FACTORS INFLUENCING THE ADOPTION OF THE E-LEARNING TECHNOLOGY IN TEACHING AND LEARNING BY STUDENTS OF A UNIVERSITY CLASS

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Abstract

The main objective of this study is to provide students and actors of online education in a university with solutions for influencing factors of students' positive opinion about the use of the e-learning technology in teaching and learning. This paper is meant to improve the use of instructional technology in our region for societal benefit and the technological learning development. We believe that it is impossible to improve innovations in increasing sustainable applications of technology in education without answering the question: Why aren't students interested in e-learning? What are the learning technological factors that may influence the positive opinion about the use of e-learning technology for teaching and learning? The result of the experimentation shows clearly that 78.8% of the surveyed students have a high experience in general use of Internet services and they are familiar with Internet technology. Result shows also that only 23.2% of them state that they have a high experience in using Internet for learning. The survey results also show that 59.6% of students have problems in using ICTs for learning (Information and communication technologies for learning). The survey results show that 44.4% and 19.2% respectively disagree and strongly disagree with the statement that the learning process is based on cognitive flexibility.

Keywords: E-learning, Teaching, Learning, Influencing Factors, ease of use, usefulness

Introduction

As part of the new technologies, the Internet and websites are one of the fastest and most effective ways of communication. Compared to traditional ways of communication, Internet-based communication may provide information in either synchronous or asynchronous way (Zengin, Arikan & Dogan 2011).

The Internet has become one of the most important means to provide learning resources for students to share and obtain information (Richard and Haya 2009). Students today are considered "digital natives" that is to say, users who have grown up using technologies such as computers, cell phones and the Internet (Prensky 2001).

In the context of the World Wide Web, the information and communication technologies profoundly enhance communication opportunities.

E-learning is a concept that covers a variety of applications, process and learning methods. E-learning is also referred to the use of information and communication technologies to facilitate the access to online learning/teaching resources and to provide students with collaborative environments and tools thanks to Web 2.0 applications. Web 2.0 offers a set of tools and utilities that affect communication and its social impact (Rossi 2009). The objective of this paper is to explore those factors inhibiting the use and development of e-learning to highlight strategies to improve the interest of the students.

Theory:

The theoretical framework used to study the inhibiting factors of the interest of students in e-learning is based on the Technology Acceptance Model (henceforth TAM) (Davis 1989). TAM is one of the most influential extensions of Ajzen and Fishbein's theory of reasoned action (TRA) in the literature. It was developed by Fred Davis and Richard Bagozzi (Davis 1989, Bagozzi& Warshaw 1992). TAM replaces many of TRA's attitude measures with the two technology acceptance measures: ease of use, and usefulness. TRA and TAM, both of which have strong behavioral elements, assume that when someone forms an intention to act they will be free to act without limitation. In the real world there will be many constraints, such as limited freedom to act (Bagozzi& Warshaw 1992). Bagozzi, Davis and Warshaw say: "Because new technologies such as personal computers and learning with using technology are complex and an element of uncertainty exists in the minds of decision makers with respect to the successful adoption of them, people form attitudes and intentions toward trying to learn to use the new technology prior to initiating efforts directed at using it. Attitudes towards usage and intentions to use may be ill-formed or lacking in conviction or else may occur only after preliminary striving to learn to use the technology evolves. Thus, actual usage may not be a direct or immediate consequence of such attitudes and intentions". (Bagozzi& Warshaw 1992).

Earlier research on the diffusion of innovations also suggested a prominent role for perceived ease of use. Tornatzky and Klein (Tornatzky& Klein 1982) analyzed the adoption, finding that compatibility, relative advantage, and complexity had the most significant

relationships with adoption across a broad range of innovation types. Eason studied perceived usefulness in terms of a fit between systems, tasks and job profiles, using the terms "task fit" to describe the metric. (quoted in Stewart 1986).

Several researchers have replicated Davis's original study (Davis 1989) to provide empirical evidence on the relationships that exist between usefulness, ease of use and system use (Adams, Nelson & Todd 1992; Davis 1989; Hendrickson, Massey & Cronan 1993; Segars & Grover 1993; Subramanian 1994; Szajna 1994). Much attention has been given to testing the robustness and validity of the questionnaire instrument used by Davis. Adams and al. (Adams 1992) replicated the work of Davis (Davis 1989) to demonstrate the validity and reliability of his instrument and his measurement scales. They also extended it to different settings and, using two different samples, they demonstrated the internal consistency and replication reliability of the two scales. Hendrickson and al. (Hendrickson, Massey & Cronan 1993) found high reliability and good test-retest reliability. Szajna (Szajna 1994) found that the instrument had predictive validity for intent to use, self-reported usage and attitude toward use. The validity of the instrument designed by Davis is confirmed through researches, and has supported its use with different populations of users and different software choices.   Segars and Grover (Segars & Grover 1993) re-examined Adams *and al.*'s (Adams, Nelson & Todd 1992) replication of the Davis work. They were critical of the measurement model used, and postulated a different model based on three constructs: usefulness, effectiveness, and ease of use. These findings do not yet seem to have been replicated. However, some aspects of these findings were tested and supported by Workman (Workman 2007) by separating the dependent variable into information use versus technology use. Mark Keil and his colleagues have developed Davis's model into what they call the Usefulness/EOU Grid, which is a 2×2 grid where each quadrant represents a different combination of the two attributes. In the context of software use, this provides a mechanism for discussing the current mix of usefulness and EOU for particular software packages, and for plotting a different course if a different mix is desired, such as the introduction of even more powerful software (Keil, Beranek & Konsynski 1995).

