing etc.
- Collaborative services need to be instantiated on a multitude of devices ranging from desktops to mobile devices such as lightweight Smartphones and PDAs. This challenges development of proper user interface accommodated to the

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new device and equipped with required applicable security and privacy mechanisms.

II. Research Problems

According to directives addressed in the Vision CWE2020 in the process of design and development of Next generation collaboration environments is faced with several research problems, which have not been yet adequately elaborated. For that reason we plan in the framework of the development of collaboration platform to focus on few of them as follows:

- Lack of interoperability of higher level services in existing collaborating platform with focus on systems for e-learning. Here main problems are related to enabling access, quality control and filtering of the open content from many sources integrated in the collaborative service and the related functionalities that depend from the platform and the system used
- Lack of functionality for searching regarding the user skills and competency needs, which becomes crucial for obtaining the most appropriate content. The research here is oriented into development of effective skill-based federated tools that allows search, access, re-use and recommendation of content (User-generated and user-improved content) to meet target competencies.
- Lack of usable security and privacy services and mechanisms in the services enabling collaborative environments. A number of issues in that area have not been completely solved yet; including for example protection of users' sensitive personal data in social communities, seamless access to resources in heterogeneous collaborative environment, access control to certain types of content in P2P based content delivery systems, and usable authentication mechanisms for mobile users of collaborative platforms.
- Lack of effective content distribution. In the context of collaboration among the individuals/communities that generate large amounts of multimedia content (e.g. video conferencing records, video/audio/text based documents) the problem of effective distribution of content to end users still has no proper and adequate solution.

III. State-Of-The-Art

A. Integration (integrative platform)

Web services have bestowed newfound importance on Service-Oriented Architectures (SOA) by providing a standard-based approach to interoperability between applications. SOA provides a set of principles, patterns and practices to provide and consume services which are orchestrated to realize an agile infrastructure, being able to support a pluggable service infrastructure where providers, consumers, and middleware services can collaborate in the famous 'Publish -- Find -- Bind' triangle [4]. The requirements to provide an appropriately capable and manageable integration infrastructure for new Future Internet designed services are coalescing into the concept known as the Enterprise Service Bus (ESB). There are two key ideas behind this approach [5, 12]: loosely couple the systems taking part in the integration and break up the integration logic into distinct easily manageable pieces. The Enterprise Service Bus is an open standard based message backbone designed to enable the implementation, deployment, and management of these solutions based on SOA (Service Oriented Architecture). An ESB is a set of infrastructure capabilities implemented by middleware technology that enable an SOA and alleviate disparity problems between applications running on heterogeneous platforms and using diverse data formats. It supports service, message, and event-based interactions with appropriate service levels and manageability [19].

Major research challenges recognized as being beyond State of the Art are related to: Dynamic connectivity capabilities, Topic and content-based routing capabilities, Enhanced service discovery, End-to-end security solutions, etc.

B. Content delivery and distribution

One of the most successful multimedia content distribution methods in the last decade are based on P2P technologies. The technologies have been developed through number or generations, enriching their features and pushing scalability, robustness and dependability to the limits. P2P technologies present a natural content distribution technology that could effectively support future Internet collaborative working environments.

The prevalent P2P technology today is based on BitTorrent protocol [22]. The reason for this is its orientation towards effective and scalable data transfer of a single data unit (file) or collection of units. Additional features were added for effective distribution in the past, like DHT, PEX and the others. Users can utilize the protocol with one of numerous BitTorrent clients. Current development trends in advanced BitTorrent clients like µTorrent, Azureus, Miro and Tribler, are oriented towards extending basic client functionality. Content search, rating and presentation are main features being developed. The integration of the P2P transport and presentation within a browser [3] (support for Wikipedia multimedia content distribution) and rich metadata and limited interactivity enable contribute to unified content distribution. While efficient content distribution is of crucial importance it is even more obvious that the user friendly and tailored consumption of the content should not be neglected. Content delivery networks based on this technical paradigm will be used in the integrated collaborative platform which implementation is described in the Work Program of this proposal.

C. Skill-based content search

Abundance of digital content puts a user in front of the problem of making the "right" choices from an expansive list when searching for content either for information, entertainment or e-learning and training. Finding the relevant resources remains an issue, because searching for example of learning content is based on keywords and metadata that often

reflect a technical cataloguing perspective, rather than the needs of the users. Personalized skill and competence-based search promises to improve this situation. There are several reasons why skill and competence-based content search is almost inexistent today: skill and competence related data structures (e.g. IEEE Reusable Competency Definitions standard or HR-XML) do not support semantic relations; ontologies for skills and competences are missing, as well as extensions in learning opportunities standards (e.g. in CEN Metadata for Learning Opportunities specification [14]) for associating structured skills and competencies to learning opportunities; and quality of content metadata is low.

When developing a technical infrastructure that enables skill and competence-based services, such as federated search, we will base our work on the recently finished ICOPER [8] and OpenScout [17] projects from the EU eContentplus programme.

D. Security and usability-based service

- Graphical passwords-based authentication.

  Research and practice in the past years have shown that security problems that arise because of low level acceptance of the end user can be solved only by considering the usability perspective of the user. In an attempt to create more memorable authentication mechanisms, several approaches based on graphical and image password have been devised where the authentication is based on image clicking as opposed to typing character based passwords. In general, two types of mechanisms exist for graphical authentication: recognition-based and recall-based. In recognition-based ones, a user is authenticated by challenging him/her to identify one or more images he or she chooses during the registration stage. Examples of such system are Passfaces, developed by the Real User Corporation [20], and the PassPoint system [21]. In recall-based techniques, a user is asked to reproduce something that he or she created or selected earlier during the registration stage. Examples of recall-based systems can be found in [11].

- Content access control

  As the collaborative platform of the Next generation is based mainly on the infrastructure that uses P2P way of communication the problem of content protection of the content offered via the collaborative platform requires some basic solution [18]. The importance of security and the main security requirements for the emerging infrastructures in the Future Internet content delivery networks has already been emphasized, for example in [7]. According to access control on the content being shared can be achieved either directly or indirectly by: a) directly protecting the content; b) restricting the access in the network where the content is being delivered; or c) restricting the access to the peer that possesses the content. Zhang et al propose a mechanism that can be considered as digital rights management (DRM) mechanism for BitTorrent [22]. Another mechanism for access control on data that utilizes encryption is described in [9]. In this scheme, all peers that are involved in the content delivery process receive content encrypted with a same key for all peers. One form of providing access control on the P2P network itself is by using private tracker, as specified in a BitTorrent protocol's extension. An access control mechanism on each peer enables the peers to recognize the authorized peers and to avoid communication with the non-authorized ones. Such mechanism for a BitTorrent P2P network, called Closed Swarms protocol, is presented by Borch et al. [3].

IV. Development of the Collaboration Platform

A. Design through use cases

The collaboration platform has been designed based on use cases typical for business and educational environments. A number of use cases has been thoroughly studied like a meeting, lecture, consultations, seminar, discussion room, lectures recording, tutoring, etc. The most general the meeting use case is further described below.

Mrs. Ann leads a project working group. The group is responsible for few forthcoming project tasks. To synchronize and ensure smooth continuation of the work she decides to organize a meeting. She studies the tasks, prepares agenda proposal, carefully pick the meeting participants and collects all relevant information and documents related to the tasks. She selects the meeting place and the time of the meeting. From her experience the meetings are most effective when their duration is limited. If someone couldn't join the meeting the materials collected and the meeting recordings will be available. The agenda and materials prepared have been made available to the participant for review and possible comments or additions.

During the meeting some additional documents have been discussed clarifying the participants' views on the tasks. One of the tasks had considerable uncertainties related to its plan execution. Additional expert has been invited to the meeting to clarify possible outcomes and related risks. Due to limited meeting duration needed actions and their expected outcomes has been quickly agreed and decided.

After the meeting Mrs. Ann has collected all additional documents and recordings, prepared minutes and made them available to the group. She tagged and provided notes to the materials so the work and knowledge generated through their collaboration will be easier to follow, find and reuse.

Through the use case analysis a number of functional and other requirements were collected. Every use case has brought in new aspects, functional and non-functional, additional actors or stakeholders to make the requirements broader but more precise as well.

Basic requirements led to a number of collaboration platform building blocks fulfilling the requirements excerpted from the use cases. Example of such building blocks are synchronous multimedia communication, shared white-board and screen, chat, bulletin boards and forums, meeting minutes capture, event recordings, voting and other govern tools, collaborative on-line space with dedicated storage, calendar,

publishing and word processing capabilities, aim oriented annotation and search and scalable content distribution system. But there is a number of nonfunctional requirements as well, related to security, privacy, usability, scalability and performance. In particular security has been recognized as crucial for business oriented collaboration platform usage. Various security services needs to be provided from authentication, confidentiality to access control. In addition individual stakeholders have specific requirements related to the building blocks implementation, licensing, deployment capabilities and management which need to be taken into account.

B. Conceptual plan and implementation

There are number of different platforms, systems and services that implement a part, whole or a number of the building blocks discussed in Section II. They are often unconnected and do not present the expected functionality of the target collaborative platform as a whole. Nonfunctional and other specific requirements are often not taken into account.

A conceptual collaborative platform plan that takes into the account mentioned requirements is presented in Figure 1. In the center of the system is a user that uses a number of available and (in the project) designed and implemented systems to achieve his collaboration goals.

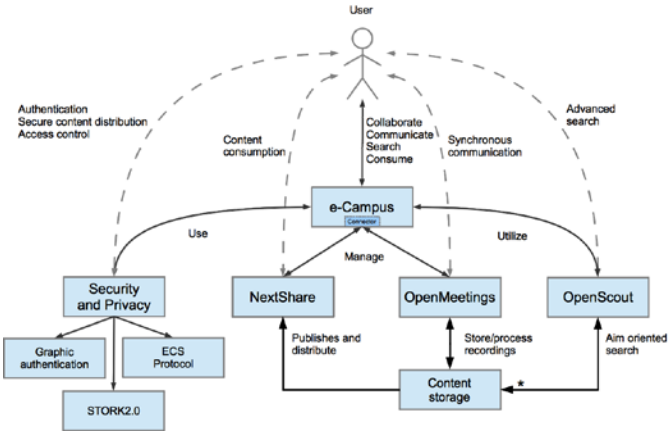

Figure 1. Figure 1.Collaboration platform conceptual plan

The system focal point is eCampus [6], a learning management system (LMS) acting as a single user interface for collaboration. Mrs. Ann can easily create a 'place' for the meeting, add meeting materials, prepare the agenda, select system internal and external users for participation and schedule the meeting according through system calendar facilities. An example screen-shot of such functionality is shown in Figure 2, denoted with (1).

As main synchronous communication facility the OpenMeetings system [16] is used providing a needed base for multimedia communication, shared white-board, chat and screen recordings. The system interface was simplified as possible to improve its usability, keeping only essential elements. A screen-shot showing Ann in communication, presenting the slides, essential event control and ability to invite new participants is shown in Figure 2, denoted with (2).

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Aim oriented search is important concept for more efficient discovery of materials relevant for particular use case implementation. The search is utilized through OpenScout framework [17]. The framework enables competence and skill based tagging of learning materials and search according the tags. The project Mrs. Ann is working on related to development of a skill based curriculum in the field of economics. The tags as being developed in the project are used as well to tag the project material as is shown in Figure 2, denoted with (3) - search for material and (4) - material sources including with material/recordings tagging.

To enable scalable and low cost content distribution the platform utilizes NextShare, a P2P content distribution developed in the EU FP7 P2P-Next project [18]. In this way Ann can ingest collected materials and recordings into the distribution system; its users are noted about the material based on information published through an Atom feed including with data needed for P2P distribution. The content is consumed through browser plugin [1] developed in the project.

As already noted in Section II security has been considered as very important aspects. In the platform we had incorporated three distinct security mechanisms: graphical authentication suitable for smart mobile devices [13], pan-european, cross border authentication framework STORK 2.0 (www.eid-stork2.eu) and an access control protocol for P2P networks - Enhanced Closed Swarm (ECS) protocol [10]. Ann can use NextShare content distribution mechanisms to support bulk delivery of public content to large audiences like students. But through ECS protocol usage she can specify and enforce who can access private group materials. Two authentication mechanisms enable authenticated access to the meetings, pan-european, STORK based access is presented in Figure 2, denoted with (5).

On the end a connector, presented in Figure 1 with blue box within eCampus LMS system, act as a bridge between most of the presented building blocks (except security mechanisms).

The connector exports RESTful interfaces to eCampus system, enabling subsystems functionality utilization and management in unified, programmable way. The interface API is briefly presented in Figure 2, denoted with (6).

