AN EXPLORATORY STUDY ON THE POTENTIAL OF MASS CUSTOMISATION IN E-LEARNING

Nikolaos Kourakos, School of Informatics,
Centre for HCI Design, City University, London, UK.
snadek@yahoo.com

Bill Karakostas, School of Informatics,
Centre for HCI Design, City University, London, UK.
billk@soi.city.ac.uk

Dimitris K. Kardaras, Business Informatics Lab,
Athens University of Economics and Business, Athens, Greece.
kardraras@aueb.gr

Eleutherios A. Papathanassiou, Business Informatics Lab,
Athens University of Economics and Business, Athens, Greece.
eap@aueb.gr

ABSTRACT

It is argued that Mass Customisation (MC) is expected to be a critical strategic option for the survival and competitiveness of many organisations in the 21st century. MC focuses on delivering differentiated products and services at competitive prices. MC implies the development and distribution of products and services that are customised to specific customer needs and are made available at an acceptable cost and in accordance to customer's priorities with respect to quality factors. This paper considers e-learning services and investigates the acceptance of e-learning through MC, i.e. is the ability to provide mass-customised learning solutions. Customised learning maybe is the optimal way that suits exactly the needs of any individual student. Relevant literature indicates that there is an expanding demand for customized educational services. The paper reports on results of an exploratory study in Greece and specifies what are the views and further more the acceptance of University students regarding mass-customised e-learning services. It also refers to the required service characteristics that could possibly reconfigure in order to meet individual needs. The study draws on MC and learning theories and the results are useful for both academics and practitioners of MC and e-learning.

KEYWORDS

Mass Customization, e-learning, technology acceptance models

1. INTRODUCTION

A slightly large variety of definitions and approaches have been developed in order to explain and describe the issue of Mass Customization (MC). The offering of customized products and services, with mass production efficiency is the core meaning of mass customization (Piller & Muller, 2004). McCarthy (2004), describes MC as a strategy that involves goods and services that have a large market orientation, while it tries to satisfy the specific needs of individual customers under the cost option. Selladurai (2004), focus on the process of the production of goods and services and to the tailoring of this process to cover the individual needs of customers, in a mass market. MC is the process that replaces mass production as the major method used in production facilities (Pine, 1993: Gilmour and Pine, 1997). Hart (1996), focused on "*the use of flexible process and organizational structures.*" Hayes and Pisano (1994), claims that MC refers to build products at the very last moments to meet an actual requirement using mass production techniques to assemble items that are uniquely tailored to the demands of individual customers. Ulrich and Eppinger (1995), defines customized products as: "*slight variations of standard configurations and are typically developed in response to a specific order by a customer*". Da Silveira et al. (2001), claims that MC relates to the organization ability to provide customized goods and services via flexible processes in rather high volumes with rather low – reasonable cost. The ability of an organization to provide individually designed products and services for every customer within a process that can be characterized by flexibility, agility and high integration

is the meaning of MC (Pine & Victor, 1993: Eastwood, 1996). Dietrich et al (2004), describes MC as "*a transaction process, which focuses on individualization of mass-market products and services to satisfy specific needs of the customer, at an affordable and reasonable price*", while Tseng and Jiao (2003), provide us with one wide adopting working definition according to who MC can be viewed as "the technologies and systems to deliver goods and services that meet individual customers' needs with near mass production efficiency". MC tries to be a bridge between to opposite's production concepts, mass production from one side and customization from the other. A rather oxymoron occurs here. The target of mass production is to offering standard products in huge numbers in a mass market at low cost using economies of scale benefits (Saeed & Young, 1998). Aim of customization is to give to each individual customer what exactly he needs with a relative accepted level of efficiency. As Pine (1993) notice, main target of MC is to give nearly to everyone exactly what he wants.