Venkatesh and Davis extended the original TAM model to explain perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes. The extended model, referred to as TAM2, was tested in both voluntary and mandatory settings. The results strongly supported TAM2 (Venkatesh & Davis 2000). In an attempt to integrate the main competing user acceptance models, Venkatesh and his research group formulated the Unified Theory of Acceptance and Use of Technology (UTAUT). This

model was found to outperform each of the individual models (Adjusted R square of 69 percent) (Venkatesh et al. 2003). UTAUT has been adopted by some recent studies in healthcare.

Independent of TAM, Scherer developed the Matching Person & Technology Model in 1986 as part of her National Science Foundation-funded dissertation research. The MPT Model is fully described in her 1993 text (Scherer 2005, 1st ed. 1993), "Living in the State of Stuck," now in its 4th edition. The MPT Model has accompanying assessment measures used in technology selection and decision-making, as well as outcomes research on differences among technology users, non-users, avoiders, and reluctant users.

The adoption of a system: Factors influencing the intention of students to adopt e-learning technology
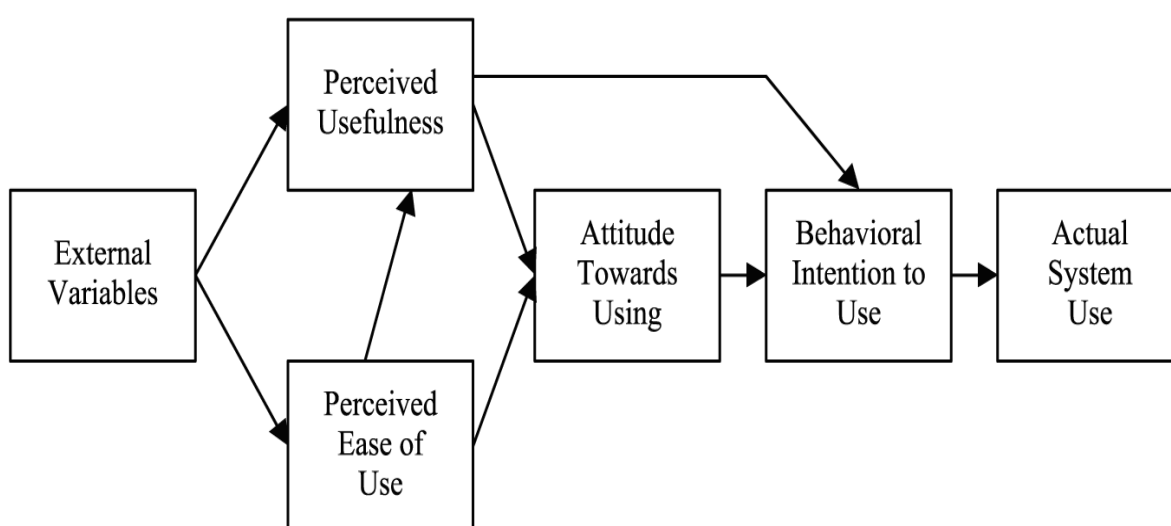
The technology acceptance model (TAM) developed by Davis demonstrates that the adoption of a technology by students based on the computer is explained by the perceived ease of use and the perceived usefulness. According to this model, the perceived usefulness and the perceived ease of use are determinants of developing a particular attitude towards the use of innovation (Davis 1989). The model of Davis based on the adoption of technology is one of the most influential in this field of research. The TAM has a solid theoretical foundation and has been developed in relation with information technology. The theory of Davis was particularly inspired from the works based on adoption of innovations. The perceived usefulness is defined as "the degree to which a person believes that using a particular system would improve his work performance". In our first research question, we are interested in the impact of the perceived usefulness of e-learning technology on the adoption of e-learning system by students to pursue the online training for the sake of preparing the e-learning module. The perceived ease of use is defined as "the degree to which a person believes that using a particular system is characterized by the ease of use" (Davis 1989). The present research is also focused on the impact of the perception of ease of use of the features of the Moodle platform on the adoption of e-learning system.