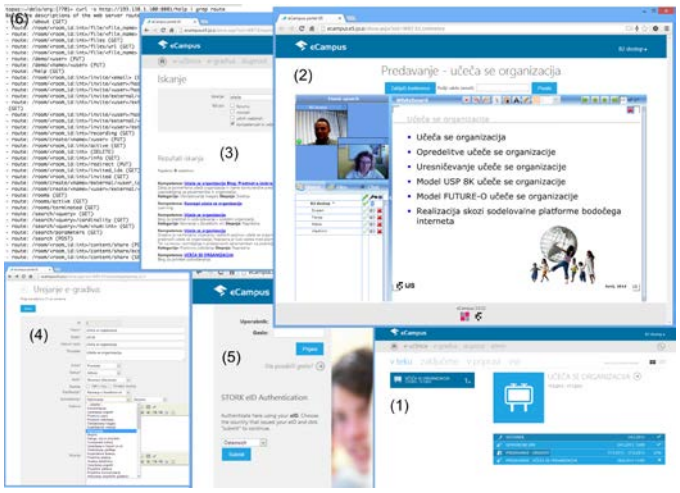

Figure 2. Implementation view

The design of the connector and subsystems provides enough flexibility to be deployed even independently of the eCampus base. In one way the interfaces developed can be reused by another LMS system (e.g. LMS Moodle) or a part of the subsystems be seamlessly replaced without interfering with the base system OpenMeetings with BigBlueButton [2]. The system can be easily deployed into cloud environment to gain all the environment advantages.

V. Conclusion

The development of the platform is addressing several important and challenging research problems that are part of the Future Internet Networks and Enterprise Systems scientific agenda. The main contribution of the presented next generation platform will especially be in the development of new product based on the achievements that are beyond the state of the art as defined in the scientific agenda of future internet collaborative environments, content distribution systems, privacy and new security solutions in advanced systems and networks. The impact will be in the development and adoption of new challenging technologies and services. The major importance is certainly in the investigation of a number of technological problems and the associated policy domains that have bearing on the network and service infrastructure elements of the Internet of tomorrow. The research will have impact in the area of the engineering and scientific field known as Future Internet Technologies, Digital Agenda but in same time the impact will be noticeable in the industrial environment as new competitive services to be put on the market will be enabled.

References

[1] A. Bakker, R. Petrocco, M. Dale, J. Gerber, V. Grishchenko, D. Rabaioli and J. A. Pouwelse, "Online Video Using BitTorrent and HTML5 Applied to Wikipedia," IEEE P2P 2010, 2010.

[2] BigBluButton videoconferencing system. Available: www.bigbluebutton.org.

[3] N. T. Borch., A. Bakker, R. Petrocco, M. Dale, J. Gerber, V. Grishchenko, D. Rabaioli & J. Pouwelse, "Online Video Using BitTorrent and HTML5 Applied to Wikipedia," In 2010 IEEE Tenth International Conference on Peer-to-Peer Computing (P2P) proceedings, 2010.

[4] D. Bálek, F. Plášil, "Software Connectors and their role in component deployment," Proceedings of DAIS'01, Krakow, Kluwer, 2001.

[5] L. Bulej, T. A. Bures, "Connector Model Suitable for Automatic Generation of Connectors, " Springer, New York, 2003.

[6] eCAMPUS. Available: http://www.b2.eu/en/software-system-solutions.aspx.

[7] G. Gheorghe, R. Lo Cigno, A. Montresor, "Security and privacy issues in P2P streaming systems: A survey. Peer-to-Peer Networking and Applications," Springer, New York, 2010.

[8] ICOPER project, EU cContentplus programme. Available: www.icoper.org.

[9] R. Jimenez, L. Eriksson, B. Knutsson, "P2P-Next: Technical and Legal Challenges." The Sixth Swedish National Computer Networking Workshop and Ninth Scandinavian Workshop on Wireless Adhoc Networks, Uppsala, Sweden, 2009.

[10] V. Jovanovikj, D. Gabrijelčič, T. Klobucar, "Access control in BitTorrent P2P networks uisng the enhanced closed swarms protocol." Netware 2011: August 21-27, 2011, French Riviera, Nice - Saint Laurent du Var, France. [S. l.]: IARIA, cop. 2011, pp. 97-102.

[11] A. H. Lashkari, A. Gani, L. G. Sabet, S. A. Farmand, "A new algorithm on Graphical User Authentication (GUA) based on multi-line grids," Scientific Research and Essays 5 (24), pp. 3865-3875, 2010.

[12] F. Leymann, "The (Service) Bus: Services Penetrate Everyday Life," 3rd Intl. Conf. on Service Oriented Computing ICSOC'2005, LNCS 3826 Springer-Verlag Berlin Heidelberg, 2005.

[13] M. Mihajlov, B. Jerman Blazic, "On designing usable and secure recognition-based graphical authentication mechanisms," Interact. comput, 2011, vol. 23, no. 6, pp. 582-593.

[14] MLO CEN/ISSS WS-LT Metadata for Learning Opportunities (MLO), http://www.cen.eu, 2008.

[15] New collaborative working environments 2020, EU Commission, 2006.

[16] OpenMeetings. Available: http://openmeetings.apache.org/.

[17] OpenScout project, EU eContentplus programme. Available: www.openscout.net.

[18] P2P-Next EU FP7 IP project. Available: www.p2p-next.org.

[19] M. P. Papazoglou, "Extending the Service Oriented Architecture," Business Integration Journal. 2005.

[20] Real User Corporation: "Passfaces: Two Factor Authentication for the Enterprise- ". Available: www.passfaces.com.

[21] S. Wiedenbeck, J. Waters, J. C. Birget, A. Brodskiy & N. Memon, "Authentication using graphical passwords: Effects of tolerance and image choice," in Symposium on Usable Privacy and Security (SOUPS). Carnegie-Mellon University, Pittsburgh, 2005.

[22] X. Zhang, D. Liu, S. Chen, Z. Zhang, R. Sandhu, "Towards digital rights protection in BitTorrent-like P2P systems," Proceedings of the 15th ACM/SPIE Multimedia Computing and Networking, San Jose, USA, 2008.

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Mini-Conference Model for Undergraduate Courses

A Roadmap to International Publications

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***Abstract* —** With the changing face of technologies, instructors usually find it hard to keep the course syllabus up with the current advancement in technologies. Introducing the new trends next to the core learning outcomes is inevitable and has to happen seamlessly. In order to transform the deterrence of learning new technologies into a motivational incident, this report presents how a mini-conference approach has been adopted in the Applied Research Skills course, an undergraduate course taught to the final year students of Computer and Information Science department at the Higher Colleges of Technology – Dubai Women's College. Throughout the semester, students pursued original research projects focusing on focus on the Applied Research in Information Technology to solve community issues. At the end of the semester, students submitted their research findings as technical conference papers for the mini-conference, the CIS Research Day. Submitted papers were reviewed by a panel of reviewers and presented during the Research Day. Best papers have been selected based on the reviews. Selected best papers have been submitted to peer-reviewed international conferences and have been selected, presented and published. A practical, hands-on method has been adopted to teach the course that encouraged students to partake in the rewards of conducting their own secondary research in a professional and effective manner.

Keywords—mini-conference approach; applied research skills; Research day

I. INTRODUCTION

In order to include the rapidly developing technologies and trends in to the course curriculum, mini-conference approach can be used as an effective method of learning by doing teaching approach using which the students will be introduced to research activities. This approach has the potential of motivating the students to deal with the latest advancements in technologies and present them in authentic settings.

Incorporating HCT's strategic initiatives (HIGHER COLLEGES OF TECHNOLOGY, 2013) and the "learning by doing" philosophy, mini-conference model proposed blends the three pillars of academic: Research, Teaching, and Service. IS 2010 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems by ACM, AIS and AITP (IS 2010 Curriculum Guidelines, 2010) also have stressed that the IS professionals must have strong analytical and critical thinking, interpersonal communication and team skills and strong ethical principles. These skills were relevant to research, teaching and service aspects of academic responsibility which are part of the mini-conference approach.

Based on the above, the key objectives of the mini-conference approach that has been implemented to teaching applied research skills course is to increase the contribution to scientific research & experience in

- Creating a new learning process
- Learning new technologies and their implications
- Enhancing Leadership skills
- Refining Project Planning and Problem Solving
- Increasing critical thinking and problem solving skills
- Developing Writing Skills
- Developing Reading and critiquing Skills
- Developing Oral Skills
- Developing Citizenship Skills
- Thinking out of the box and finding innovative solutions.

The model has been experimented in one of the Arab countries where research is yet to be matured. The paper has been organized as below:

- Section II discusses the already existing literature related to mini-conference approach.
- Section III describes the mini-conference model that has been adopted and implemented.
- Section IV describes the Research Day held towards the end of the course as final assessment.
- Section V concludes the paper.

II. BACKGROUND STUDY

Educators adopt various approaches to enhance the teaching and learning process. Learning by doing is one such approach. In order to include the rapidly developing technologies and trends in to the course curriculum, mini-conference approach can be used as an effective method of learning by doing teaching approach using which the students will be introduced to research activities. This approach has the potential of motivating the students to deal with the latest advancements in technologies and present them in authentic settings.

Adopting a mini-conference approach at the undergraduate level courses to motivate the students to learn by writing research papers is not new and the first occurrence of such an approach in computing was in (Börstler & Johansson, 1998). (Davis & White, 2005) recounts the authors experience in adopting a mini-conference model to teach multimedia course which helped the students to enhance their research, technical writing and oral presentations. Cass & Fernandes (2008) report about a mini-conference approach where students took up research assignments and enhanced their communication skills and changed their attitude towards research. (Sivilotti & Weide, 2004) is one of the evidences where mini-conference model has been used to teach research courses. (Healey & Jenkins, 2009) reports about developing undergraduate research and inquiry where students have been made to work in groups on research projects from generating their own valid, practical and worthwhile research questions through to presenting findings at a research 'mini-conference'. All of the evidences describe the adoption of mini-conference approach at the undergraduate level to enhance the learning process of IT related courses and research courses. Also all of them have focused on enhancing the communication and writing skills but none of them have focused beyond this. The mini-conference model adopted to teach the ITEC N415 - Applied Research Skills has not only focused on enhancing the students' written, communication and presentation skills but also created a roadmap to international publications. Also it has blended the three pillars of academia: Teaching, Research and Service.

III. Mini-Conference Model

This section describes the course and how it is offered as a mini-conference model.

A. Course Description

This course intend to provide an overview of information sources, and the research process. Students are expected to

- Gain practical and generic information retrieval skills and conduct secondary research.
- Produce written report(s) of the results as part of a business case.

This course intends develop a process of identifying, searching, evaluating and using discipline-specific information to produce an annotated bibliography.

The various learning outcomes of the course are as below:

- LO1: Conduct secondary research on a selected topic at an advanced level and in a professional and effective Manner
- LO2: Critically evaluate current research using standard and accepted criteria.
- LO3: Write reports and present information which meets professional organizational standards.

The outcomes clearly indicate the necessity to conduct secondary research and produce scholarly reports. Weekly course delivery plan was created based on the LOs which is shown in Fig. 1.0. The weekly planner clearly shows the steps involved in creating the research paper.

B. Course Structure

The course was divided into three phases:

- In the first phase, students were introduced with the basic concepts of the course satisfying the learning outcomes and began their research projects.
- In the second phase, the students started learning by doing their original research and sharing their ideas to the rest of the class in the form of oral and written presentations.
- Finally, in the third part, the students participated in the mini-conference "Research Day": they submit research papers, presenting their papers during mini-conference etc. A debriefing session was held after the Research Day to reflect on the experiences.

Week	Learning Outcome (LO)	Learning Activity	Assessment Item	Allocated mark
1-2	LO1	• Define research. • Define what plagiarism is and how to avoid it.		
3-4		• Survey a variety of sources of information. • Select a research topic of interest.	Research Paper Proposal	10%
5-6		• List effective search strategies for finding information • Cite references in text correctly and paraphrase correctly giving credit to the Source.		
7-8	LO1 & LO3	• Discuss publications • How to publish a research • Finding a research problem. • Format and present a report to a professional standard		
9-10		• Write a bibliography correctly to known standards (e.g. MLA, APA). • Carry on with writing on the selected research problem using different sources.	Research Paper Phase –I **(10% Individual & 10% group work)** I Draft	20%
11-12	LO1 & LO2	• Identify the difference in quality of information • Critically evaluate and filter sources of information using appropriate criteria including, but not limited to historical perspective, currency of information, and validity of data. • Carry on with writing on the selected research problem using different sources.	Research Paper Phase –II **(5% Individual & 5% group work)** Final Draft	10%
13-14	LO3	• Distinguish the differences between an informative and an argumentative research report. • Carry on with writing on the selected research problem using different sources.	Case Study Analysis	20% **(Individual)**

Fig. 1.0 Weekly Course Delivery Plan

These phases clearly blend the three pillars of academia. The emphasis was given on: identifying a research topic/problem, writing a research proposal, critically evaluating the related literature, collecting and analyzing data and discussing the results, and writing up the research report which meets universally agreed professional standards.

