Research Article
The Study of Enhancing the Quality of Education via Virtual Learning Environments

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Abstract: The objective of this study is to analyze the relationship between students' variables such as age, sex, IT skills, work situation and previous experience in virtual courses and their perception about the quality in terms of satisfaction and perceived learning of a course given in a VLE. In general, the changes taking place in the field of technology have brought about a number of challenges to guarantee a quality education which responds to current needs. This makes us ask whether traditional education can respond to these needs or whether nevertheless it is necessary to develop new learning environments such as Virtual learning Environments (VLEs). Regarding this, the objective of this study is to analyze the relationship between student variables (age, sex, IT skills, work situation and previous experience in virtual courses) and their perception about the quality (in terms of satisfaction and perceived learning) of a course given in a VLE. For this purpose, 215 students studying or have graduated from Payame Noor University in Tehran students including graduate and postgraduate students were participated. All of them had some experience in VLE. In order to collect data, the questionnaire designed by Ponzurick *et al*. (2000) was used. The results showed that there is no significant difference between male and female on perceive learning in a VLE. Further, age can play a role on perceived learning in a VLE. The least satisfied students are those between 18 and 24 while the most satisfied are 35 or older. Also, prior students experience with VLEs does not influence on the perceived learning by the students. Further, students who work perceive a greater learning and are more satisfied than those students who do not work. Finally, the students from postgraduate courses were those who perceive most learning and who gain most satisfaction. The conclusions of this study suggest some interesting directions for future training actions carried out in VLEs.

Keywords: Educational quality, traditional education, VLE

INTRODUCTION

At present we are confronted by a series of social, economic and technological changes brought about by the eruption of the so called Information and Communication Technologies (ICT).

In business these changes cause a considerable growth in competition and either new skills or a more efficient use of existing skills are required to cope with this. On the other hand, these changes bring about an equivalent number of challenges to guarantee a quality education which responds to current needs and which at the same time should not be distanced from those technologies which are increasingly accessible and user friendly to the man in the street. This makes us ask whether traditional education can respond to these needs or whether nevertheless it is necessary to develop new learning environments such as Virtual learning Environments (VLEs).

Given this situation, our study focuses on analysing the use of VLEs as a medium for guaranteeing and improving the quality of education in such a way that knowledge, the principal factor in current economy, is boosted and society's needs are responded to.

Knowledge, learning and quality: Knowledge has become the most important resource in current economy dominated by TICs and its adequate management in the corner stone of the management of the most competitive companies and organizations.

Drucker (1994) argues that in the modern economy, knowledge is the most important resource-more than labour, capital and land-and, indeed, the only meaningful resource today. The organization that wishes to cope dynamically with the changing environment needs to be one that creates knowledge not merely processes it efficiently (Gore and Gore, 1999). Maestre (2000) defines knowledge management as a "collection of procedures, rules and systems which aim to capture, treat, recover, present and transmitdata, information and knowledge of an organisation". It is composed of a series of sub processes:

- Creation of knowledge
- Distribution and diffusion of knowledge
- Measurement of knowledge

On the other hand, the majority of the theorists of Total Quality Management (Deming, 1982) have

argued that acquisition and development of knowledge will allow a successful strategy of quality. Lim *et al.* (1999) propose an adaptation of the PDCA (plan-do-check-act) cycle of continuous improvement of Deming to allow knowledge management to be an integral part of the quality strategy of an organization. The steps are as follows:

- Capture and create knowledge
- Share or distribute knowledge
- Measure the effects
- Learn and improve

There exist numerous definitions of the term quality which cover any number offacets. Generally, they can be classified in two principal categories: definitions that are based on conforming to certain specifications and definitions based on client satisfaction (Hoyer and Hoyer, 2001). Juran and Gryna (1995) transfer these two conceptualizations to the field of education comparing it to a productive activity: Educational centers start with a raw material (students), they apply a process (teaching) and they obtain a final product (graduate) in accordance with the specifications (course programme and methodology) and certain process controls (exercises, examinations, etc). This focus thus coincides with the first category of definitions and refers to the student's academic performance. On the other hand, Moonen (1997) considers that outputs (learning) on the one hand and outcomes (student satisfaction) on the other are obtained.