The model of Davis based on the adoption of a technology is based on Internal variables and external variable. The Internal variables of the model demonstrate that the attitude of the user on the use of new technology is explained by the perceived ease of use and the perceived usefulness of the new technology itself. The theory supports the impact of the perceived usefulness of e-learning technology on the adoption of e-learning system by students to pursue the online module of e-learning. The theory supports the impact of the perception of ease of use of the features of the Moodle e-learning platform on the adoption of

the e-learning system. The external variables linked to the model are composed by other factors influencing student's adoption of e-learning technology in learning and teaching and they are assumed to influence intentions of adoption of innovation through ease of use and usefulness (See Figure 1) such us in the present study the expertise of learners in information and communication technologies, the design of the e-learning process are not explicitly included in the model, but they are assumed to influence intentions of adoption of innovation through ease of use and usefulness.

Figure 1 illustrates the adoption of e-learning innovation, explained by the perceived usefulness and the ease of use of the system. According to the Davis model (Davis 1989), all other factors such us in our case the expertise of learners in Internet and information and communication technology, the design of the electronic learning process are assumed to influence intentions of adoption of innovation through ease of use and usefulness. The perceived ease of use influences perceived usefulness of a system. The two factors, the perceived usefulness and the ease of use have an influence on behavioral intention to use a system that affects the use and adoption of a system that is in the present study the adoption of e-learning system to prepare the e-learning module. The positive perception of the usefulness and the ease of use explain the adoption of e-learning by students and the negative perception of usefulness and ease of use don't explain the adoption of the innovation of e-learning by students to pursue the learning of the e-learning module.

Figure 1. Technology Acceptance Model: Source (Davis 1989)

Internal Variables influencing student's opinions about the use of e-learning technology included in Davis model

- **The ease of use of a technology by students based on the e-learning system**

    In the present study, the adoption of a technology by students based on the computer and learning technologies from Davis point of view is explained by the perceived ease of use of the e-learning platform features. According to this model, the perceived ease of use is determinant of developing a particular attitude towards the use of innovation (Davis 1989).

- **The perceived usefulness of the e-learning system**

    In the present study, the adoption of a technology by students based on the computer and learning technologies from Davis point of view is explained by the perceived usefulness of e-learning system. According to this model, the perceived usefulness is determinant of developing a particular attitude towards the use of innovation (Davis 1989).

External Variables linked to Davis model and influencing the ease of use and usefulness of the e-learning system
- **The expertise of learners in information and communication technology**

    Based on the results of the questionnaire distributed to learners, we tested a set of factors related to the acquisition of information and communication technologies to determine their impact on the improvements of the e-learning. These factors are: General web surfing, internet search of learning object, access to computer, possession of an e-mail address, problems of use of information and communication technologies.

    Based on Davis model, the external variables linked to the model is composed by other factors influencing student's adoption of e-learning technology in learning and teaching and they are assumed to influence intentions of adoption of innovation through ease of use and usefulness (See Figure 1) (Davis 1989). The expertise of learners in information and communication technologies is an external factor linked to Davis model and influence intentions of adoption of innovation through ease of use and usefulness (See Figure 1).

- **The opinion of learners about the design of the e-learning process**

    The learning process in the context of e-learning is composed by learning objects and activities. The structure of the learning resources, the flexibility of learning process on learning styles of learners and the design of the learning resources, etc. are used to know the perception of students about the learning process. Based on Davis model, the external variables linked to the model is composed by other factors influencing student's adoption of e-learning technology in learning and teaching and they are assumed to influence intentions

of adoption of innovation through ease of use and usefulness (See Figure 1) (Davis 1989). The Design of the e-learning process adopted by online teachers is an external factor linked to Davis model and influence intentions of adoption of innovation through ease of use and usefulness (See Figure 1).

Research questions

The main objective of the present study is to find solutions for inhibiting factors of the improvement of the interest of our students in e-learning technology. We believe that factors that can be tested are internal and external variables linked and included in Davis model (Davis 1989). The ease of use of the e-learning system and the usefulness of the e-learning system are internal variables included in Davis model. The expertise of learners in information and communication technology, and the design of the e-learning process are external variables linked to Davis model and influence the ease of use and the usefulness of the e-learning system.

Four hypotheses guided the present study. The first and the second questions are included in Davis model (Davis 1989), the third and the fourth questions are external variables linked to Davis model and influence intentions of adoption of innovation through ease of use and usefulness (See Figure 1).

- The usefulness of the e-learning technology is influencing factor of student opinion about the adoption of the e-learning technology in teaching and learning.