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Based on these phases, the mini-conference model has been derived and shown in Fig. 2.0. It has adopted a phased approach. Systematic assessments were carried out at each stage of the research process to let the students know the progress well in advance.

a) ***Step 1*** - Research Proposals: Similar to the conference call for papers, students were introduced with the Research Day at the beginning of the semester. They were asked to focus on applied research in latest Information Technologies to solve community issues. In response to the call for research papers students formulated their teams, identified research problems and submitted their research proposals in week 4. The research proposals were graded and approved. Feedback was given to improve the research ideas.

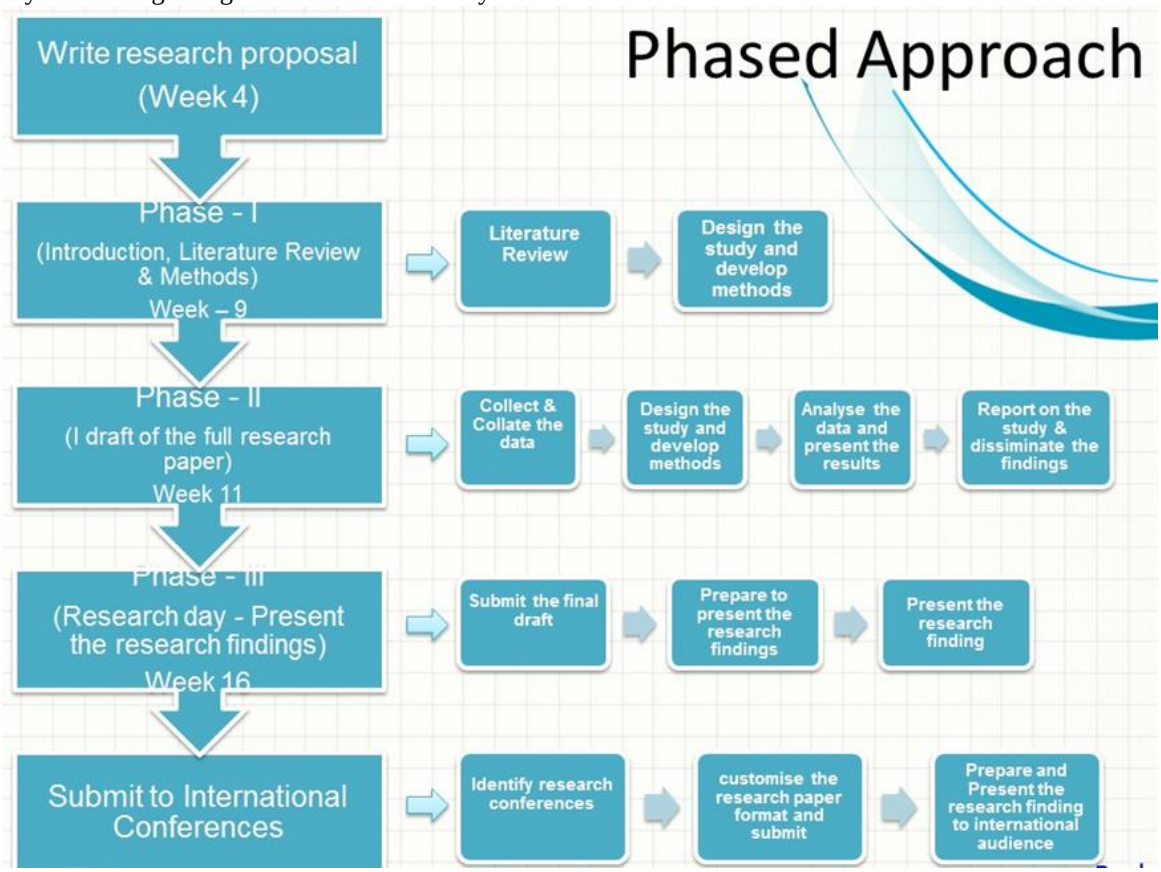

Fig. 2. 0 Phased Approach Adopted in the Mini-Conference Approach

b) ***Step 2*** – Phase I & II: Students worked in teams on the approved research problems and

- Identified the research methods and methodologies needed to address the problem
- Organised professional level workshops on topics such as plagiarism, referecing, citation and searching for literature from authentic sources with the help of college library. This helped the students to avoid plagiarism, perform effective literarure search and cite properly.
- Conducted critical evaluation of the literature related to latest trends related to their work in order to identify the gaps and justify their work
- Collected and analyzed data relevant to the research and proposed solutions to the problems identified
- Reported their research in the form of research reports.

The submitted report was evaluated and first level feedback was given based on which the students worked again to prepare the final draft. This step is crucial the students are writing their first research paper and straightening their ideas and work is inevitable for a smooth learning process to take place. The reports for Phase I & II were submitted and presented in week 9 and 13.

c) ***Step 3 – Phase III:*** The final drafts were submitted for the Research Day. Each paper was reviewed by three reviewers. The review panel consisted of faculties and professional from industry. The papers were presented during the research day and four papers have been selected as best papers. Strict criteria were used for grading the papers based on the review and presentation. Research day was held in week 15 and feedbacks and reflections were given in week 16.

d) ***Step 4 – Submission to International Conferences:*** Selected best papers were submitted to peer- reviewed

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international conferences. The submitted papers were selected to be published and presented in international conferences.

IV. Research Day – The Mini-Conference Day

The Research Day was conducted as a mini-conference. The program committee consisted of Chair and Faculties from the Computer and Information Science (CIS), and researchers from Industry like Emirates bank reviewed the papers and evaluated the students' presentations. The organizing committee consisted of the MCs for the various sessions from the students. Chair of CIS Department gave the keynote address. [Refer Appendix-1 for Research Day invite, paper presentation schedule].

As mentioned earlier, 70 students from 4 sections presented 20 research findings in parallel sessions which was attended by staff members, guests and students. The discussions and feedback given at the end of each presentation were very useful.

A. Reflection

Students felt that the research activity to be hard. They found themselves being introduced to

- New concepts accompanied by theory
- Difficult research activities such as
  - finding **authentic resources**,
  - knowing **how to write a paper**,
  - knowing **how to write a critical review**
  - **broadening the horizons** against learning new technologies that were not covered in their courses.
- Students do not understand the
  - Applicability of **research process to real-life situations**
  - Implications of **using these concepts in students' future professional context**.

But after the Research Day, students showed a dramatic change in their opinion. Most of the students felt the activity to be rewarding. Students mentioned that the mini-conference has

- **increased** the **ability** to **think**, **learn**, and **work** independently and in groups
- **strengthened** oral and written **communication skills**
- **sharpened critical thinking** skills
- **gained** more **confidence**
- **enriched** their knowledge which would help them **prepare** for **graduate school** or the **workforce.**

Similarly, faculties who taught the course were challenged as students started learning by doing. Few of the major challenges were:

- How to **create awareness** about the importance of research?
- How to **motivate and reward students** for their efforts and the value of their time?
  - For some students, getting distinction in the research course is enough.
  - For others, a summer research job or trip to an international conference may do the trick.

As the students progressed and learnt the art of doing research, they started realizing the importance of doing research. The students mentioned that the skills helped them perform better at their work places. Students felt that the mini-conference was one of the most rewarding events for them. Also best papers were submitted to various refereed IT conferences which was another rewarding activity. All the four have been selected but two of them have been presented and published. They are shown in below:

- Research Paper titled "Influence of Technology on Children's Health" written by Maitha Al Mazmi, Halima Aslam which was selected to be one of the best papers on the Research Day held on 14 Jan 2013 as one of the best papers has been accepted, presented and published in the Proceedings of the International Conference on technology and Business Management, Dubai, Mar 18-20, 2013 http://www.icmis.net/ictbm/ictbm13/proceedings/pdf/D3230-done.pdf
- Another research paper titled "A case study from a college in UAE: The positive impact of using iPads with first year college students" written by Buthaina Alshaiba, Maitha Ahli, arwa Almeeza and Maryam Alawadhi was selected and presented in the Educational Without Borders conference held on March 25-28, 2013. Marwa, one of the authors presented the paper. http://ewb.hct.ac.ae/ewb2013/student-presenters/marwa-almeeza/

The other two best papers have been accepted to be presented in one of the top level conferences, the Eighth International Conference on Internet and Web Applications and Services which was be held on June 23 - 28, 2013 - Rome, Italy but the students did not register and present due to financial constraints.

It is to be noted that it was not the first time the model was experimented in HCT. The same approach was tested in smaller levels in the final year courses including the Applied Research Skills course which include ITEC N460 – Operating Systems and ITEC N418 – Information Technology Project. Exceptional students' work from these courses have been submitted to refereed international conferences which are accepted, presented and published (Al Housani, Mutrib, & Jaradi, 2009) & (Al Housani, Marzouqi, Redha, & Rajan, 2011). Table 1.0 shows the list of all the papers published and their related courses. This clearly shows the generality of the model which makes it suitable to be implemented for any course.

I. Conclusion

The mini-conference model proposed is an effective framework which can be used for any undergraduate course. It is vital to note that the model focuses on delivering the course contents and the advancements in technologies and techniques related to the course. The mini-conference approach has been adopted and experimented in the final year courses of IT other than Applied Research Skills course in smaller levels and it has

been proven that the results of such courses could also be elevated to professional level for publications. The research day conducted towards the end of the course not only helped the students to present their papers in a professional manner but also prepared them to face real conferences. The course helped the students to gain knowledge on how to do research as part of the course along with additional recognitions such as international publications.

Title of the Paper & Publication	Related Course
Housani, B.A.; Marzouqi, I.A.; Redha, S.A.; Rajan, A., "“BuziWomen” — UAE women entrepreneurs," *Current Trends in Information Technology (CTIT), 2011 International Conference and Workshop on* , vol., no., pp.86,91, 26-27 Oct. 2011 doi: 10.1109/CTIT.2011.6107940 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6107940&isnumber=6107930 The same project was submitted to the Imagine Cup competition and was selected to be one of the TOP 10 projects. Link: http://blogs.msdn.com/b/pooyad/archive/2010/04/28/imagine-cup-gulf-2010-regional-finals-may-3rd.aspx	ITEC – N418 – Information Technology Project Jan 2010 – Jun 2010
Al Housani, B.; Mutrib, B.; Jaradi, H., "The Linux review - Ubuntu desktop edition - version 8.10," *Current Trends in Information Technology (CTIT), 2009 International Conference on the* , vol., no., pp.1,6, 15-16 Dec. 2009, doi: 10.1109/CTIT.2009.5423142 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5423142&isnumber=5423104	ITEC N460 – Operating System Feb 2009 – Jun 2009
Saleh, F.; Jani, H.; Marzouqi, M.A.; Khajeh, N.A.; Rajan, A., "Social networking by the youth in the UAE: A privacy paradox," *Current Trends in Information Technology (CTIT), 2011 International Conference and Workshop on* , vol., no., pp.28,31, 26-27 Oct. 2011, doi: 10.1109/CTIT.2011.6107957 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6107957&isnumber=6107930	ITEC N415 – Applied Research Skills Feb 2011 – Jun 2011
Buti, A.; Saleh, S.; Hussain, S.; Rajan, A., "The impact of social networking on Emirati teenagers," *Current Trends in Information Technology (CTIT), 2011 International Conference and Workshop on* , vol., no., pp.23,27, 26-27 Oct. 2011, doi: 10.1109/CTIT.2011.6107956 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6107956&isnumber=6107930	ITEC N415 – Applied Research Skills Feb 2011 – Jun 2011
Al Raesi, A.; Al Meharabi, M.; Al Hilli, S.; Rajan, A., "The UAE graduates are not placed in their right job titles," *Current Trends in Information Technology (CTIT), 2011 International Conference and Workshop on* , vol., no., pp.37,40, 26-27 Oct. 2011, doi: 10.1109/CTIT.2011.6107959 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6107959&isnumber=6107930	ITEC N415 – Applied Research Skills Feb 2011 – Jun 2011
Al Shamsi, H.; Ahmed, S.; Redha, F., "Monitoring device for elders in UAE," *Current Trends in Information Technology (CTIT), 2011 International Conference and Workshop on* , vol., no., pp.32,36, 26-27 Oct. 2011 doi: 10.1109/CTIT.2011.6107958 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6107958&isnumber=6107930	ITEC N415 – Applied Research Skills Feb 2011 – Jun 2011

Table 1 .0 List of publications through courses before the formal adoption of mini-conference approach

REFERENCES

Al Housani, B., Mutrib, B., & Jaradi, H. (2009). The Linux review - Ubuntu desktop edition - version 8.10. *The 2009 International Conference on the Current Trends in Information Technology (CTIT)* (pp. 1-6). Dubai, UAE: IEEE Xplore.