As shown by Deming's cycle, evaluation is an essential component within a quality improvement programme. Kirkpatrick (2004) has developed a training evaluation model that includes four levels or steps of outcome evaluation:

- Reaction
- Learning
- Behaviour
- Results

Given that levels 1 and 2 are more directly related to the two quality categories, we have looked at and are most widely used in companies in this study we will center on those two levels.

E-LEARNING

Traditionally, distance learning has been considered as an alternative to the traditional classroom classes and has not been capable of substituting these due to a number of difficulties. Many attempts have been made to solve these problems and these attempts have been milestones of the major steps in distance learning. The last of these has been produced thanks to the introduction of ICT in education living rise to e-learning which can be defined as: Teaching supported by information and communication technologies in which it is not necessary for there to be a physical meeting of teachers and students and whose objective is to facilitate a flexible (at any time and place) interactive (with synchronous and asynchronous communication) and student- centered learning. Likewise, a virtual learning environment is considered to be the framework in which e- learning is developed.

Following Hannun (2001) we can classify characteristics of e-learning as:

- Logistic aspects (independence of space, time and device; easy distribution; ease of content update, etc)
- Instructional aspects (interaction, the possibility of personalisation, student's own control, collaborative learning, etc)
- Economic aspects (reduction of costs and scalability)

One must take into account that for an institution or company to be able to offer training via internet, certain soft wares are necessary which pending on to how complete it is it is generally called LMS (Learning Management System) platform. The current LMS market is known for being:

- Fragmented
- Functions of platforms are increasingly similar
- Platforms of own development will be the less important both in the short and in the long term
- In some countries there exists a tendency to use open source LMS

On the other hand, a new generation of LMS called LCMS (Learning Content Management Systems) is making its presence felt. LCMS are used for creating, storing, assembling and distributing personalised e-learning contents under the form of learning objects. While for LMS the basic minimum unit of instruction is the course itself for LCMS, the training is organised around its components: learning objects are selected and are distributed within a specific sequence according the users individual requirements (Brennan *et al.*, 2001).

After a hesitant and insecure beginning, e-learning rose significantly in all countries and then suffered a period of failure and bankruptcy for some enterprises. That was followed by a stage of growth of the market, slow but safer and more mature (ICT, 2004).

Throughout 2003, the e-learning market grew by 7% reaching 800 million euros in 2004. Forecasts indicate an annual growth of more than 20% from 2004 to 2008 and that 2000 million euros will be reached in 2008.

Initiatives to impulse e-learning are numerous such as the *Global* Virtual University which is established by the United Nations University (UNU), the "e learning-Designing Tomorrow's Education" programme adopted by the European Union in2000 or the National Education Technology Plan by the government of the United States.

The future of e-learning is characterized by greater important given to contents, by an increase in blended-learning, by the extension of m-learning or mobile learning, by the nurturing of e-learning for all (thanks to initiatives such as open source LMS, the Open Course Ware Project by the MIT or the napsterization of learning) and by the appearance of new models of Universities.

Development of an improved virtual learning:

- **Environment (IVLE):** Although it is certainly true that e- learning provides some advantages with respect to traditional teaching, one should not relieve that e-learning is a panacea. With the aim of achieving a higher quality in education it is evident that one must take advantage of the options which e-learning offers to use tools that favour learning, which are in some cases difficult to use in the Traditional Learning Environments (TLEs).

With this aim the following tools are proposed: Concept Maps and Learning Styles.

- **Concept maps:** Concept Maps, developed by Novak in 1975 are based on Ausubel's Meaningful Learning Theory (Ausubel, 1968). This theory posits that new knowledge can be learned most effectively by relating it to previous existing knowledge. Meaningful learning has the advantage that it facilitates the acquisition of new knowledge and that the learnt materials can be retained significantly longer than those learnt by rote (González *et al.*, 2000). Concept Maps are graphical representations of knowledge that are comprised of concepts and the relationships between them (Novak and Gowin, 1988). They can be used as:

- **A tool for support of learning:** To examine students' knowledge (Hoz *et al.*, 2001), to identify specific misconceptions in knowledge (Gonzalez, 1997) and to identify alternative educational approaches to address misconceptions (Passmore, 1998) and in cooperative learning (Baroody and Bartels, 2000).
- **A tool for assessment of learning:** The traditional method of Concept Map scoring was proposed by Novak and Gowin (1988) and is based on the components and structure of the Concept Map.
- **A tool to organize and present information:** A Concept Map can be used as an advance organizer

(Novak and Gowin, 1988) showing a global overview of the material that is to be learned helping students to overcome the distance between the knowledge that they possess and the new knowledge that they should learn. On the other hand, these can also be employed in multimedia formats including links to educational materials associated with the various subjects or concepts such as navigation maps (Nilsson and Mayer, 2002).

Concept Maps also have utility in business and organizations in general. To the degree that these entities carry out education and training of their personnel, educational applications are pertinent as well (Cañas *et al.*, 2003). Furthermore, Concept Maps can be used for knowledge capture, for obtaining the knowledge that an organisation may wish to preserve and share with others.

Learning styles: The term Learning Styles refers to certain specific cognitive strategies people prefer and which could more specifically be defined as ways of recompiling, interpreting, organising and thinking about new information (Gentry and Helgesen, 1999). We should consider that if we design a student centered teaching the theories of Learning Styles should seriously influence the Teaching Styles. Teaching Style has a significant influence on students. In the opinion of Alonso *et al.* (1999) one does not aim to accommodate the preferences of each and every student in each and every occasion given that this would be impossible in a traditional class. Nonetheless the difficulties that are considered for the adaptation to Learning Styles of all the students in a TLE could be overcome in a VLE.

A considerable body of studies on academic achievement and Learning Stylesexists which confirm this relationship between different education levels: primary education, secondary and higher as also in the business field (for example, Tannenbaum, 1982). Thus, we can consider that there is sufficient evidence that students learn more effectively when they are taught using their predominant Learning Styles.

Creating an IVLE: Having described e- learning, Concept Maps and Learning Styles, we propose the design of an Improved Virtual Learning Environment (IVLE*)* which combines those three elements to bring together the benefits that each has individually.

To create an IVLE it is necessary to firstly design and develop educational materials specially conceived for a virtual learning environment. To achieve this, criteria for web design should be followed which includes technical or graphic design aspects and of content design which includes aspects related to the design and structure of the contents themselves and the inclusion of Concept Maps such as navigation maps and

information organizers. Finally, the contents that have been designed should be adapted to the varying Learning Styles following indications by Money and Mumford (1995).

Once these specially adapted materials have been created, it is necessary to distribute them via a tool which allows each student to receive a personalised course according to their preferred Learning Styles. To do this, the philosophy of the 3DE (Design, Development and Delivery Electronic Environment for Educational MultiMedia) *sy*stem, a research project within the European Union IST 5th Framework Programme headed by the Politecnico di Torino (Italy), has been followed. This system follows the idea of aLCMS selecting and distributing the subjects, using in this case the criteria of each student's preferred Learning Styles. Thus 3DE pedagogical approach is based on changing the teacher-learner relation from the 1-to-N paradigm - one teacher for many learners, as in standard classrooms - or 1-to-1, as in computer based environments where each learner has access to a virtual teacher, towards a N-to-1 model: The learner can select among several available teachers the one who best suits his learning style (Saarikoski *et al*., 2001, as cited in Nilsson and Mayer, 2002). The system organises the contents hierarchically according to the following elements (Del-Corso *et al*., 2002): learning object (an elementary resource, such as a text or a drawing), micromodule (an elementary, logically indivisible learning unit), theme (a co-ordinated sequence of micromodules according to the defined prerequisites) and course (a sequence of assembled themes).

Objective of the study: The objective of this study is to analyze the relationship between student variables (age, sex, IT skills, work situation and previous experience in virtual courses) and their perception about the quality (in terms of satisfaction and perceived learning) of a course given in a VLE. At the same time we aim to analyse other variables that can influence in student perception such as type of subject and class size.