- The ease of use of the features of the e-learning platform is an influencing factor of student opinion about the adoption of the e-learning technology in teaching and learning.

- The expertise of learners in information and communication technologies, an external variable linked to Davis model is an influencing factor of their opinion about the adoption of the e-learning technology in teaching and learning.

- The design of the e-learning process adopted by the online instructors, an external variable linked to Davis model (the structure of the learning process, flexibility of the learning process, hypermedia and hypertext, etc.) is an influencing factor of student opinion about the adoption of the e-learning technology in teaching and learning.

Method
Sample participants and size

In an effort to determine the influencing factors of students' positive opinion about the use ofe-learning in learning and teaching and to find possible solutions for these factors, a survey was conducted with a group of 151 students from the university during the academic

year 2011-2012. The participants in this study consisted of undergraduate students in the field of special education and pursuing the e-learning module in the e-learning environment.

The survey instrument and its construction

The questionnaire method is the support of our study that was distributed face-to-face. This questionnaire contains 11 questions which can explore the influencing factors of student's opinion about the use of e-learning in teaching and learning. Table 2 contains the results and shows clearly the structure, all the parts of the questionnaire and all the survey items and modalities. For the construction of the questionnaire, the researchers used Likert scale (Likert, 1932). The Likert scale is a psychometric scale commonly used in research that used questionnaires. When responding to a Likert questionnaire item, respondents specify their level of agreement or disagreement on a symmetric agree-disagree scale for a series of statements. In this paper, the researchers used the format of a typical five-level Likert item, for example, it could be: Strongly disagree, Disagree, Neutral, Agree, Strongly agree). Scores on responses are based on Likert Scale and were described in table 1.

Table 1. Scores of five-level Likert item

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	2	3	4	5

Data are collected at the end of the first academic semester of 2011-2012, exactly in January 2012. SPSS (Statistical Package for Social Sciences) was used to analyze data (Frequencies of distribution and cross tabulation were performed).

The researchers used the means and standard deviations as indicated in table (2) to answer the research questions of the study.

The standard deviation is calculated by division of the arithmetic mean of each variable by the high score attributed to Likert Item; this score is 5 in our study.

Description of the survey instrument and the procedure of applying it

The final questionnaire was constructed after the content validity. The questionnaire is divided into 4 domain that are expertise in Internet and ICTs, the electronic learning process, the usefulness of the e-learning technology, the ease of use of the e-learning system. Each domain is composed by a set of item. The first and the second items belong to socio-demographic characters and the general characteristics of the sample, such as age and sex. The third item allows testing the degree of the expertise of students in general web surfing. The fourth item allows knowing the degree of the expertise of students of the sample in using Internet for learning. Item number 5 allows knowing the degree of the expertise of students in

using computer for learning. Item number 6 allows knowing if students possess an email address and whether they use it in the learning context. Item number 7 tested if students have problems in using ICTs (information and communication technology for learning). Item number 8 allows knowing the degree of clarity and structuring of the learning process at the e-learning platform. Item number 9 tests the degree of flexibility of navigation of students in learning resources provided by the design adopted by instructor for the learning process. Item number 9 allows knowing the preference of students in using learning process based on hypermedia and hypertext. Item number 10 tests the acceptance of the visual and the design of the learning resources by students. Item number 11 allows knowing the degree of the usefulness of the e-learning technology for pursuing the online course of distance learning for special education. Item number 12 allows knowing the degree of ease of the use of the features of the e-learning system from student's points of views.

To guarantee that learners are serious during the answering of the questionnaire, it was distributed face-to-face at the end of every sub-module of the learning discipline of Adobe Flash. The unclear questions were well-explained for the learners to get the best possible answers.

Presentation of the e-learning environment

The e-learning environment is accessible at the web address http://moodle.unimc.it. The web portal has been defined as an entry point to the Internet(Laudon and Traver 2008; Lewis 2002; Stair and Reynolds 2008). The experimented learning process at the Moodle e-learning platform is prepared by a teacher in order to teach the e-learning module. Students register automatically and can access the course from the university or from any computer that is connected to the internet. Students access the socio-constructivist e-learning process in Moodle e-learning environment to pursue the module "distance learning". The learning is based essentially on social interactions between online learners to construct knowledge. Sometimes, students interact with the online instructor by sending requests linked to the use of the features of the e-learning platform and also to the access of the e-learning process. The instructor sees that students have some problems in using the features of the e-learning environment and they interact together or with their online tutor to solve all learning problems. The instructor sees also that students have some problems in using information and communication technology for education.