Al Housani, B., Marzouqi, I., Redha, S., & Rajan, A. (2011). “BuziWomen” — UAE women entrepreneurs. *2011 International Conference and Workshop on Current Trends in Information Technology (CTIT)*, (pp. 86 - 91). Dubai, UAE: IEEE XPlore.

Börstler, J., & Johansson, O. (1998). The students conference—a tool for the teaching of research, writing, and presentation skills. *in Proceedings of the 6th annual conference on the teaching of computing and the 3rd annual conference on Integrating technology into computer science education: Changing the delivery of computer science education.* Dublin City Univ., Ireland.: ACM Press.

Cass, A., & Fernandes, C. (2008). Simulated Conference Submissions: A Technique to Improve Student Attitudes About Writing. *In Proceedings of the 38th ASEE/IEEE*

Frontiers in Education Conference (pp. 22-25). Saratoga Springs, NY: IEEE Xplore.

Davis, H., & White, S. (2005). A Research-Led Curriculum in Multimedia: Learning about Convergence. *In: ACM ITiCSE: The 10th Annual Conference on Innovation and Technology in Computer Science Education. Volume 37 Issue 3*, pp. 29-33. NY, USA ©2005: ACM New York.

Healey , M., & Jenkins, A. (2009). *Developing undergraduate research and inquiry.* York Science Park, Heslington, York YO10 5BR, UK: The Higher Education Academy. Retrieved July 02, 2013, from http://www.heacademy.ac.uk/assets/documents/resources/publications/developingundergraduate_final.pdf

HIGHER COLLEGES OF TECHNOLOGY. (2013). *STRATEGIC PLAN 2012-2017 AN AMBITION FOR MORE: GOING THE DISTANCE THROUGH LEARNING BY DOING - HCT Strategic Directions 2012-2017.* Dubai: HIGHER COLLEGES OF TECHNOLOGY. Retrieved 11 11, 2013, from http://www.hct.ac.ae/files/HCT-Strategic-Plan-2012-2017.pdf

Sivilotti, P. A., & Weide, B. W. (2004). Research, teaching, and service: the miniconference as a model for CS graduate seminar courses. *Proceedings of the 35th SIGCSE Technical Symposium on Computer Science Education (SIGCSE 2004)* (pp. 487–491). Norfolk, VA: ACM Press.

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The Assessment of Learning Outcomes in Chemical Engineering Education: A Case Study from Saudi Arabia

Ahmed Abasaeed, Abdullah Alsadaawi, Saeed Al-Zahrani and Abdelhamid Ajbar*

***Abstract*—** This paper presents the main features of a study carried out by the higher education authority in the kingdom of Saudi Arabia for developing a practical framework for formulating and assessing learning outcomes in chemical engineering education. The proposed learning outcomes were based on a compilation of different international accreditation frameworks. The formulated learning outcomes were grouped into four learning areas: (1) engineering sciences and foundation chemistry**,** (2) engineering analysis and investigation, (3) engineering design and (4) engineering practice. The paper also presents the main elements of a proposed standardized exit exam to test the developed learning outcomes. A table of specification was constructed that maps the developed learning outcomes with the test questions distributed over various learning levels (knowledge and comprehension, application and analysis, synthesis and evaluation). The table of specification allows the transformation of the developed learning outcomes into balanced questions to be used in the exit exam. The paper also discusses the implications of the proposed plan on the chemical engineering education in the kingdom and the concerns that are raised by the different stakeholders.

***Keywords*—** Assessment; learning outcomes; exit exam; chemical engineering; Saudi Arabia.

I. INTRODUCTION

The engineering education environment is changing as information and communication technologies are having greater impact, and innovation is becoming increasingly essential. Companies today operate in a highly competitive environment, and in order to stay ahead of competitors, they are more inclined to value engineering graduates who possess a variety of non-technical qualities, in addition to the technical know-how for the job. Employers as well as academic accreditation entities are putting pressure to incorporate sound assessment techniques into engineering programs. Therefore, the assessment of learning outcomes has become a primary focus for engineering education in today's competitive environment [1-2].

The outcome-driven assessment process, if carefully designed and implemented, can be useful at different levels. It can provide critical information on whether graduates have acquired the knowledge and skills defined by predetermined educational objectives. The assessment process can also convey useful formation to faculty and administrators on the effectiveness of the design and delivery of the educational program. It can also develop, in the long term, instruments to obtain comparable information on what students actually learn across different engineering colleges [3-4].

Quality assurance requirements, the primary drivers of assessment, are likely to be more imperative in third work countries. Engineering education in the kingdom of Saudi Arabia, for example, is less than half-century old. However, with the large expansion of the industrial sector as result of oil revenues, the country has seen a large increase in its engineering colleges, both public and private. Currently, the Kingdom has 21 public and 3 private universities offering engineering education. More than half of these engineering colleges are less than five years old. This rapid expansion was, however, not met with adequate assessment of student learning outcomes. Although a number of engineering colleges are accredited, there are sustained complaints from the industry about the unsuitable quality of the educational product compared to the demands and expectations of the labor market. The country ministry of higher education strongly encourages the universities to seek accreditation. However, private and newly founded public engineering institutions present real challenges to the higher education authorities as they try to maintain acceptable quality standards in their curriculum and products. In attempt to tackle these challenges, the ministry of higher education has launched a study to implement an exit exam for the engineering graduates across the country. The study was carried out over a period of two years and involved in the first step the elaboration of a "qualifications framework". This was followed by the setting up of the exam structure. The authorities have also decided to implement the exit exam, on a trial basis, starting from the first semester of the next academic year (2014-2015). The objective of this paper is to provide and discuss details of this study as applied to the chemical engineering education.

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It should be noted that few countries in the world (e.g. Colombia) [5] impose a mandatory testing of graduating engineering students. But large-scale voluntary direct assessments via standardized tests are carried out by various nongovernmental assessment agencies in many countries [6-9]. These direct evaluation tests cover both generic competencies (e.g. reading, writing, mathematics and critical thinking) as well as technical skills. Other experiences of assessment use popular alternatives like "curriculum-embedded" assessments and student portfolios [9-12].

II. RESEARCH METHODLOGY

The study carried out at the request of the higher ministry of education in Saudi Arabia lasted two years and involved essentially the following tasks. The first stage involved an extensive review of available literature on the development of frameworks for learning outcomes in engineering education in order to compile previous related works, experiences, and lessons learned. The literature review covered experiences from various countries worldwide. The review also covered independent and important projects on learning outcomes such as the Accreditation Board for Engineering and Technology (ABET) [13], Conceiving- Designing- Implementing-Operating (CDIO) [14], European Accredited Engineer framework (EUR-ACE) [15], Assessment of Higher Education Learning Outcomes project (Tuning-AHELO) [16], UK standard for professional engineering competence (UK-SPEC) [17], standards for Engineers Australia (EA) [18], National Academy of Engineering (NAE) [19] and International Engineering Alliance (IEA) [20]. The second task involved the development of a local framework for engineering learning outcomes for various disciplines while the final task consisted in the development of the structure of the proposed exit exam. In the course of the study, the products of each stage were reviewed locally and by international experts through several workshops organized by the ministry.

III. PROPOSED FRAMEWORK

Chemical Engineering (ChE) skills include the knowledge of basic sciences, foundation chemistry, general engineering fundamentals and physical & chemical processes. Chemical engineers apply, in a well-integrated manner, these areas of knowledge as well as the acquired soft skills in the analysis, design and ultimately the operation and control of chemical plants while maintaining and preserving codes of practice, ethics, safety, health, economics and environment [21-25].

The proposed framework for learning outcomes was organized into four "learning areas" namely: engineering sciences, engineering analysis and investigation, engineering design, and engineering practice. Within each learning area, the content is further defined by a set of abilities. Each ability is composed of two major parts:

- The ability statement which broadly defines what an engineering graduate in his field/discipline should know and be able to do.
- The descriptive statements of the learning outcomes (LO) associated with the ability. These LOs describe in greater detail the knowledge and skills eligible for testing [26].

The following is a description of these abilities followed by the description of the main features of the proposed standardized exit exam.

A. Learning area: Engineering sciences and foundation chemistry

A.1 Ability (ChE1): The ability to demonstrate knowledge in foundation chemistry and fundamentals of chemical engineering.

Associated Learning Outcomes:

Graduates who possess this ability (ChE1) should be able to:

1. Describe and apply the basics of organic and inorganic chemistry.
2. Use concepts of units and dimensions; state major process variables; use physchrometric charts; perform basic material and energy balances.
3. State the first and second law of thermodynamics and their implications; utilize volumetric properties of pure and mixed fluids.
4. Discuss the various properties of engineering materials, the atomic and crystalline structures of materials, and the phase diagram of solid materials; identify causes of materials failure and imperfections.

A.2 Ability (ChE2): The ability to demonstrate knowledge of physical processes encountered in chemical engineering practice including the various separation process.

Associated Learning Outcomes:

Graduates who possess this ability (ChE2) should be able to:

1. Describe the fundamental, the physical meaning and the equations governing these processes; explain fluid statics and dynamics; recognize the differences between flow through annulus, submerged bodies and porous media.
2. Define and distinguish the basics of physical transfer processes and the factors that affect transfer and diffusion processes.
3. Apply the fundamentals of stage operations using phase diagrams and phase equilibrium, and describe the main factors affecting them.

A.3 Ability (ChE3): The ability to demonstrate knowledge of chemical processes encountered in chemical engineering practice and the implications of reaction kinetics on them.

Associated Learning Outcomes:

Graduates who possess this ability (ChE3) should be able to:

1. Use reaction stoichiometry and rate equations for irreversible and reversible reaction for both single and multiple reactions.
2. Understand the concepts of conversion, selectivity and yield.

A.4 Ability (ChE4): The ability to demonstrate basic knowledge of control systems used in chemical

plants.

Associated Learning Outcomes:

Graduates who possess this ability (ChE4) should be able to:

1. Understand process control structure and the concepts of set points, disturbances, controlled, manipulated variables and transfer functions.

B. *Learning area: Engineering analysis and investigation*

B.1 Ability (ChE5): The ability to identify, formulate, analyze and solve common chemical engineering problems including physical and chemical processes or units.

Associated Learning Outcomes:

Graduates who possess this ability (ChE5) should be able to:

1. Apply basic material and energy balances to analyze and solve problems for a unit, process or an entire flow sheet using sequential and/or process solutions by performing hand-calculations and/or using suitable computer simulation packages and software.
2. Identify and utilize the limitations imposed by thermodynamics on processes; apply the proper equation of state and proper analysis of phase and chemical equilibria; examine the performance of power cycles.
3. Quantify the implications and differences in flow regimes; quantify the effects of elbows, constrictions and pipe size on power requirements of pumps; utilize the properties of materials to select a suitable material for constructing pipes based on the flowing fluid properties.
4. Calculate heat and mass transfer coefficients; estimate the properties and role of insulating materials on heat transfer; perform steady state analysis related to different modes of heat transfer.
5. Analyze stage-wise and continuous gas-liquid separation processes by applying graphical and analytical methods for absorbers and distillation columns.
6. Appreciate the implications of changes in temperature and pressure on ideal reactors; perform material and energy balances using rate expressions; determine reaction kinetics from experimental data.
7. Devise proper control structures for chemical units; design PID controllers; analyze closed loop performance.
8. Apply the basics of economic analysis such as profit, depreciation, profitability, cash flow, present value and alternative investment; recognize the vital importance of economic analysis in plant design.

C. *Learning area: Engineering design*

C.1: Ability (ChE6): The ability to design units, components and plants to meet specific needs while observing technical, environmental, economical, societal, ethical and safety constraints.

Associated Learning Outcomes:

Graduates who possess this ability (ChE6) should be able to:

1. Apply the basic principles of chemical engineering while observing limitations imposed by thermodynamics on units and their designs.
2. Appreciate the impact of the flowing material, flow type and material of construction on power requirements and on the design of piping systems and pumps.
3. Use proper energy equations and codes & standards to calculate energy requirements for a plant using equipment, such as heat exchangers and evaporators.
4. Apply the basics of mass transfer operations in the design of units such as absorption, distillation columns and liquid-liquid extraction units.
5. Apply the knowledge of basic material and energy balances, and reaction kinetics in the design of ideal reactors (CSTR and PFR)

C.2 Ability (ChE7): The ability to utilize experimental data, software, empirical equations and rules of thumb in the design of chemical engineering units.