2. MC AND E-LEARNING.

2.1 E-learning and the need for Customized e-learning environments.

Nowadays, the Internet and the WWW has reshaped not only the product and service provision but the whole society including commerce, entertainment and education. Today we can talk about e-commerce, e-services, e-learning. As Boyer et al. (2002) claims, we can describe e-services as *'comprised of all interactive services that are delivered on the Internet using advanced telecommunications, information, and multimedia technologies'*. Education and more specifically e-learning is a major segment of e-service provision. The online delivery of education starts in 1990s with the parallel explosion of the Internet usage. According to E. Masie (2001), "*The real truth about e-learning's future*" in a few years "*there will not be a division between e-learning and traditional learning, as learning will naturally evolve to utilise technological progress to improve learning efficiency"*. In addition an IDC (2003) study emergence the e-learning as one of the emergency areas for the next years. Maybe the holy grail of e-learning is the ability to provide customized learning solutions. Customized learning maybe is the optimal way that suits exactly the needs of any individual student. Nowadays, there is an expanding demand for customized educational services. There is a plethora of reasons why learners and academic students have different needs. We can notice the learning background, the culture, the variety of working needs and expertise, the social knowledge, the cognitive capabilities, the individual learning style. For all these reasons, the perspectives and the acceptance issues from the students become very critical success factors. The customized e-learning, the major involved factors and the acceptance models are the aims of this paper.
Abramowicz et al. (2002) claims that one of major drawbacks of existing e-learning systems is the teacher- centric approach and the traditional teacher to students model. In this approach students are consider as one entity, not a set of individual entities, individual personalities, individual objects. According to authors e-learning systems must be user centric and take into account the current learners activities and goals. Further more there is another point of view, the point of people with special needs (disabilities). The World Wide Web Consortium (W3C/WAI) (2005), works on this dimension and give a basic guideline about how to make resources as accessible as possible. Additionally work on this issue has been done by IMS Global Learning Consortium and the Dublin Core Metadata. The dynamic assembly of small pieces of learning content, called Learning Objects (LO), the way of representation and the mode of delivery are some of the major objectives in a learning customization process. According to Blackmon et al. (Learning Systems Architecture Lab of Carnegie Mellon University, 2005) there are several ways to customized learning, as:

- *At random (random selection of LO by learner)*
- *By response (learner response to questions)*
- *By profile (learners skills, mastery and learning style)*
- *By discovery (matching learning objective and learning objects)*

The concentration of this work is the learners profile issue. In order to explore and recording the learner's preferences and acceptance factors we use the Technology Acceptance Model (TAM) (Davis, 1993).

2.2. Technology Acceptance Model

There is a continuing exploding investment in the area of information systems and more specifically in e-learning (Ngai, Poon & Chan, 2005). There fore, the understating of acceptance of these systems remains a high priority (Venkatesh & Davis, 2000).

In this research area there is a slightly wide variety of models that tries to explain the adoption of information systems. Rogers (1983), give us a general framework of technology acceptance within the theory of diffusion of innovations (TID). Fishbein & Ajzen (1975), developed their theory of reasoned action (TRA). As an extension of TRA, Ajzen (1985) introduced the theory of planned behaviour (TPB). But maybe the most well-known and widely accepted and cited model is the technology acceptance model (TAM). Davis (1985) developed the TAM to explain the computer usage and acceptance of information technology. As Money & Turner (2004) notice, the Institute for Scientific Information Social Science Citation indexed more than 300 journal citations of the initial TAM paper published by Davis et al. (1989). The Davis's model is shown in Figure 1.

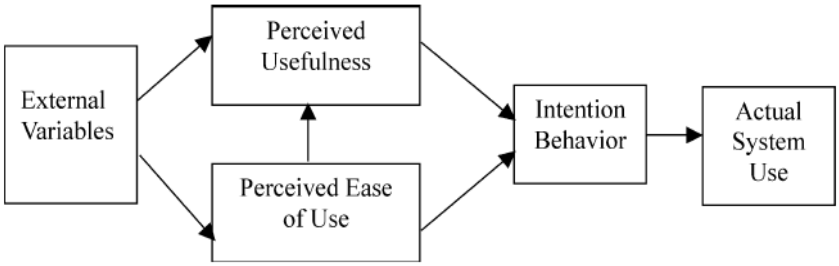

Figure 1. Technology Acceptance Model (Davis)

Notice that external variables include all system design features. The perceived usefulness (PU) and perceived easy of use (PEOU), are two fundamental determinants in predicting user's intention to use the IT technology.