Findings

Table 2. Survey responses

Domain of the Item	Survey items		Modalities	Responses	
				Percentage	*Frequency*
The usefulness of the e-learning technology	1.	I believe that e-learning is very useful for learning the online courses.	1. I agree strongly	11,3	17
			2. I agree	6,6	10
			3. Neutral	7,9	12
			4. I disagree	68,9	104
			5. I disagree strongly	5,3	8
	The arithmetic men			3,50	
	Standard deviation			70,06	
The ease of the use of the e-learning system.	2.	I believe that the features of the Moodle e-learning platform are easy to use.	1. I agree strongly	9,3	14
			2. I agree	8,6	13
			3. Neutral	7,9	12
			4. I disagree	63,6	96
			5. I disagree strongly	10,6	16
	The arithmetic mean			3,57	
	Standard deviation			71,5	
Expertise of learners in Internet and ICTs.	3.	Having a high expertise in general web surfing.	1. I agree strongly	78,8	119
			2. I agree	12,6	19
			3. Neutral	1,3	2
			4. I disagree	4,6	7
			5. I disagree strongly	2,6	4
	The arithmetic mean			1,39	
	Standard deviation			27,9	
	4.	Having a high expertise in using Internet for learning.	1. I agree strongly	23,2	35
			2. I agree	9,9	15
			3. Neutral	3,3	5
			4. I disagree	56,3	85
			5. I disagree strongly	7,3	11
	The arithmetic mean			3,14	
	Standard deviation			62,9	
	5.	I have a high expertise in using computer for learning.	1. I agree strongly	29,1	44
			2. I agree	9,3	14
			3. Neutral	2,6	4
			4. I disagree	52,3	79
			5. I disagree strongly	6,6	10
	The arithmetic mean			2,98	
	Standard deviation			59,6	
	4.	I possess an email address and I use it in the learning context.	1. I agree strongly	62,9	95
			2. I agree	29,8	45
			3. Neutral	1,3	2
			4. I disagree	5,3	8
			5. I disagree strongly	0,7	1
	The arithmetic mean			1,51	
	Standard deviation			30,2	
	5.	Having problems in using ICTs	1. I agree strongly	59,6	90
			2. I agree	13,9	21

		(Information and communication technology for learning).	3. Neutral	11,9	18
			4. I disagree	11,3	17
			5. I disagree strongly	3,3	5
		The arithmetic mean		1,84	
		Standard deviation		36,9	
The e-learning process.	6.	The learning process at the e-learning platform is clear and structured.	1. I agree strongly	23,2	35
			2. I agree	8,6	13
			3. Neutral	9,3	14
			4. I disagree	51	77
			5. I disagree strongly	7,9	12
		The arithmetic mean		3,12	
		Standard deviation		62,3	
	7.	The learning process at the e-learning platform gives us flexibility to navigate in learning resources.	1. I agree strongly	17,9	27
			2. I agree	8,6	13
			3. Neutral	9,9	15
			4. I disagree	44,4	67
			5. I disagree strongly	19,2	29
		The arithmetic men		3,38	
		Standard deviation		67,6	
	8.	I prefer learning process based on hypermedia and hypertext.	1. I agree strongly	70,2	106
			2. I agree	13,9	21
			3. Neutral	8,6	13
			4. I disagree	5,3	8
			5. I disagree strongly	2	3
		The arithmetic men		1,54	
		Standard deviation		31	
	9.	The visual and design of the learning resources in the learning process is acceptable.	1. I agree strongly	19,2	29
			2. I agree	7,9	12
			3. Neutral	3,3	5
			4. I disagree	61,6	93
			5. I disagree strongly	7,9	12
		The arithmetic men		3,31	
		Standard deviation		66,2	

Discussions

Internal Variables included in Davis model (Davis 1989)

   Factor 1: The perception of the usefulness of the e-learning

   The results show that 68.9% and 5.3% of surveyed students respectively disagree and disagree strongly that e-learning technology is useful for learning and teaching. Compared to the standard deviation (70.06%), the result shows clearly that the very large majority of learners do not have a positive perception about the usefulness of the e-learning technology for learning and teaching. In our case, the perception of the usefulness of the use of e-learning technologies is an influencing factor of students' positive opinion and adoption of e-learning technology for learning because with reference to the TAM (Davis 1989), only the positive

perception of the usefulness of the technology based on computer facilitates the adoption of students to this technology.

Factor 2: The perception of the ease of use of the features of the e-learning platform

The survey results show that the majority of students 63.6% and 10.6% disagree and disagree strongly that the features of the Moodle e-learning platform are easy to use. Based on the standard deviation (71.5%), the result shows clearly that the majority of the surveyed students have a negative perception about the ease of use of the features of the Moodle e-learning platform. In the present study, the perception of the ease of use of the features of the Moodle e-learning platform does not help students to the adoption of the e-learning system and it is an inhibitor factor for the adoption of e-learning technology by students because, with reference to the theory of Davis (Davis 1989), the positive perception of the ease of use of the technology by students facilitates their adoption for this technology. Based on Davis model (TAM), the perception of the ease of use of the features of the e-learning platform is an influencing factor of the positive opinion of students about e-learning.