Hypotheses: Based on the above objective, the following hypotheses were framed:

H1: There is no significant difference between male and female on satisfaction in a VLE
H2: There is no significant difference between male and female on perceive learning in a VLE
H3: Age cannot play any significant role on satisfaction in a VLE
H4: Age cannot play any significant role on perceived learning in a VLE
H5: There is no significant difference between those having prior experience on satisfaction in a VLE and those who do not
H6: There is no significant difference between those having prior experience on perceived learning in a VLE and those who do not

H7: In a VLE students who work perceive a greater degree of learning than those who do not
H8: In a VLE students who work are more satisfied than those who do not
H9: In a VLE postgraduate students perceive greater learning than undergraduate students
H10: In a VLE postgraduate students are more satisfied than undergraduate students

METHODOLOGY

Participants: An analysis has been carried out of various courses given in a VLE in which the researchers work at the same time as teachers. This analysis has been carried out at a quantitative level. In this study, 215 students studying or have graduated from Payame Noor University in Tehran students including graduate and postgraduate students were participated. All of them had some experience in VLE. The average age was 32 years for graduate students and 24 for undergraduate students.

Research methods: For the purpose of this study, only those students having experience in virtual learning environments were randomly selected.

A survey was used to collect data. Some of the participants were asked to fill out the questionnaire while it was carried out by e-mail for others which guaranteed the anonymity of the surveyed people.

In the questionnaire, some of the questions were related to the students achievement measured in terms of perceived learning by the student and another with the satisfaction. To measure perceived learning, the Richmond *et al*. (1987) tool has been employed whereby students should respond to one question only: On a scale of 0 to 9 how much have you learned on this course? A grade equal to 0 means that nothing has been learned while 9 means that the student has learned more than on any other course that they have taken. Following Ponzurick *et al*. (2000) we have measured overall student satisfaction in the course using one item. In both cases a 5 point response scale has been used taking into account the recommendations by Lissitz and Green (1975) who suggests that from 5 points on wards the reliability of the scales tends to diminish.

Regarding the independent variables considered in the questionnaire, we can mention student age, student gender, student work situation, prior student experience with VLEs, course level.

DATA ANALYSIS AND RESULTS

Table 1 and 2 below show the analyses of variance that have been performed for each of the independent qualitative variables with respect to the dependent variables including perceived learning and satisfaction, respectively.

Table 1: Analysis of variance of perceived learning by qualitative independent variable

Variable		N	Mean	SD	F	Sig.
Gender	Male	150	3.766	0.677	2.345	0.135
	Female	65	3.696	0.756		
Age	18-24	120	3.586	0.671	6.846	0.000
	25-34	55	3.934	0.662		
	35 and above	40	4.342	0.643		
Prior experience with VLEs	Yes	42	4.000	0.690	2.103	0.118
	No	213	3.762	0.694		
Work situation	Does not work	130	3.763	0.763	18.234	0.000
	Does work	85	4.124	0.742		
Course Level	Undergraduate	150	3.442	0.732	8.765	0.003
	Graduate	65	4.012	0.7120		

Table 2: Analysis of variance of perceived learning by qualitative independent variable

Variable		N	Mean	SD	F	Sig.
Gender	Male	150	3.071	0.725	1.234	0.401
	Female	65	3.162	0.719		
Age	18-24	120	4.182	0732	7.652	0.000
	25-34	55	4.342	0.721		
	35 and above	40	4.653	0712		
Prior experience with VLEs	Yes	42	3.143	0.713	0.261	0.321
	No	213	3.212	0.765		
Work situation	Does not work	130	4.173	0.723	17.854	0.002
	Does work	85	4.232	0.682		
Course level	Undergraduate	150	4.111	0.732	6.346	0.01
	Graduate	65	5.234	0.683		

An ANOVA confirms that there are not significant differences in IT awareness with regard to student gender; therefore we proceed to the testing of the hypothesis H1. The ANOVA shows that difference between means is not significant. Therefore, hypothesis H1 is supported. In other words, there is no significant difference between male and female on satisfaction in a VLE. Further, the ANOVA shows that the differences between student' sgender with regards to their own perceived learning are not significant and thus we accept the hypothesis H2. In fact, there is no significant difference between male and female on perceive learning in a VLE