Associated Learning Outcomes:

Graduates who possess this ability (ChE7) should be able to:

1. Interpret experimental data for the benefit of the design.
2. Use empirical equations and rules of thumbs in the design of chemical engineering units.

D. *Learning area: Engineering practice*

D.1 Ability (ChE8): The chemical engineer must demonstrate an understanding of professional ethics, codes and standards, safety, health, control, HAZOP analysis, costing, management and sustainability as well as knowledge of contemporary issues and modern developments in the chemical engineering field.

Associated Learning Outcomes:

Graduates who possess this ability (ChE8) should be able to:

1. Use codes and standards in the chemical engineering profession.
2. Recognize the implications of professional responsibility regarding the design, operation and control of chemical processes as well as adherence to liability, accountability and codes of ethics.
3. Recognize the new development in chemical processes, new analysis techniques and new software in the chemical engineering field.
4. Demonstrate sensitivity to preserving clean environment.

IV. PROPOSED TEST STRUCTURE

The proposed test is paper based, planned over a 3 hours session and consists of a total of 50 multiple choice questions. The test is open to holders of a bachelor degree in Chemical Engineering as well as students in the final year of such programs. Books, lecture notes, or similar materials are not allowed in the test. Necessary reference sheets, equations and relevant data are provided if needed. The detailed structure of the test is clarified with the construction of the Table of Specifications (Table 1). The table of specifications is a map that facilitates the transformation of the developed learning outcomes into balanced questions.

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The first column of the table shows the learning area, namely (engineering sciences & foundation chemistry, engineering analysis & investigation, engineering design, engineering practice). The second column indicates the alpha-numeric code assigned to the ability, as outlined in the earlier section. The third column contains the codes of learning outcomes as specified in the previous section. Different learning outcomes are grouped – if necessary – according to question allocation requirements. The need for grouping some learning outcomes stems from the fact that the number of learning outcomes could exceed the suggested maximum number of questions in a particular learning area. The grouping of complementary learning outcomes would ensure that at least one learning outcome in a particular group will be tested.

The forth column indicates the number of questions allocated to each learning outcome group. In the present case, 50 questions are included in the test to be conducted over 3 hours. The fifth column, distributed over three ***learning levels*** (knowledge & comprehension, application & analysis, synthesis & evaluation), specifies the question distribution among the three learning levels. For example, there are 9 questions assigned to the first LO group (ChE1-01 to ChE1-04) of the first ability (ChE1). Four questions are allocated to the first learning outcome (ChE1-01). Two of these four questions are assigned to the first learning level (knowledge & comprehension) while the other two questions are assigned to the second learning level (application & analysis). It is important to note that the distribution of questions among the learning outcomes follows a careful process which ensures an adequate coverage for different learning areas (vertical allocation) as well as for various learning levels (horizontal allocation). In this regard, the distribution of questions among the three learning levels is 13 questions (26%) for knowledge & comprehension, 23 questions (46%) for application & analysis, and 14 questions (28%) for synthesis & evaluation. The distribution, on the other hand, of questions among the four learning areas (including foundation chemistry) is 17 questions (34%) for engineering sciences, 16 questions (32%) for engineering analysis & investigation, 11 questions (22%) for engineering design, and 6 questions (12%) for engineering practice. The sixth column shows the distribution of questions among different subject areas as well as the total number of questions. The seventh column shows the percentage of questions allocated to each learning area while the eighth column specifies the total allocated time (in minutes) to each learning area. The last column indicates the average question time (in minutes) as calculated from the preceding two columns. This average represents only a general guidance as it is understood that some questions may require longer or shorter time.

V. Conclusion

This paper has presented the essential features of an ambition plan by the higher education authorities in Saudi Arabia to set up an exit exam for the Kingdom engineering graduates. The plan was set up after two years of extensive study by local staff and international reviewers. The paper presented the main elements of this plan as applied to the chemical engineering discipline. The plan has been approved by the higher education authority in the country and is due to be implemented on a trial basis within one year. The remaining of the work on this plan focuses now on forming a comprehensive database of questions that conform to the table of specifications that was established in this study.

It is understood that the plan, if carefully implemented, could have a positive impact on engineering education. However, there are a number of issues that are still controversial in this plan, and are still under debate by the different stakeholders. The exam results may serve to rank the different universities which could affect government spending on them. Newly formed universities are concerned that their structures are not yet solid enough to compete with the other well established colleges. Students and parents are concerned that the exam results, if communicated to employers, could affect their chances for recruitment. Faculty members raise the concern that the students will ultimately focus their efforts on studying for the exit exam rather than for the actual curriculum. Multiple choice questions may be inappropriate for testing high level cognitive skills. All these concerns are valid and are still being discussed within the ministry. The results of the first exam are expected within a year, and will provide valuable feedback that may correct any shortcomings of this experience.

Acknowledgment

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References

[1] T.P. Yildirim, L.J. Shuman, and M. Besterfield-Sacre, "Model eliciting activities: assessing engineering student problem solving and skill integration processes," *Int. J. Eng. Educ.*, vol. 26, pp. 831-845, 2010

[2] I. Moore and S. Williamson (2008, June) *Assessment of learning outcomes, The Higher Education Academy – Engineering Subject Center*, Available: http:// www.engsc.ac.uk/

[3] B. Bogue, B. Shanahan, R. Marra and E. Cady, "Outcomes-based assessment: driving outreach program effectiveness," *Leadersh. Manag. Eng.*, vol. 13, pp. 27–34, 2013.

[4] J. Leydens, B. Moskal and M. Palevich, "Qualitative methods used in the assessment of engineering education," *J. Eng. Educ.*, vol. 93**,** pp. 65-72, 2004.

[5] G. Ferrer, *Educational Assessment Systems in Latin America: Current Practice and Future Challenges*. Washington DC, Preal, 2006.

[6] Australian Council for Educational Research (2002, February, 2). Available: http://www.acer.edu.au/documents/GSA_ValidityStudy.pdf

[7] K.L. Harris and R. James, "The course experience questionnaire, graduate destination survey, and learning and teaching performance fund in Australian higher education," in *Public Policy for Academic Quality: Analyses of Innovative Policy Instruments*, D. Dill and M. Beerkens, Eds. New York: Springer, 2010, pp. 103-124.

[8] National Institute for Learning Outcomes Assessment (2009, May, 14), Avalable:http://www.learningoutcomeassessment.org/documents/NILOA_ForWeb_5-22.pdf

[9] D. Nusche, *"Assessment of Learning Outcomes in higher education: a comparative review of selected practices*," OECD Education Working Paper No. 15, 2008.

[10] M. Augeri, M. Brents, E. Christiansen, B. Etzenhouser, S. Fox, K. Giese, C. Graves, L. Orticelli, J. Pollock and M. van Andel (2011, April, 27) . *Assessment of student learning outcomes, The University of Iowa,* Available:

http://www.uiowa.edu/~outcomes/documents/FocusGroups-SUMMARY.pdf
[11] C.D. Kuh and P.T. Ewell, "The state of learning outcomes assessment in the United States," *High. Educ.Manag. Policy*., vol. 22 , pp. 1-19, 2010.
[12] T.H. Bers, "The role of institutional assessment in assessing student learning outcomes," *New Direc. High. Educ*., vol. 141, pp. 31-39, 2008.
[13] ABET. *Criteria for Accrediting Engineering Programs*, Baltimore, MD, ABET, 2010.
[14] E.F. Crawley, J. Malmqvist, S. Ostlund and D. Brodeur, *Rethinking Engineering Education: the CDIO Approach*, New York, Springer Science, 2007.
[15] European Network for Accreditation of Engineering Education (2008, Feb, 29).Available: https://www.oecd.org/education/highereducationandadultlearning/40256023.pdf
[16] Organization for Economic Co-Operation and Development (2012) ,Available: http://www.oecd.org/
[17] UK-SPEC (2012), Available: http://www.engc.org.uk/ecukdocuments/internet/document%20library/AHEP%20Brochure.pdf
[18] Engineers Australia (2012), Available: http://www.engineersaustralia.org.au/about-us/program-accreditation
[19] National Academy of Engineering, *The Engineer of 2020: Visions of Engineering in the New Century*. Washington DC, The National Academies Press, 2004.
[20] International Engineering Alliance (2009, June, 18), Available: http://portal.tpu.ru/apec_eng/alliance/Standards%20policies%20and%20guidelines/IEA-Grad-Attr-Prof-Competencies-v2.pdf
[21] M.F. Chong and D.K. Sum Ng, "Evaluation of "year 1 assessment week" in promoting transferable skills among first year chemical engineering students," *Educ. Chem. Eng*., vol. 8, pp. E31-E39, 2013.
[22] C.D. Grant and B.R. Dickson, "Personal skills in chemical engineering graduates, The development of skills within degree programmes to meet the needs of employers," *Educ. Chem. Eng.*, vol. 1, pp. 23-29, 2006.
[23] E.P. Byrn and J.J. Fitzpatrick, "Chemical engineering in an unsustainable world; obligations and opportunities," *Educ. Chem. Eng.*, vol. 4, pp. 51-67, 2009.
[24] J.J. Fitzpatrick, E.P. Byrne and D. Kennedy, "Making programme learning outcomes explicit for students of process and chemical engineering," *Educ. Chem. Eng.*, vol. 4, pp. 21-28, 2009.
[25] R.C. Darton, R.G.H. Prince and D.G. Wood, *Chemical Engineering: Visions of the World*, London, UK, Elsevier, 2003
[26] D. Kennedy, *Writing and Using Learning Outcomes: A Practical Guide*. Cork, UK, University College Cork, 2007.

Table 1: Table of specifications for the test

Learning Area	Skill Code (Ability)	LO-Code Group	Suggested Number of Questions	Assigned Allocations Among Learning Levels: Knowledge and Comprehension	Application and Analysis	Synthesis and Evaluation	Suggested Distribution by Major Subject Area and Associated number of Questions: Major Subject Area	#	% of Test	Total Time (Min)
Engineering Sciences and Foundation Chemistry	ChE1	ChE1-01	9	2	2	0	Foundation Chemistry and Process Fundamentals	4	34 % (13 Questions + 4 foundation chemistry)	57
		ChE1-02		2	1	0		3		
		ChE1-03		1	0	0		1		
		ChE1-04		1	0	0		1		
	ChE2	ChE2-01	5	2	0	0	Physical Transport Processes	3		
		ChE2-02		2	0	0		1		
		ChE2-03		1	0	0		1		
	ChE3	ChE3-01	2	1	0	0	Chemical Processes	1		
		ChE3-02		0	1	0		1		
	ChE4	ChE4-01	1	1	0	0	Process synthesis, control and economics	1		
Engineering Analysis and Investigation	ChE5	ChE5-01	4	0	1	1	Process fundamentals	2	32 % (16 Questions)	62
		ChE5-02		0	1	1		2		
		ChE5-03	6	0	1	1	Physical transport processes	2		
		ChE5-04		0	2	0		2		
		ChE5-05		0	1	1		2		
		ChE5-06	3	0	2	1	Chemical Processes	3		
		ChE5-07	3	0	1	1	Process synthesis, control and economics	2		
		ChE5-08		0	1	0		1		
Engineering Design	ChE6	ChE6-01	1	0	0	1	Process fundamentals	1	22 % (11 Questions)	40
		ChE6-02	5	0	1	0	Physical transport processes	1		
		ChE6-03		0	1	1		2		
		ChE6-04		0	2	0		2		
		ChE6-05	2	0	1	1	Chemical processes	2		
	ChE7	ChE7-01	2	0	1	1	Physical transport processes	2		
		ChE7-02	1	0	1	0	Chemical processes	1		
Engineering Practice	ChE8	ChE4-01	3	0	2	1	Physical transport processes	3	12 % (6 Questions)	21
		ChE4-02	3	0	0	1	Process synthesis, control and economics	1		
		ChE4-03		0	0	1		1		
		ChE4-04		0	0	1		1		
			50	13 (26%)	23 (46%)	14 (28%)		50	100%	180

A Hybrid Model of Painting: Pictorial Representation of Visuospatial Attention through an Eye Tracking Research

S.A. Al-Maqtari, R.O. Basaree, and R. Legino

***Abstract*—** A hybrid pictorial representation of visuospatial attention in performance art becomes a crucial issue in order to explore a new drawing technique development. This drawing technique development is straight related to the eye tracking research and biometric process that involved visual data analyses of eye movements, public behavior, and space- based visual attention features, which is the first study in a visual art field. Multidisciplinary approach will use in this study through combining between human eye movements analyses toward Paulikevith's dancing and the traditional techniques of drawing. In post-modernism, visible and invisible theory, the challenge is to represent quality content of invisible concepts such as attention, sound, motion, and time based on a clear interpretation of specific properties of the form. In this paper, we propose the hybrid model of Visuospatial Attention form (VAF) based on the outcomes of combining among spotlight attention model and pictorial representation through Aspect-Recognition theory. We will conduct the experiment using Tobii T60 remote eye tracking hardware and Tobii Studio software set to collect and analyze the participants' eye movements when watching performance movie, *Tajwal.* The expected outcomes will be 2D and 3D installation artworks that represent the form's qualities of visuospatial attention in visual art which could be as an alternative concept of attention.