3. THE RESEARCH FRAMEWORK

3.1. The Research Model

For the specific objectives of this research to access the factors that influence a customizable e-learning environment we propose the following TAM – based model. The different two new entities are, the perceived added value (PAV) and the perceived personalization / customization (PPC). The examinations of the factors that influence the acceptance of these two critical factors are the research aims of our study. The Figure 2 represents the model.

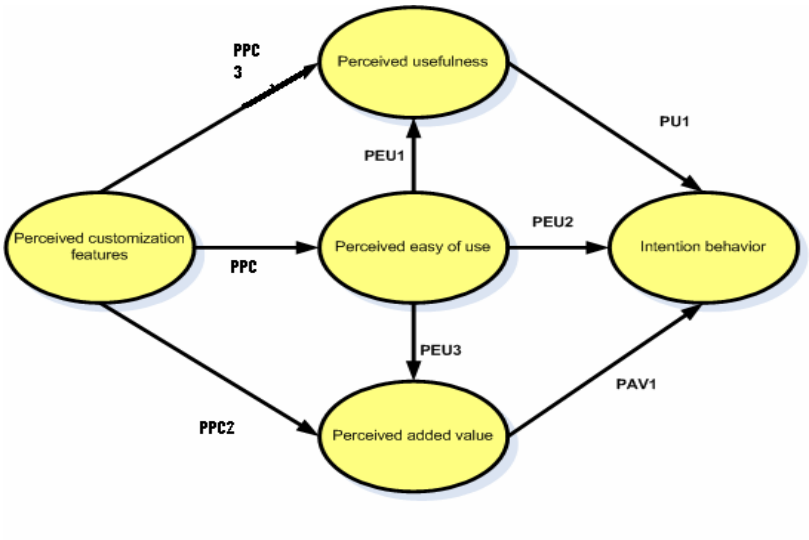

Figure 2. The research model of this study.

3.2 Methodology framework.

3.2.1. Profile of respondents.

The subjects for the study were undergraduate students of Athens Economic and Business University (AUEB). The participants were 114 students enrolled in business classes, out of 130 who where invited to participate, which is a response rate of 87,69 %. Participation in the research was based on the willingness of the students. Questionnaires were distributed, completed and returned within the same working day. Students (n=114) field in a questionnaire with closed questions. Among the 114 respondents, 41,8 % was male, while 51,8 % was females. Participants of first class were a 37,7% of the sample, second class percentage were a 14%, third class were a 35,1% and forth class percentage were a 13,2% of the sample.

3.2.2. Methodology details.

The survey instrument was composed of 75 statements. On perceived usefulness (PU) 10 items adopted from original TAM model (Davis et al., 1989). Perceived easy of use (PEOU) 10 items, also adopted from original TAM, perceived added value (PAV) 5 items, and perceived personalization / customization (PPC) 7 items. The others are common descriptive statistics questions (e.g. gender, year of study, etc). For PU, PEOU, PAV and PPC there was a five-point Likert scale, ranging from value 1 that means strongly negative / disagree, to value 5 that means very positive / agree.

3.2.3. Limitations of the study.

Referring to the limitations of the present study, we have to mention the following:

- The questionnaire has been exclusively distributed to the students of Athens Economic and Business University. It was not applied to students of others Hellenic Universities, in order to compare them in the same schools.
- To make this research also on other European higher education institutions of the same field, in order to compare the students of different counties and cultures seems very interesting.
- It was not extended on students of other fields in the same or different institutions.
- There could also be included post-graduate students, in order compare the pre-graduate and the post-graduate sample groups.
- The investigation of student's acceptance with another model approach (e.g. TPB), in order to compare the results is another limitation of this study.