On the other hand, ANOVA indicates that there is significant differences between student's age with regard to perceived learning. A post-hoc comparison of the means via a Waller-Duncan testing reveals two mean groups: Group 1 is formed from students whose ages are between 18 and 24 years and group 2 is formed from students whose age is higher than 24 years. Thus we can confirm that older students perceive a greater learning so that hypothesis H4 is rejects. In other words, age can play a role on perceived learning in a VLE. Analogously ANOVA shows that there is a significant relationship between student age and satisfaction. The post-hoccomparison of the means via a Waller-Duncan testing reveals three mean groups. Thus the test confirms that the least satisfied students are those between 18 and 24 while the most satisfied are 35 or older, so hypothesis H3 is rejected.

ANOVA also shows that prior students experience with VLEs does not influence on the perceived learning by the students. Therefore hypothesis H6is accepted. Nonetheless, neither is empirical evidence found regarding the influence of experience of the students in courses given by a VLE with reference to their own satisfaction, therefore hypothesis H5 is rejected.

The analyses also indicate that a significant relationship between work situation and perceived learning and between work situation and satisfaction does exist which empirically confirms that students who work perceive a greater learning and are more satisfied than those students who do not work. Therefore hypothesis H7 and H8 are supported.

The data obtained from the analyses empirically support hypothesis H9 and H10, given that they indicate that there does exist an influence between course level and the two dependent variables, the perceived learning by the students and the satisfaction, with the students from postgraduate courses being those who perceive most learning and who gain most satisfaction.

CONCLUSION

Although numerous publications on virtual learning exist, few studies focus on empirical study of the quality of VLEs. In this study, a model based upon the most frequently used variables from the literature has been proposed to measure this quality. These variables are learning and student satisfaction; and there exists a coincidence with the first levels of the training actions evaluation model by Kirkpatrick (2004).

On the other hand, in the existing literature, an interest in the influence that certain variables can have on quality, as we have defined it, that is to say, in terms of learning and student satisfaction has been detected. In the revised literature, diverse results have been obtained such that it has not been possible to reach any definitive conclusion regarding the analyzed variables. Thus, in this study, a set of these variables has been

carried out and they have been analyzed upon a wide sample of students.

The conclusions of this study suggest some interesting directions for future training actions carried out in VLEs. We have been able to define a profile for the student who would achieve the best results in terms of perceived learning and of satisfaction. This profile would correspond to a student of 35 years of age or more, who works and carries out a postgraduate course.

Nonetheless we have not been limited to analyzing the qualities or limitations of a VLE, but in addition an improved VLE model has been proposed in which the options that e-learning offers have been exploited leading to the use of certain tools such as Concept Maps and the adaptation of the training programme contents to the students Learning Styles. These factors favour learning but are difficult to use in a traditional class. The objective here is that they should result in an improved quality in education.

It has been verified that using the proposed IVLE greater levels of quality, both in student satisfaction and in learning are obtained.

Finally, given that knowledge has become the most important resource in present economy and its appropriate management is the corner stone of the management of the most competitive companies and organizations, an IVLE can present considerable opportunities as it encourages the quality of the knowledge acquisition process.

REFERENCES

Alonso, C.M., D.J. Gallego and P. Honey, 1999. Learning Styles. Diagnostic Procedures and Improvement (Spanish). Ediciones Messenger, Bilbao.

Ausubel, D.P., 1968. Educational Psychology: A Cognitive View. Rinehart and Winston, New York.

Baroody, A.J. and B.H. Bartels, 2000.Using concept maps to link mathematical ideas. Math. Teach. Middle School, 5(9): 604-609.

Brennan, M., S. Funke and C. Anderson, 2001. The Learning Content Management System: A New e-Learning Market Segment Emerges. Market Segment Emerges IDC WhitePaper. Retrieved form: http://www.idc.com.

Cañas, A.J., J.W. Coffey, M.J. Carnot, P. Feltovich, R. Hoffman, J. Feltovich and J.D. Novak, 2003. A summary of literature pertaining to the use of concept mapping techniques and technologies for education and performance support. Report to the Chief of Naval Education and Training, Prepared by the Institute for Human and Machine Cognition, Pensacola, FL.