***Keywords*—**Eye Tracking Research, Hybrid Painting, Pictorial Representation, Visual Attention.

I. INTRODUCTION

In the recent years, there has been an increasing interest in the pictorial representation and depiction through the recognition- based hybrids theories as a crucial subject in the contemporary visual perception debates and depiction studies [1]-[7]. Cognition theories attempt to ground a hybrid theory of depiction that represents pictorial reference by mental perspective of properties from which the picture represents its objects. Lopes's theory of depiction— the aspect- recognition theory is a well-known hybrid theory that embraces pictorial reference based on a denotative symbol systems, [5]-[7]. Today, visual art researchers focused on the visual representation of invisible study in order to get deep understanding of various complex visual perception issues in installation art, such as the attempts of exploring a space experience through representing the shape of invisible objects such as sonic in terms of technical practice, [8], or the attempts of representing of public experience in installation practices based on the theoretical and critical investigating, [9]-[11]. Indeed, attention is one of an emotional invisible concept that commonly has been utilized in visual art studies, however using a multidisciplinary approach in order to provide creative research with novel ideas are highly recommended in contemporary art research methodologies [12]-[13]. Particularly, the experimental studies based eye tracking research that capture and analyze the visuospatial attention in art is too rare, it can only found in Neuroscience, Psychology, Psycholinguistics, Ophthalmology, Usability, Human-computer interaction, and Package Design and marketing researches for biomedical and industrial design purposes, [14]-[17].

A. The Problem Statement

One major drawback of the recent visual representation studies, is that fails to take public attention into account which is the main property in visual representation theory . Although the recent using of multidisciplinary approaches for visual representation, some studies focused only on the standpoint of the art studio while exploring invisible concepts in outdoor spaces, fails to define the sound form properties like the study by , did not use specific models of attention in public visual behavior studies and used subjective inducting to archive their purposes . In addition, attention based on eye tracking research in art is too rare, it can only found in Neuroscience, Psychology, Psycholinguistics, Ophthalmology, Usability, Human-computer interaction, and Package Design and marketing researches for scientific reasoning and industrial design purposes .

B. Aim

This study aims to shape the form of visuospatial attention toward Paulikevitch's performance artwork "see fig1", based on the study's model (VAF) using the combining of eye movements' analyses with the traditional drawing techniques.

C. Objectives

We will achieve our aim through the following objectives:

a) To identify the attention's features and the hybrid pictorial representation's properties in order to develop (VAF) model based on reviewing Attention and Pictorial theories.

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b) To record the fixations using an eye tracker Tobii T60 in order to visualize attention through using the analyses methods of Tobii Studio software.
c) To shape (VAF) using installation artworks based on the combining between the finding of a, b, and traditional techniques of drawing.

D. Research Question

We address the following questions:

a) What are the components of (VAF) model based on the combining between Spotlight attention, and the aspect- recognition theories?
b) How can detect public's attention through the fixations data in dynamic environment, and visualize its features using eye movement's analyses methods?
c) How can shape the experience of public attention in performance art based on the outcomes of (VAF) model and traditional drawing?

Fig.1 Paulikevitch's performance artwork, *Tajwal*

II. METHOD

A. Design & Methods

The purpose of this research is to shape (VAF) toward Tajwal project based on eye movements analyses, pictorial theory through traditional drawing. Create a test design will be the design of this study based on one experimental group. Three scenes of Tajwal project will separate to create three tests: test 1: Gender, test 2: War, and test 3: Resistance.

So, the project will be undertaken in three areas:

a) Literature review/ research: *to identify (VAF) model based on attention spotlight theory and aspect-recognition theory of pictorial representation through Literature review.*
b) Visualization software / research: to record and visualize the gaze data based on two methods, Statistic and Visualization.
   a. Statistic: this method is based on area of interest (AOI) tool. The researcher will use the following metrics to provide gaze data, fixation count, fixation length, time of the first duration, fixation Duration, and visit Duration.
   b. Visualization: It depends on four tools based on Tobii studio analyses which are: bee swam, gaze plot, heat map, and cluster.
c) Pictorial Representation/ research: to shape (VAF) based on the model's requirements as follows:
   a. Attention features: which are spotlight (focus, fringe, and margin), motion, Intensity, color, location, cluster, respond time (RT) and orientation.
   b. Pictorial Properties: which are pictorial references, information based identification, constraints on thought, pictorial aspects, pictorial systems, pictorial recognition, pictorial meaning, and pictorial experience.

B. Respondents

We plan to follow the procedures of shuffling sampling technique. We will collect Fixation (eye movement's data) from eight students, three female and five male aged from 23 to 32 years old in University of Malaya. Respondents will be asked to focus their gaze when watching movie which has totaling approx. (3.13 min). Clip namely Tajwal will present in three scenes: war, resistance and the gender.

C. Experiment Setup

The visual attention through human eye movement will be recorded using an infrared video- based remote eye tracker (Tobii T60) system and Tobii studio software suite to capture and analyze the spectators' experience when watching Tajwal movie, "fig 2". Respondents will be asked to watch Tajwal clip and focus their gaze in three test trails totaling approx. (3.13 min). The viewing distance between the respondents and the center of the track box will set to (65 cm) from the eye tracker. Stimuli (Tajwal clip: gender, war, and resistance) will collect from YouTube and store at (60 Hz) on the native TFT screen (1280 × 1024 pixels). First, the researcher will take the gender, age, background information for each one, and then they will be asked to move their gaze on the calibration points. Second, they will be asked to focus their gaze on the three scenes when watching movie.

D. Visualization Process

It depends on the research design through the following techniques, "fig. 3":

a. Orientation vs. (VAF) Shape: Bee Swam tool is used to display the coded dot of a fixation for all the participants at the same time in different colors. It will use to identify the shape element of (VAF) based on the visual view of dotes distribution, and the total number of participants at N > 0.5 in order to decide of using geometric or organic shapes.

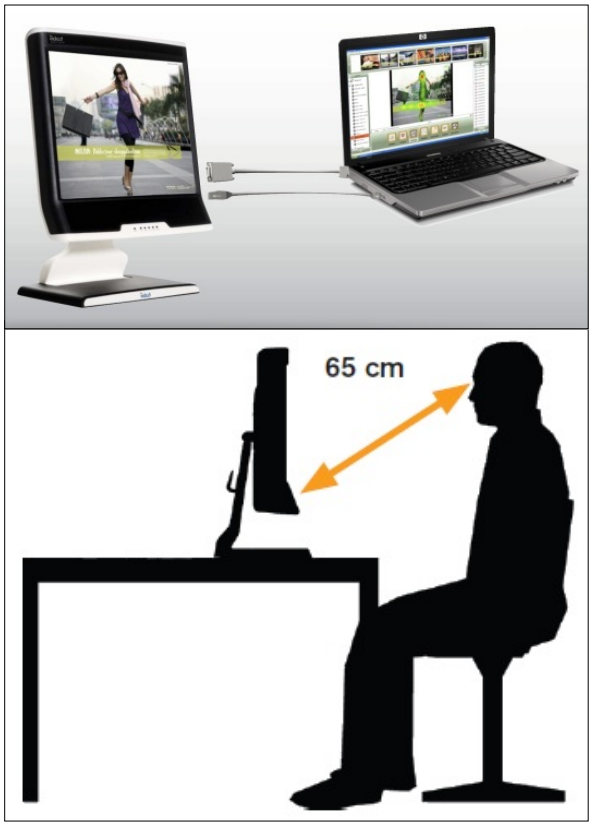

Fig. 2 Tobii hardware, Software and experiment setup

b. Selected location vs. (VAF) line: Gaze Plot tool is used to display with dot the single view, order of fixation by numbers, and the length of the fixation for each image by each participant. It will use to identify the line element of (VAF) through the feature of location based on plot's direction, and the feature of weight based on plot's order numbers.

c. Time& motion vs. (VAF) motion form: also, gaze plot will use through the (RT) numbers sequence and the segment technique to select 6 frames (one each ten second) of each scene in order to identify motion.

d. Spotlight vs. (VAF) Color and Value: Heat map tool is used to visualize the behavior of gaze. It consists of transparent background with the highlighted areas of attention. Heat map will use to identify color type of (VAF) for the three senesces based on the area of interest method (AOI) by fixation amount, fixation length through combining the result of gaze with the color theory wheel by Robert Plutchik. Also, it will use to identify the value tones of (VAF) based on the time stamp, duration, and the principles of spotlight model of attention: Focus, fringe, and margin.

e. Cluster vs. (VAF) form and space: Cluster tool is used to display the graphic representation with a high attention of fixation clusters on the background. This tool will use to identify the motion, form, and space of (VAF).

f. Intensity vs. (VAF) Texture: area of interest (AOIs) tool provides the tables and graphs of attention data after selecting the regions of interest. The researcher will use AOIs to estimate the custom data of attention based on selecting the body area and will define the texture through Intensity based on visit duration results.

III. STATEMENT OF SIGNIFICANCE

This study could be as an alternative source of an innovation and creation that provide a new technique of painting. It represents objects such motion, time, and attention from invisible meaning into a self-visible experience through using hybrid methods by scientific and artistic approaches. Therefore, this study will carry benefits to the following:

a. Visual artists and Designers, students and scholars
b. Neuroscience and vision scholar
c. critics and philosophers
d. psychologists

IV. CONCEPTUAL FRAMEWORK

The conceptual framework of this study is the hybrid (VAF) model which based on the combination between two theories, spotlight attention theory by William James, and aspect-recognition theory of depiction by Lopes.Spotlight attention theory will use to identify the attention features, which are spotlight (focus, fringe, and margin), motion, Intensity, color, location, cluster, responds time (RT) and orientation. And aspect- recognition theory of depiction will use to identify and describe the properties of depiction in pictorial representation. The pictorial properties of that will be used based on the theory are pictorial references, information based identification, constraints on thought, pictorial aspects, pictorial systems, pictorial recognition, pictorial meaning, and pictorial experience. The hybrid (VAF) model components illustrated in "Fig 4".

V. CONCLUSION

The expected outcome of this proposed study is 2D and 3D installation artwork which planned to hold it in Art Expo Malaysia fair. It will transfer a new concept of self- visual attention for public experience toward performance art. The procedures of this study will orient visual artists, painters, critics to borrow unfamiliar tools to explore the invisible objects in this world in deeply examination.