3.2.4. Results

A general question was about the student's knowledge on mass customization. The scale of possible answers spread from 1 (not at all) to 5 (very much). The result table is following.

Table1. The student's Knowledge about MC

N	Valid	112
	Missing	2
Mean		1,76
Median		2,00
Std. Deviation		,450
Variance		,203

We may observe that from a sample of 112 valid answers, 83 students, that is to say 74,1 %, did not knows about MC principals at all. The knowledge gap especially for students with economic and business orientation about MC is obvious.

Table 2 shows respondents' experience on MC products.

Table2. The student's recognition of MC_PRODUCTS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	20	17,5	17,5	17,5
	3	53	46,5	46,5	64,0
	4	37	32,5	32,5	96,5
	5	4	3,5	3,5	100,0
	Total	114	100,0	100,0	

32,5 % of students recognizes products with the ability to fit on their needs very often. Also a 46,5 % of the sample recognizes customizable products with a middle level frequency. Only 17,5 %, a relative small number of students state a rare recognition of MC products.

Table 3 presents the data regarding respondents' experience on MC services.

Table3. The student's recognition of MC_SERVICES

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	1,8	1,8	1,8
	2	44	38,6	38,9	40,7
	3	40	35,1	35,4	76,1
	4	24	21,1	21,2	97,3
	5	3	2,6	2,7	100,0
	Total	113	99,1	100,0	
Missing	System	1	,9		
Total		114	100,0		

It has to be noted that the percentages for services accordingly to percentages for products was lower, that is to say a 40,7 % (cumulative negative opinions) concerned the inflexible service provision.

The next question investigates student's need for developing a customizable e-learning environment.

Table4. The need for a customizable e-learning in AUEB

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	5,3	5,5	5,5
	2	6	5,3	5,5	10,9
	3	29	25,4	26,4	37,3
	4	39	34,2	35,5	72,7
	5	30	26,3	27,3	100,0
	Total	110	96,5	100,0	
Missing	System	4	3,5		
Total		114	100,0		

The demand for offering customizable e-learning services was quite interesting. Only a cumulative 10,9 % of students has a negative position for this. A 27,3 % has very strong and a 35,5 % has a strong interesting respectively.

Perceived Personalization / Customization (PPC).

The first question investigates whether students consider the development of a customizable context as useful. The scale follows the series: 1= not at all, where 5 = is very much. The frequency table is following.

Table5. Position about customizable context

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	4	3,5	3,6	3,6
	2	7	6,1	6,3	9,9
	3	47	41,2	42,3	52,3
	4	44	38,6	39,6	91,9
	5	9	7,9	8,1	100,0
	Total	111	97,4	100,0	
Missing	System	3	2,6		
Total		114	100,0		

At this point, it can be noted that a cumulative 47,7 % of students, was very or just positive about this factor. Negative positions (value 1 or 2) has only a cumulative 9,9 %.

The second question was on the ability to personalize the user interface. The same 1 to 5 scale were used. The frequency table is following.

Table6. Position about user interface

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	,9	,9	,9
	2	15	13,2	13,5	14,4
	3	50	43,9	45,0	59,5
	4	41	36,0	36,9	96,4
	5	4	3,5	3,6	100,0
	Total	111	97,4	100,0	
Missing	System	3	2,6		
Total		114	100,0		

It has to be noted that the percentages for customizable interface, accordingly to percentages for context was lower, that is to say a 40,4% (cumulative positive opinions) concerned the flexible and personalized user interface.

The third question has as its objective to explore whether the students consider the development of a customizable set of published papers as useful. The frequency table is following.