External Variables linked to Davis model (Davis 1989) influencing the ease of use and the usefulness of the e-learning system.

Factor 3: Expertise in internet and ICTs

- **Having a high experience in using Internet service.**

The results show that 78.8% of students surveyed have a high experience in general use of Internet services and they are familiar with internet technology. Based on the standard deviation (27.9%) for this first variable, the result shows clearly the important mass of students familiarized with internet services and don't have problems in using it. Having a high experience in general web surfing is first factors favouring the interest of student in e-learning because it isn't possible to be interested in e-learning without familiarity with Internet services (chat, forums of discussions, web, electronic messaging, etc.), also e-learning technology is based on the use of internet in learning and teaching. This first factor: Having a high experience in general web surfing isn't an influencing factor of student's positive opinion about the use of the e-learning technology in teaching and learning.

- **Having a high experience in using Internet for learning.**

The survey results for this variable show that only 23.2% agree strongly that they have a high experience in using Internet for learning**.** Based on the standard deviation (62.9%) for this second variable, the result shows clearly the low percentages of students having a high experience in exploiting Internet for learning compared to the standard deviation. These results show that there is a high percentage (78.8%) of students who have a

high experience in general web surfing and who don't have a high experience in exploiting the internet for learning, which explains that the internet, for more surveyed students is not oriented towards learning, but rather chat and other internet services not useful for learning. According to the TAM (Davis 1989), there are other factors such us in our case the factor: *Having a high experience in using Internet for learning* isn't explicitly included in the TAM and it is assumed to influence intentions of adoption of the e-learning technology through ease of use and usefulness. The result confirms that the factor: Having a high experience in using Internet for learning is influencing the opinions and the interest of students in e-learning.

- **The use of computer for learning.**

    The survey results show that 29.1% of surveyed students have access to computer at home or at the university and they use it for learning (Interactive course, PowerPoint presentations, etc.). Based on the standard deviation (59.6%) for this first variable, the result shows clearly the low percentages of students using a computer for learning. Based on the TAM (Davis 1989), there are other factors such us in this case the factor*: The use of computer for learning*, isn't explicitly included in the TAM and it is assumed to influence intentions of adoption of the e-learning technology through ease of use and usefulness. The result confirms that this factor is influencing the positive opinions about the use of the e-learning technology in teaching and learning**.**

- **Possession of an e-mail address and the use it in the learning context.**

    The survey results show that 62.9% of students surveyed have an e-mail address and they use it in the learning context. Based on the standard deviation (30.2%) for this first variable, the result shows clearly the important mass of students having email address and using it for learning (receiving learning objects from teachers and other students, sending learning objects, using email address for sending some activities for teachers, receiving learning news from teachers, etc.). This factor is not influencing the positive opinion of students about e-learning. The email address is an important electronic communication tool to use in the learning and teaching concepts and does not make a problem for a majority of students in the study.

- **Having problems in using ICTs (Information and communication technology for learning)**

    The survey results show that 59.6% of students have problems in using ICTs for learning (Information and communication technology for learning). Compared to the standard

deviation (36.9%) for this first variable, the result shows clearly the high percentages of students having problems in using ICTs (Information and communication technology for learning). These results explain that the majority of surveyed students have problems using information and communication technologies for education. Based on our experience in online education, we see that there are more students who can have more problems using ICTs. According to the TAM (Davis 1989), there are other factors such as, in this case the factor: Having problems in using ICTs (Information and communication technology for learning), is not explicitly included in the TAM and it is assumed to influence intentions of adoption of innovation through ease of use and usefulness. The result confirms that the problems in using ICTs (Information and communication technology for learning) are influencing the opinions and the interest of our students in the use of the e-learning technology in learning and teaching.

Factor 4: The e- learning process

- **The adoption of the best structure for the electronic learning process at the e-learning platform**

    The structure of the electronic learning process at the e-learning platform means the organisation and relations between concepts in the learning resource.

    The survey results show that 51% and 7.9% of students surveyed respectively disagree and strongly disagree that the electronic learning process has a good structure. Compared to the standard deviation (62.3%) for the variable: structure of the electronic learning process at the e-learning platform, the result shows clearly that the high percentages of students disagree that electronic learning process has a good structure. These results demonstrate the point of view of students about the structure of the electronic learning process, which is not adopted by an important mass of student. Based on the TAM (Davis 1989), there are other factors such as in this case the factor: *The adoption of the best structure for the electronic learning process at the e-learning platform,* is not explicitly included in the TAM and it is assumed to influence intentions of adoption of innovation through ease of use and usefulness. The result confirms that the adoption of the best structure for the electronic learning process at the e-learning platform is an influencing factor of students' positive opinion about the use of e-learning technology in learning and teaching.