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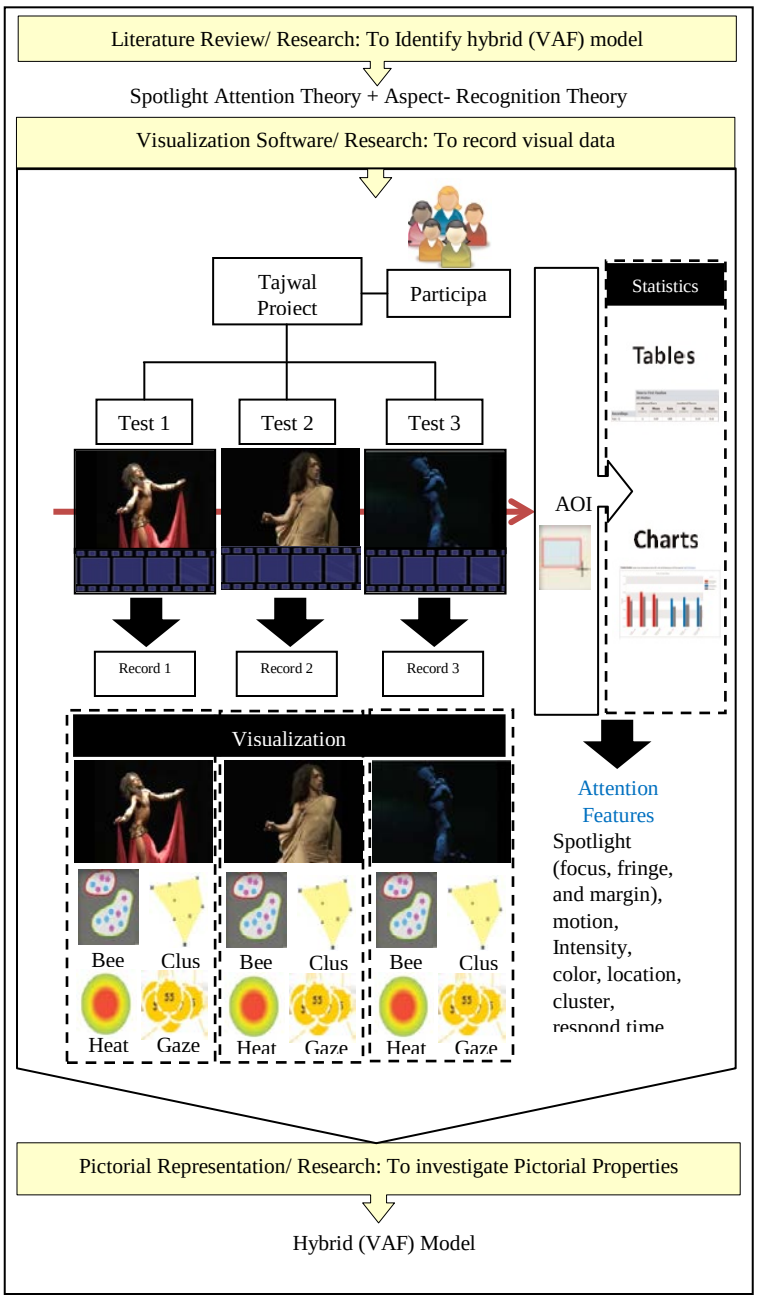

Fig.3 Research Design and Methods

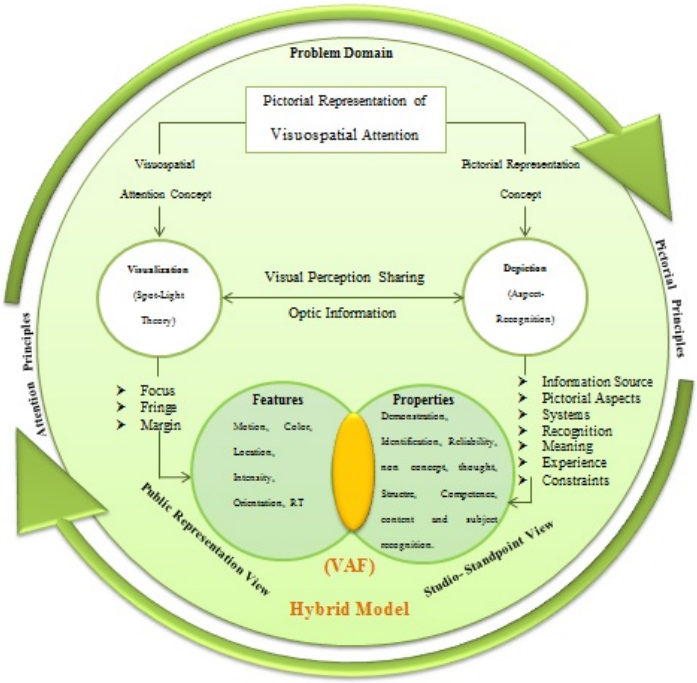

Fig.4. Conceptual Framework

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REFERENCES

[1] B. Katerina. "The Opticality of Pictorial Representation." *Journal of Aesthetics & Art Criticism* 66, no. 2 (2008): 183-192, published.

[2] D. J. Berg, S. E. Boehnke, R. A. Marino, D. P. Munoz, and L. P. Munoz. "Free Viewing of Daynamic Stimuli by Humans and Monkeys." *Vision Research* 9, no. 5:19 (2009): 1-15, published.

[3] C. C. Ondine, "Orphans of Modernism: Chicano Art, Public Representation, and Spatial Practice in Southern California." Ph.D., The University of Rochester, 2002.

[4] C. Hilary, *Creative Research: The Theory and Practice of Research for the Creative Industries*. Switzerland: AVA Publishing SA, 2010.

[5] D. John, "A Representational Theory of Artefacts and Artworks." *British Journal of Aesthetics* 41, no. 4 (2001): 353, published.

[6] D. S. Howard, "The Image Incarnate: On the Documentary Representation of Painting in Film." Ph.D., The University of Iowa, 2000.

[7] S. L. Feagin, "Presentation and Representation." *Journal of Aesthetics & Art Criticism*, Summer98 1998, 234, published.

[8] I. Sherri, "Artworks and Representational Properties " *Dialogue* 43, no. 2004 (2004): 627-644.

[9] L. Itti, and P. Baldi. "Bayesian Surprise Attracts Human Attention." *Vision Research* 49, no. 10 (2009): 1295-1306, published.

[10] Chi Kei Solly. LEUNG, "Explaining Depiction: Recent Debates in the Philosophy of Pictorial Representation " Lingnan University 2009.

[11] L. A. Linnell, "Exploring the Experience of a Place through the Visual Representation of Aural Presence." RMIT University, Melbourne 2010, published.

[12] J. Malins and C. Gray Appropriate Research Methodologies for Artists, Designers & Craftspersons: Research as a Learning Process. Available: http://carolegray.net/Papers%20PDFs/cc.pdf

[13] M. Michelle, "The Pedagogy of Space: Visual Representation of Place in Contemporary Art." M.F.A., University of Southern California, 2003.

[14] R. Mark, "Pictorial Representation: When Cognitive Science Meets Aesthetics." *Philosophical Psychology* 12, no. 4 (1999): 387-413, published.

[15] T. Massimo, and G. Galfano, "Color, Form and Luminance Capture Attention in Visual Search." *Vision Research* 40, no. 13 (2000): 1639-1643, published.

[16] V. Johan, "Reconsidering Pictorial Representation by Reconsidering Visual Experience." *Leonardo* 41, no. 5 (2008): 493-497.

[17] W. Richard, "On Pictorial Representation." *Journal of Aesthetics & Art Criticism*, Summer98 1998, 217, published.

[18] N. H. M. Zain, F. H. Abdul Razak, A. Jaafar, and M. F. Zulkipli, "Eye Tracking in Educational Games Environment: Evaluating User Interface Design through Eye Tracking Patterns." In *Proceedings of the Second international conference on Visual informatics: sustaining research and innovations - Volume Part II*, 64-73. Selangor, Malaysia: Springer-Verlag, 2011, published.

A Tutorial Based Learning Model (TBL) for Engineering Students: the best they can get

Dr. Bhawani Shankar Chowdhry, Syed M. Zafi S. Shah, and Syed M. Z. Abbas Shah

Abstract*—Problem Based Learning (PBL) has proved to be a successful method in improving student knowledge retention and understanding. However, the implementation of PBL puts stress on resources in terms of teaching staff and lab usage which is a hindrance for the participating students. In this paper we present the results of an experiment conducted for the implementation of a Tutorial Based Learning model which can be incorporated in to a scenario where the number of students is large (>100) and resources are limited which is very much the case in developing countries. The experiment involved four modules taught at the undergraduate course in Electronics Engineering at Mehran University of Engineering and Technology, Pakistan. A total of 120 students were divided in to four sections each consisting of 30 students. Each section was further divided in to groups of 6 students each. Two hour Tutorial Based Learning (TBL) sessions were conducted for each section on different courses each week in which a particular problem/topic was discussed. The students were asked to present the deliverables of the problem on the completion of the program. At the end of the experiment which ran for one semester, results showed a marked improvement in the student grades for the courses involved in the experiment and increased student participation in classes.*

***Keywords*—**Electronic Engineering, Problem Based Learning, Tutorial Based Learning.

I. Introduction

DEVELOPING countries face the challenging task of providing quality education to students with limited resources in terms of teaching staff and equipment.

After the introduction of PBL in Maastricht University, Maastricht, The Netherlands [1], it has been implemented in several scenarios [2]-[4]. The PBL involves teacher to act in a facilitating role instead of a tutoring role and allow the student to explore some decided aspect of his field of study [5].

The authors in [6] and [7] discuss a PBL implementation in which the Problem Based Learning is preceded by course lectures for Electronic Engineering [6]. This approach is said to have provided the student exposure to both conventional style learning as well as solving real problems. However, such practice has the disadvantage of students moving between two very different forms of learning.

The authors in [8] provide their observations on the implementation of a PBL system for the teaching of Wind Energy Conversion Systems for a Masters Degree. First, the theoretical background of wind turbines was provided to the student in taught lectures followed by a PBL section. The PBL involved providing the students with a virtual simulation of a wind turbine and its inherent systems as well as a real physical system. The students were then asked to analyse the two systems to develop an understanding of the two and determine experimental integrity. It was found that the students performed well on the virtual analysis part of the PBL implementation but did not receive well the real time analysis. This method, like [5], [7] has the disadvantage of presenting the student with a dramatic change in the learning method.

The authors in [9] discuss the impacts and the observations from PBL courses in various fields. It was found that the PBL based courses exhibited higher student attendance as compared to conventional lecture style classes. This has been shown to support the theory that PBL provides a practical understanding of the theoretical concepts and thus is a motivating factor for student involvement. It was also found that PBL courses had improved the problem solving skills of the students as determined through exercises. It was concluded that students favoured a PBL based setting because of its learning benefits and understanding of theoretical concepts.

However, the implementation of PBL has encountered problems [10], [11] in terms of students behaviour, workload on the students as well as the instructors involved, the behaviour of the instructors as to the extent of help to be provided to the students, the required resources and the number of students involved in the program.

In order to try and overcome some of the mentioned problems, in this paper, we present a learning model that incorporates theoretical understanding with practical real world problem solving. The second section presents a description of the system model, the third section gives the methodology of our implementation and the fourth section presents and discusses the results. The paper is concluded in the fifth section which also presents potential areas of further study.

II. System Model

TBL system was implemented for four out a total of five courses taught during the second year of the undergraduate program of BEng. Electronics Engineering at Mehran University of Engineering and Technology, Jamshoro, Pakistan. Three courses were related to core Electronics

Engineering, namely Measurement and Instrumentation (MI), Amplifier and Oscillators (AO) and Digital Electronics (DE) whereas the fourth course was on engineering mathematics called Differential Equations and Fourier Series (DEFS). All of the courses were previously taught in a traditional lecture/exam setup, however, for the experiment, in addition to theoretical lectures separate TBL sessions were scheduled every week. Apart from the outcomes of the course as a whole, the targeted outcomes of the experiment were to:

a) Enhance student learning
b) Develop interpersonal and discussion skills
c) Trigger cognitive thinking for practical problem solving

The experiment was conducted over the span of one semester (13 weeks) in 2013. A class consisting of 120 students was divided in to four sections of 30 students. Each section was assigned a supervisor. The supervisor was responsible for facilitating the students in matters relating to understanding of the problem and logistical issues**.** Furthermore, 5 subgroups were formed within each section such that each subgroup consisted of 6 students. It was ensured that each subgroup consisted of at least one student from the top six students of the section as determined from previous examination results. A problem comprising of three stages was devised for each course included in the experiment. Every week, a two hour TBL session was organised in each section for one of the four courses in which students were provided a description of a case study. Students were instructed to organise subgroup meetings and submit a report on the work progress during the TBL sessions. At the end of every month, students were introduced to a new aspect of the case study. Finally, students were required to deliver presentations on their understanding of the case study.

III. Methodology

A. Measurement and Instrumentation

The course on Measurement and Instrumentation is designed to introduce the basic principles of instrument operation and measurement systems to the students. It aims to provide the students with the skills required to be able to conduct measurements of physical parameters and interpret them. It also provides the students with an understanding of functionality and principles of commonly used instruments.

B. Amplifiers and Oscillators

The course on Amplifier and Oscillators aims to provide the student with skills necessary to develop analogue circuits for tasks such as signal conditioning, communication systems and to gain an insight in to the various methods employed to accomplish certain analogue functions using discrete components.

C. Digital Electronics

This course serves as the foundation course for digital system design for applications. It involves the study of the various aspects of digital circuit design and study of the functions of common combinational and sequential digital circuits. It also provides an insight in to the characteristics of the different technologies available in the digital electronic industry.

D. Differential Equation and Fourier Series

Differential Equation and Fourier Series is a course designed to introduce the student to the application of differential equations to formalising problems in electronic circuit analyses. It also provides the student an understanding of basic Fourier principles and the concept of decomposition using Fourier series.