Del-Corso, D., E. Ovcin, G. Morrone and D. Gianesini, 2002. The 3DE custom course compiler: An engine to assemble custom web courses. Proceeding of the 32nd ASEE/IEEE Frontiers in Education Conference. Boston, Nov. 6-9.

Deming, W.E., 1982. Quality, Productivity and Competitive Position. Massachusetts Institute of Technology, Center for Advanced Engineering Study, Cambridge.

Drucker, P.F., 1994. The Sociedad Postcapitalista (Italian). Grupo Editorial Norma, Colombia.

Gentry, J.A. and M.G. Helgesen, 1999. Using learning styleinformationtoimprovethecorefinancial management course. Financ. Pract. Educ., 9(1): 59-69.

González, F., F.C. Ibáñez, J. Casalí, J.J.Y. López and J.D. Novak, 2000. Una Aportación a la Mejora de la Calidad de la Docencia Universitaria: Los Mapas Conceptuales. Universidad Pública de Navarra, Pamplona.

Gonzalez, F.M., 1997. Evidence of rote learning of science by Spanish university students. School Sci. Math., 97(8): 419-428.

Gore, C. and E. Gore, 1999. Knowledge management: The way forward. Total Qual. Manage., 10(4-5): 554-560.

Hannun, W., 2001. Web-Based Training: Advantages and limitations. In: En Khan, B. (Ed.), Web-Based Training. Educational Technology Publications, Eaglewood Cliffs, NJ.

Hoyer, R.W. and B.B.Y. Hoyer, 2001. What is Quality? Qual. Prog., 34(7): 53-62.

Hoz, R., D. Bowman and E. Kozminsky, 2001. The differential effects of prior knowledge on learning: A study of two consecutive courses in earth sciences. Instr. Sci., 29: 187-211.

ICT, 2004. Status and Prospectivapara the E-Learning in Denmark, Spain, Greece, Portugal, and Switzerland UnitedKingdom (Spanish). E-Learning for Training in Information and CommunicationTechnologies Project. Retrieved from: http://www.t-ict.net/.

Juran, J.M. and F.M. Gryna, 1995. Análisis y Planeación de la Calidad. México: McGraw Hill.

Kirkpatrick, D.L., 2004. Evaluación de Acciones Formativas: Los cuatroniveles. Gestión, Barcelona.

Lim, K.K., K.A. Pervaiz and M. Zairi, 1999. Managing for quality through knowledge management. Total Qual. Manage., 10(4-5): 616-621.

Lissitz, R.W. and S.B. Green, 1975. Effect of the number of scale points on reliability: A montecarlo approach. J. Appl. Psychol., 60(1): 10-13.

Maestre, Y.P., 2000. Gestióndel Conocimiento and Computer Dictionary. Fundación DINTEL, Madrid.

Moonen, J., 1997. The efficiency of telelearning. J. Asynchronous Learn. Netw., 1(2): 68-77.

Nilsson, R.M. and R.E. Mayer, 2002. The effects of graphic organizers giving cues to the structure of a hypermedia document on users' navigation strategies and performance. Int. J. Hum. Comput. Stud., 57(1): 1-26.

Novak, J.D. and D.B. Gowin, 1988. Aprendiendoa Aprender. Martínez Roca, Barcelona.

Passmore, G., 1998. Using vee diagrams to facilitate meaningful learning and misconception remediation in radiologic technologies laboratory education. Radiol. Sci. Educ., 4(1): 11-28.

Ponzurick, T.G., K.R. France and C.M. Logar, 2000. Delivering graduate marketing education: An analysis of face-to-face versus distance education. J. Market. Educ., 22(3): 180-187.

Richmond, V.P., J.C. McCroskey, P. Kearney and T.G. Plax, 1987. Power in classroom vii: Linking behaviour alteration techniques to cognitive learning. Commun. Educ., 36(1): 1-12.

Tannenbaum, R.., 1982. An investigation of the relationships between selected instruction altechniques and identified field dependent and field independent cognitive styles as evidenced among high school students enrolled in studies of nutrition. Ph.D. Thesis, John's University, New York, pp: 43-68.