Table7. Position about published papers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	5	4,4	4,5	4,5
	2	6	5,3	5,4	9,9
	3	49	43,0	44,1	54,1
	4	41	36,0	36,9	91,0
	5	10	8,8	9,0	100,0
	Total	111	97,4	100,0	
Missing	System	3	2,6		
Total		114	100,0		

At this point, it can be noted that a cumulative 45,9 % of students, was very or just positive about this factor. Negative positions (value 1 or 2) has only a cumulative 9,9 %. We can say that the interesting on academic papers and the ability to form a paper's collection is quite strong among the students.

The fourth question was about the ability to customize additional lectures. Respectively the frequency table is following.

Table8. Interest for customizable set of lectures

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	1,8	1,8	1,8
	2	17	14,9	15,3	17,1
	3	50	43,9	45,0	62,2
	4	40	35,1	36,0	98,2
	5	2	1,8	1,8	100,0
	Total	111	97,4	100,0	
Missing	System	3	2,6		
Total		114	100,0		

We observe an important concentration in the 3and 4 choice. The cumulative percentage is 81 %, and he mode and the median values is 3.

The next question was about the expression of education needs from students in the face of e-lesson design. The frequency table follows.

Table9. The expression of education needs in the design face.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	1,8	1,8	1,8
	2	7	6,1	6,3	8,1
	3	41	36,0	36,9	45,0
	4	51	44,7	45,9	91,0
	5	10	8,8	9,0	100,0
	Total	111	97,4	100,0	
Missing	System	3	2,6		
Total		114	100,0		

It has to be noted that the percentages for early expression of education needs (in design state) gains a near 60 % cumulative percentage. The very low negative of negative position emphasizes further more this need. The early engagement of students in the design of an e-learning course seems to be very important factor for the acceptance of the education services.

The next question was on how students adopt the ability to personalization / customization of file formats. The frequency table has as follow.

Table10. File format customization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	5	4,4	4,5	4,5
	2	7	6,1	6,3	10,8
	3	32	28,1	28,8	39,6
	4	48	42,1	43,2	82,9
	5	19	16,7	17,1	100,0
	Total	111	97,4	100,0	
Missing	System	3	2,6		
Total		114	100,0		

At this point, it can be noted that a cumulative 72% of students, was very or just simple positive about this factor. Negative positions (value 1 or 2) has only a cumulative 9,9 %. The wide range of different file's format of education material especially for e-learning, it seems to be a problem for students.

The next question was on how students adopt the ability to build a customizable education set (lectures, texts, exams, tests) also called education package. The frequency table has as follow.

Table11. The students opinion for a customizable education set

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	2,6	2,7	2,7
	2	3	2,6	2,7	5,4
	3	36	31,6	32,4	37,8
	4	41	36,0	36,9	74,8
	5	28	24,6	25,2	100,0
	Total	111	97,4	100,0	
Missing	System	3	2,6		
Total		114	100,0		

We observe that a 62,1 %, that is to say 69 students was very or just positive about this factor. The significant low 5,4 % has a negative opinion about this. As a result of the research, the formulation of an education set (package) according to their individual needs, it's a very serious / critical factor in the students mind.

The next question aims at the recording of the importance of a series of supporting factors in the customizable e-learning environment. The examined factors are the following:

- Introduction seminar of system use.
- Using and Practice.
- Easy of systems use.
- Close collaboration of educators and learners.
- Student's early engagement and participation in e-lesson design.

Each one of the used variables takes values from 1 to 5 accordingly to Likert scale. The table of the dominant values, the total observations (for the dominant value) and the corresponding percentage of its variable are presented below.