For each course, the devised problem was broken down in to three stages in increasing order of complexity, each requiring a different set of deliverables to be satisfied. The first stage of the problem for each course related to review of the available literature so that students can familiarise themselves to the case study being considered. The second stage of the case study consisted of a task to describe the dependency and requirements of system components. The third and final stage was a set of specification parameters in a problem scenario for which each subgroup was instructed to produce a solution and provide justifications for their design. Regular theory lectures/Lab sessions were conducted alongside the TBL sessions during the semester.

IV. Results

These students were evaluated in written exams conducted at the end of the semester and for the solutions developed for the assigned case studies. Several factors are provided in [12]-[14] for taking in to consideration when assessing the effectiveness for a problem based learning program. However, there is no agreed gauge on testing the success or failure of a program. In order to incorporate the diverse testing criteria advised by authors and provide a broad insight in to the results from various sides, we used three metrics to examine the efficacy of our model. The first metric was an analysis of the performance of the students in exams and the report on the problem, the second and third was a survey conducted from the students and the staff involved in the program. We present in this paper a summary of our findings.

A. Student performance

Student performance was analysed based on the reports produced in the TBL sessions and the results of the exams appeared in for each of the courses. Three measures have been considered for inspecting student performance. The first indicator we use is the comparison of the average marks for each course with and without TBL. Fig. 1 shows the average marks (rounded to the nearest integer) scored for each course during the year TBL was implemented (2013) and the year prior to TBL implementation (2012).

It can be observed from Fig. 1 that the largest improvement of 19.75% was observed for the course DEFS. This can be possible due to the fact that TBL included mathematical application to practical electronic problems which provided a direct insight in to application of the mathematical principles

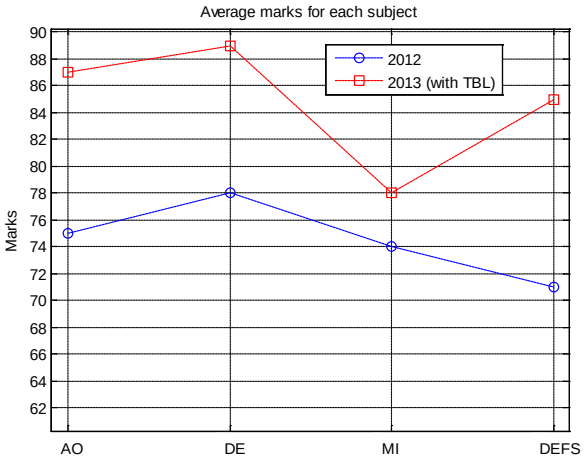

Fig. 1: Average marks for each course

rather than an abstract mathematical understanding. It was also observed that the course MI showed the least improvement that is 5.45%. The possibility for this stems from the fact that this course already required a significant amount of laboratory based work in the previous year, since TBL also emphasises on practical understanding, a relatively small improvement was observed.

The second gauge that was used is the number of failures in these courses for the two years. This was chosen so as to ascertain the uniformity of the improvement as average marks can be misleading when considering the performance of individual samples. Fig. 2 shows the number of failures in the courses for the year 2013 and 2012. It can be seen that the number of failures reduced significantly in DEFS which is supported by the average increase in marks. The least reduction is seen to occur in MI which is again corroborated by the fact that the course had a considerable amount of practical work involved in the previous year.

Fig. 3 provides a comparison between the number of students of the same class who failed at least one course in the semester prior to the introduction of TBL. It can be observed that with the implementation of TBL, the number of failures has been reduced by 10.

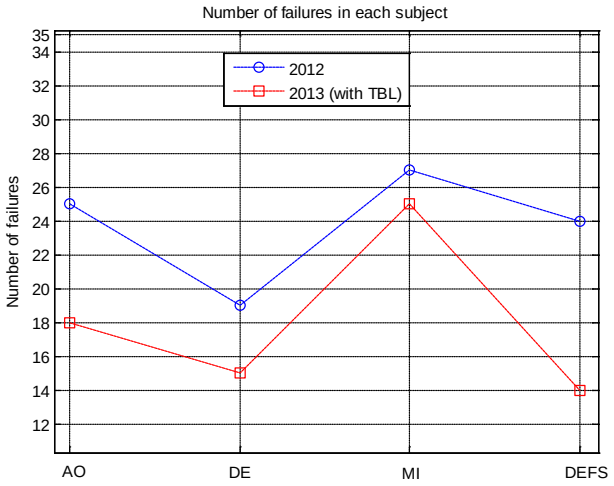

Fig. 2: Number of student failures for each course

B. Student Feedback

Upon the conclusion of the semester, all 120 students were asked to participate in a survey which was used to determine the perspective of the students on the program. The survey consisted of questions relating to various aspects of the TBL

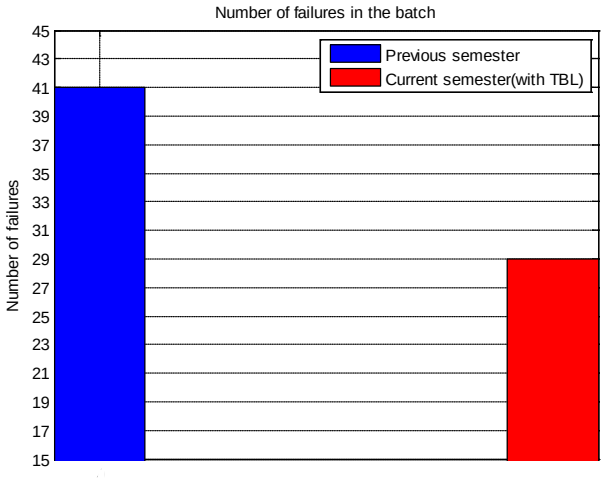

Fig. 3: Number of failures in 2013 and 2012

implementation. The questionnaire used in the survey and the student response is presented in Table 1.

It can be observed that the TBL program has been well received by the students with a significant majority being satisfied with it. A further area of interest is the student impression on the increased amount of work and the time management involved in the completion of the tasks. Nearly half the students found the increased amount of work to be manageable; however, the time given to the students for completing the tasks was found to be problem with 45% indicating so. The fact that the increased work load was manageable can be explained from the fact that the students

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were attending classes for the selected modules and thus were getting an insight to the general field of study. This is evident from the fact that 68% of students supported this aspect of the program and found it to be helpful. The problems on the management of time can be mitigated by changing the extent of the problem depth.

Another aspect to look upon is the student perception on the technical content of the program. The problems assigned to students were of open nature so as to enable to students to develop different approaches to the same problem and be able to devise solutions. This was well taken as shown by the high acceptance of the problem context. This is corroborated by the improvement in the performance of students in the module exams. Feedback was also taken on the management of resources and the support provided by teachers. Due to the tight schedule of the class timetable, making the resources available for students was a considerable challenge. However, as seen from Table 1, resource allocation was sufficiently provided for all students. This depends heavily on the nature of the tasks formulated for the courses involved. The tasks in this program required the use of computers and hardware equipment which was easily available. Teacher support for the tasks was limited to getting updates from students on current progress. As seen from the Table 1, the students were satisfied with the support the teachers provided during the program.

Table 1: Student Questionnaire and responses (N=120)

S No.	Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	Overall Satisfaction with course model	33(28)%	53(44%)	30 (25%)	04(3%)	00
2.	The amount of work was manageable	07(6%)	43(36%)	45(38%)	24(20%)	01(<<1%)
3.	Time management was a problem	19(16%)	35(29%)	47(39%)	15(13%)	04(3%)
4.	Context of problem was understandable	27(23%)	61(50%)	24(20%)	08(7%)	00
5.	Like to work in a team	81(68%)	26(21%)	13(11%)	00	00
6.	Studying course material was helpful in providing an insight in to tasks	37(30%)	45(38%)	29(24%)	09(8%)	00
7.	Teacher support was sufficient	40(33%)	58(48%)	21(18%)	01(<<1%)	00
8.	TBL has helped developed practical understanding of subject	37(31%)	65(54%)	18(15%)	00	00
9.	Resources provided were well managed	24(20%)	79(66%)	17(14%)	00	00

C. Teacher Feedback

Along with conducting a student survey, the participating faculty members were also asked to provide details of their experience during the program. Unlike the students, however, the feedback required elaborate answers on two aspects of the program, the design of the curriculum which involved planning the tasks along with the taught modules and the sessions with the students. The other was the increase in workload.

The tasks to be designed for the TBL sessions were meant to provide students with an outlook of problem solving and management skills required in a real world scenario. This involved surveying projects from various sources, breaking them in to tasks, downscaling them to be completed within the given time duration and deciding the deliverables for each part of the task. This increased work load of the teachers significantly and proved to be a tedious task. Ensuring that the problem was open enough to be carried out using different approaches also required careful consideration from the point of teachers.

V. Conclusion

In this paper, we highlighted the observations from the implementation of a Tutorial Based Learning methodology developed at Mehran University of Engineering and Technology. The methodology provides an opportunity for universities to provide their students with practical as well as theoretical knowledge. Implementation of the model was found to have improved student grades in the respective courses with the most significant improvement being observed in the areas containing significant mathematical content. Student feedback showed that the students were comfortable with such a learning system as it helped them with their courses. Furthermore, since the tasks were of familiar nature due to the support provided by the course study, grade anxiety [15], [16] was not complained by any of the students. Teacher feedback provided an insight in to the challenges that faculty members have to encounter in formulating tasks for such a program.

Finally, the TBL has shown promising results in light of improvement of student performance in our courses. However, more research needs to be carried out in understanding the long term impacts of such a module especially in the area of the skills of teamwork and management that students can potentially develop which are of interest to employers, the effect of increased workload and the formulation of tasks for such as system is also something that needs to be further studied.

References

[1] H. S. Brown, " A specific problem-based, self-directed learning method designed to teach medical problem-solving skills, and enhance knowledge retention and recall " *Schmidt HG, Devolder ML, editors. Tutorials in problem-based learning: A new direction in teaching the health professions*, pp. 16-32, 1984.

[2] Wood, D, *ABC of learning and teaching in medicine*, J. Wiley and Sons, 2010.

[3] Yadav, A., Subedi, D., Lundeberg, M. A., & Bunting, C. F, " Problem-based Learning: Influence on Students' Learning in an

Electrical Engineering Course " *Journal of Engineering Education*, vol. 100, no. 2, pp. 253-280, 2011.
[4] Chang, L. C., & Lee, G. C., " A team-teaching model for practicing project-based learning in high school: Collaboration between computer and subject teachers" *Computers & Education*, vol. 55, no. 3, pp. 961-969, 2010.
[5] M. A. Albanese. *Problem-based learning* . Netherlands: Springer Netherlands, 2010.
[6] J. E. Mitchell and J. Smith., " A case study of the introduction of problem-based learning in electronic engineering " *International Journal of Electrical Engineering*, vol. 45, no. 1, pp. 131–143, 2008.
[7] J. E. Mitchell, J. Smith. and A. J. Kenyon, " It's not for lazy students like me…," *International Journal of Electrical Engineering*, vol. 42, no. 1, pp. 41–51, 2005.
[8] Santos-Martin, D.; Alonso-Martinez, J.; Eloy-Garcia Carrasco, J.; Arnaltes, S., "Problem-Based Learning in Wind Energy Using Virtual and Real Setups," *Education, IEEE Transactions on* , vol.55, no.1, pp.126,134, Feb. 2012
[9] A,Klegeris, & H,Hurren, " Impact of problem-based learning in a large classroom setting: student perception and problem-solving skills " *Advances in physiology education*, vol. 35, no. 4, pp. 408-415, 2011.
[10] W. Hung, " Theory to reality: A few issues in implementing problem-based learning " *Educational Technology Research and Development*, vol. 59, no. 4, pp. 529-552, 2011.
[11] Mitchell, J.E.; Canavan, B.; Smith, J., "Problem-Based Learning in Communication Systems: Student Perceptions and Achievement," *Education, IEEE Transactions on* , vol.53, no.4, pp.587,594, Nov. 2010
[12] C. H Majo and B, Palmer, " Assessing the effectiveness of problem-based learning in higher education: Lessons from the literature " *Academic exchange quarterly*, vol. 5, no. 1, pp. 4-9, 2001.
[13] M. Eliot and P. Howard, " Instructor's considerations for assessing individual students' learning in team-based coursework."*In: Australasian Association for Engineering Education Conference 2011*
[14] M.S Baden and C. H. Major, ,*Foundations of problem-based learnin,*: McGraw-Hill International, 2004.
[15] S. A. West, " Objectives in response to students' uncertainty in a pre-clinical problem-based learning curriculum " *Educational Health*, vol. 11, no. 1, pp. 343–347, 1998.
[16] G. D. Hendry, G. Ryan, and J. Harris, "Group problems in problem-based learning," *Med. Teacher*, vol. 25, no. 6, pp. 609–616, 2003.

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