- **Cognitive Flexibility provided by the learning process.**

    The learning process at the e-learning platform gives online student's flexibility to navigate in learning process means the use of a variety of learning resources with multiple representations of knowledge. The authors (Spiro et al. 1992) proposed cognitive flexibility

theory to treat the complex domains of knowledge to be acquired by learners. The theory of the cognitive flexibility suggests that the learners can face the complexity of the situation of learning more easily with multiple representations of the same information in various contexts to acquire the necessary mental developments. The survey results show that 44.4% and 19.2% respectively disagree and strongly disagree that the learning process is based on cognitive flexibility. Based on the value of the standard deviation (67.6%), the result shows clearly that the electronic learning process presented for students in Moodle e-learning platform is not cognitively flexible for the majority of surveyed students. Based on the TAM (Davis 1989), there are other factors such as, in this case, the factor: *Cognitive Flexibility provided by the learning* process is not explicitly included in the TAM and it is assumed to influence intentions of adoption of innovation through ease of use and usefulness. The cognitive flexibility of the learning process in learning platform is influencing factors of the opinions and the interest of students in the use of e-learning technology in learning and teaching.

- **Hypertexts and hypermedia in the learning process.**

The results show that 70.2% of surveyed students prefer the electronic learning process based on hypermedia and hypertext against a minority of students who are not interested in this type of electronic learning process. Based on the low value of the standard deviation 31%, these results show that the adoption of hyper-texts and hypermedia in the learning resources is preferred by the majority of students. Based on our experience in online teaching, we see that the learning process based on hypermedia and hypertext is not adopted by the majority of teachers at the Moodle e-learning platform. According to the TAM (Davis 1989), there are other factors such as, in this case, the factor: Hypertexts and hypermedia in the learning process, is not explicitly included in the TAM and it is assumed to influence intentions of adoption of innovation through ease of use and usefulness. The result confirms that the adoption of hyper-texts and hypermedia in the learning process is an influencing factor of students' positive opinion about the use of e-learning technology.

- **Visual and design of the learning resources provided by the learning process.**

The results show that 61.6% and 7.9% disagree and strongly disagree that the visual and design of learning resources in the electronic learning process is acceptable. Compared to the standard deviation (66.2%). Based on the TAM (Davis 1989), there are other factors such us in this case the factor: *Visual and design of the learning resources provided by the learning process***,** is not explicitly included in the TAM and it is assumed to influence

intentions of adoption of innovation through ease of use and usefulness. The result confirms that the use of hyper-texts and hypermedia by online teachers in the learning process is an influencing factor of student positive opinion about the use of e-learning technology.

Influencing factors of student opinion about the adoption of e-learning

In the present study, data analysis validates all research questions.

- The usefulness of the e-learning technology is an Internal Variable included in Davis model (Davis 1989). Based on data analysis of the present study, this variable is an influencing factor of students' opinion about the adoption of the e-learning technology in teaching and learning.

- The ease of use of the features of the e-learning platform is also an Internal variable included in Davis model (Davis 1989) and influences student's opinions about the adoption of the e-learning technology in teaching and learning.

- The expertise of learners in information and communication technologies is considered an external variable linked to Davis model (Davis 1989) and influences the students' opinion about the adoption of the e-learning technology in teaching and learning.

- The design of the e-learning process adopted by the online instructors is an external variable linked to Davis' model (Davis 1989) (the structure of the learning process, flexibility of the learning process, hypermedia and hypertext, etc.) and influence student's opinions about the adoption of the e-learning technology in teaching and learning.

The following diagram, based on data analysis, is a representation of all influencing factors of student positive opinion about the use of e-learning discovered by the present study. Factors are divided into three levels, factors linked to the use of information and communication technology for learning, factors linked to the design adopted by instructor for the e-learning process and factors linked to the adoption of the e-learning system.