Table12. Supporting Factors

Variable	*Observations*	*Mode*	*Percentage*
Introduction seminar of system use	53	5	46,5 %
Using of the system and practice	50	4	43,9 %
Easy of systems use	54	5	47,4%
Close collaboration of educators and learners	42	4	36,8%
Students participation during the e-lesson design	39	4	34,2 %

At this point we may observe the following. The introduction seminar for the customizable e-learning environment has 53 observations (46,5 %), with preference 5 that is the higher importance. This factor becomes a particularly initial factor for the supporting. For the practice and system use the dominant choice was 4, second from the perspective of the importance, with 50 answers (43,9 %). For the easy of use the dominant value is 5 again, the first most important, with 54 reports (47,4 %). At this point, it is assured that the participants conceive as extremely important the 'easy of use' attitude. The close collaboration between educators and learners the dominant value is 4, second from the importance perspective, with 42 reports (36,8 %). However the importance of this variable concerns a lot the students. Finally, the participation in the design of an e-learning seems to be significant serious factor for students. The 39 observations (34,2 %) shows that.

The next question aims at the record of the importance of learner's style as a critical factor for e-learning customization. The frequency table is following

Table13. The importance of learner's style

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	94	82,5	83,2	83,2
	2	19	16,7	16,8	100,0
	Total	113	99,1	100,0	
Missing	System	1	,9		
Total		114	100,0		

From a sample of 113valid answers, over 83%, believes that it is very important to take in mind the learners style and cognition, while 19students do not, that is to say 16,8%. So we may notice that the cognitive style that is called learner style is already embedded to students' mind as a very critical factor in the educational process and is completely useful aid.

4. CONCLUSIONS

4.1 Conclusions

However every attempt of building an e-learning system, apart from the theoretical knowledge and the technical documentation, also requires the adoption and the active support of those that it addresses that is the students. The research that we have done on the students of the Athens University of Economics and Business, intended to record a series of factors relevant to the perceived personalization - customization of an e-learning implementation. The user profile of the students, their information and knowledge about MC. The supporting factors that their understanding was issues in this study. Finally the following table summarizes the results from this research.

Table 14. Summary of the results.

• The majority of students don't have literature knowledge about MC. But they recognize MC products and Services in their day life.
• A remarkable percentage over 62% wants much or very much the development of MC e-learning. The negative positions are under of 10% percentage
• A very strong percentage, over 82% believes that learner's style must be a critical parameter of e-learning customization.
• All the supporting factors of a customizable e-learning environment are critical for the students.
• The ability to personalize the interface, file formats, the ability to express the educational needs in the design period of a customizable e-learning, is scoring very high among the students.
• All the factors for perceived MC are significant away of negative state. The percentages of negative approaches are significantly small.

Overall, the outcomes for Perceived personalization and customization shows a strong positive state among students, suggesting that Customizable e-learning it can potentially be a helpful tool for their road to learning.

4.3 Recommendations for further research.

After the processing and the analysis of the results, there has been recorded some certain points, which are quite interesting from a research perspective, in an attempt to achieve a more complete icon of MC principals in higher education. By encoding these sectors, which are quite interesting for further research, we mention the following:

- The parallel research on other Greece higher institutions and on the same academic years will allow the comparison between classes in order to find out if the academic direction is important and simultaneously if the e-learning fits better on certain academic fields.
- The research on other academic institution in EU will give the ability to compare results with other European countries.
- We recommend including post-graduate students in the research, in order to compare the pre-graduate and post-graduate sample groups.
- A second running of this research after a period of time maybe will be useful in order to compare the results after one or two academic periods.

References

1. Hart, C. (1996). *Made to order*. Marketing Management **5**, 11-23.
2. Haynes, R. and Pisano, G. (1994). *Why satisfied customers defect*. Harvard Business Review. January-February, pp.77-86.
3. Pine, B. (1993). *Mass customization: the new frontier in business competition*. Cambridge, MA: Harvard University Press.
4. Gilmour, J., Pine, B. (1997). *The four faces of mass customization*. Harvard Business Review 1997:**75** (1):pp 91-101.
5. Selladurai, R.S. (2004). *Mass customization in operations management: Oxymoron or reality?*. Omega, the International Journal of Management Science, **32** (2004):pp. 295-300.
6. Piller, T. F., and Müller, M. (2004). *A new marketing approach to mass customization*. International Journal of Computer Integrated Manufacturing. Vol. 17, no 7: 583-593.
7. McCarthy, I.P. (2004). *The what, why and how of mass customization*. Production Planning & Control, V15, **4**, June 2004, pp 347-351.
8. Ulrich, K. T., and Eppinger, S. D. (1995). *Product design and development*. McGraw-Hill, New York (NY).
9. Silveira, Giovani Da., Borenstein D., Fogliatto S. F. (2001). *Mass customization: Literature review and research directions.* International Journal of Production Economic. V.72, 1-13.
10. Dietrich, Pawlaszczyk, Timm, Otto, Kirn. (2004). *Ontologies supporting cooperation's in mass customization: A pragmatic approach.* In proceedings ICMC - 2004, p2.
11. Pine J. B. (1993). *Mass Customization: the new Frontier in Business Competition*, Harvard Business School Press: Boston 1993.
12. Eastwood, M. (1996). *Implementing mass customization*. Computers in Industry 30 (3) (1996) 171-174.
13. Tsend, M. and Piller, F. *The Customer Centric Enterprise*. New York / Berlin: Springer 2003.
14. Ngai., E.W.T, Poon. J.K.L., Chan. Y.H.C. (2005). *Empirical examination of the adoption of WebCt using TAM.* Computers and Education, (article in press). Online retrieval from the http://www.elsevier.com/locate/cpmedu/
15. Fishbein, M., Ajzen, I. (1977). *Attitudes and Opinions*. Annual review of Psychology, 23, 487-544.
16. Ajzen, I. (1991). *The theory of planned behavior*. Organizational Behavior and Human Decision Processes (**50**) 179-211.
17. Ajzen, I., Madden, T.J. (1986). *Prediction of goal-directed behavior: Attidutes, intentions and perceived behavioral control.* Journal of Experimental Social Psychology 22(5) 453-474.
18. Masie, E. (2001). *The real truth about e-learning's future.* IT Training. Online available at http://www.train-net.co.uk/news/full_news.cfm?ID=2994/
19. Davis, F.D. (1993). *User acceptance of Information Technology: system characteristics, user perception and behavioral impacts.* Intern. Journal of Man-Machine Studies, 38, 475-487.
20. Davis, F.D., Bagozzi, R. P., & Warshaw, P.R. (1989). *User acceptance of computer technology: a comparison of two theoretical models.* Management Science, 35, 982-1003.
21. Lsal (2003, 2005) *Learning and web services.* Learning Systems Architecture Lab. Carnegie Mellon University. Online available at: http://www.lsal.cmu.edu/.
22. Rogers E.M. (1983). *Diffusion of Innovations*. 3th edition. Free Press. NY.
23. Venkatesh V. & Davis F.D. (2000). *A theoretical extension of the technology acceptance model: four longitudinal studies.* Management Science 46, 186-204.
24. Money, W. , Turner, A. (2004). *Application of the Technology Acceptance Model to a Knowledge management System.* In Proceedings of the 37th Hawaii Conference on System Science.
25. Abramowicz, W., Kowalkiewicz, M., Zawadkzi, P. (2002). *WES 2002*, LNCS 2512, PP. 109-120.
26. Jiao, J., Ma, Q. and Tseng, M. Technovation, Vol. 23, (10), pp. 809-821.
27. Saeed, B. and Young, D. (1998). *Managing the Hidden Cost of Complexity*, Boston Consulting Group (BCG). Whitepaper. Available online at http://www.healy-hudson.com/_ADD_ON/_download/Managing_hidden_cost.pdf (retrieval 15/2/04).
28. IDC:U.S. *Corporate and Government eLearning Forecase*, 2002-2007. Available at (http://www.IDC.com/)
29. Boyle, C.F., Encarnation, A.O. *MetaDoc:An adaptive Hypertext Reading System.* Adaptive Hypertext and Hypermedia: Editors: Brusilovsky, Kobsa, Vassileva: Kluwers Academic Publishers, NL (1998).