Figure 2. Factors influencing the use of the e-learning system by students.
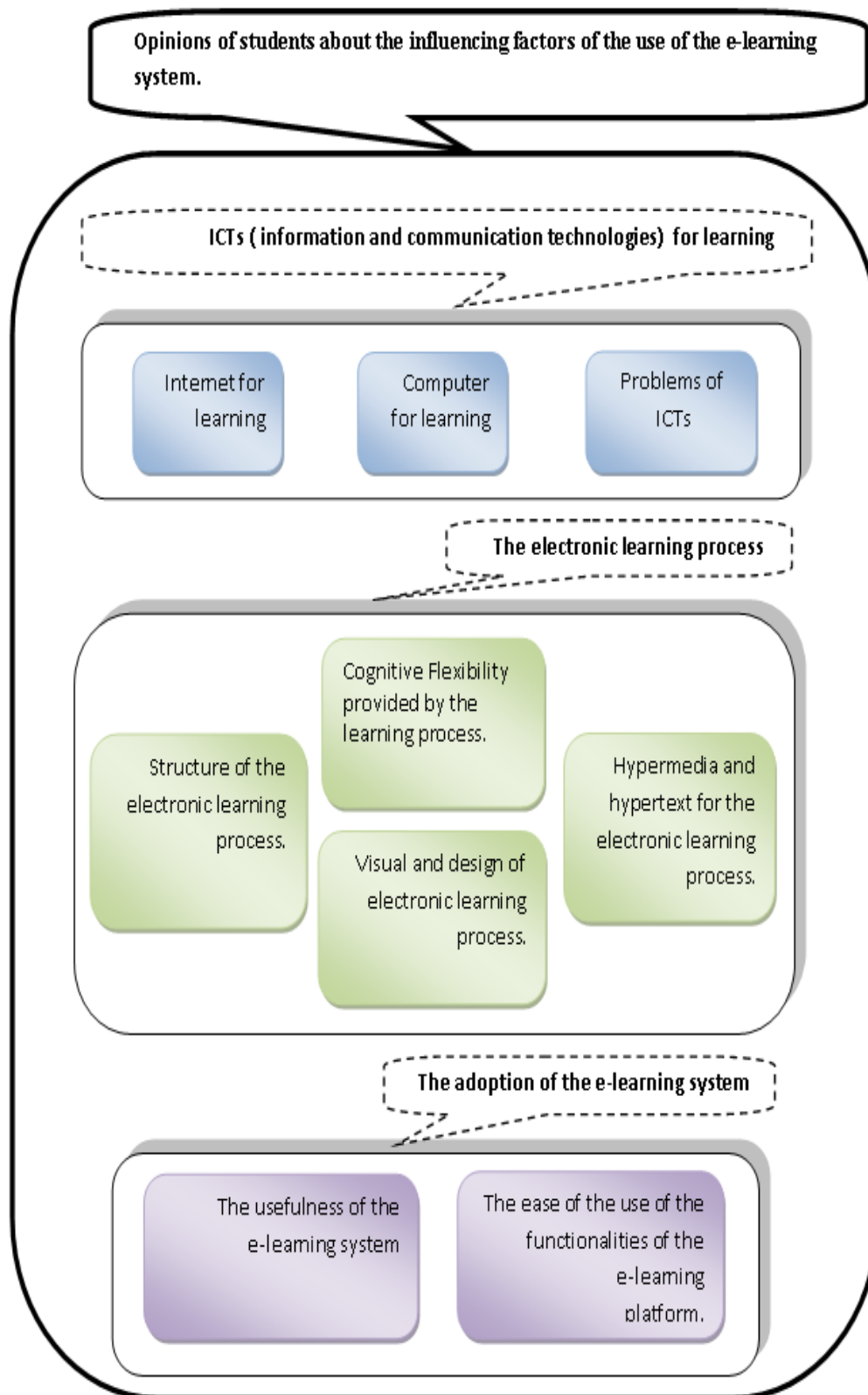
Recommended solution for the influencing factors of the student's opinions about the use of the e-learning technology in teaching and learning.

Table 3. Possible solutions for optimizing the inhibitor factors of e-learning

Influencing factors	Possible solutions
Having a high experience in using Internet for learning.	• Results of the present study clearly show that the majority of students have a high and long experience in using internet services, but the use of this communicative technology isn't oriented to e-learning or knowledge sharing, but rather to other Internet service (Chat, Facebook, Youtube, etc.). This is the major problem of students in using Internet technology. Teachers must advice students to use Internet technology for learning because Internet is the first resource of information useful for learning and to give them some activities based on the Internet research of knowledge and the blended learning. • Advise students to take advantage of the Internet to facilitate learning, searching learning object and knowledge management for e-learning. • Adopt the evaluation system to evaluate the use of Internet by students (research engine, web 2.0 for learning, etc.) and evaluate the project prepared by students with the use of Internet technology. • Advise students to minimize the internet research that is not useful for learning such as chat and other time-consuming internet services in order to maximize the time of the use of Internet for learning and exploit more the time for learning, sharing knowledge, collaborative learning, problem solving, Web 2.0 tools for learning, etc. • Over the past decade, the *World Wide Web* has become one of the most important means for providing learning resources for students to share and obtain information(Richard and Haya 2009)**.** More recently, a new wave of world wide web applications, web 2.0 emerged with a potential to further improve learning and sharing of information among learners and teachers(Ferdig 2007; Maloney 2007; pence 2007; Simôes and eGouveia 2008). • To benefit from Web 2.0 applications for the sharing of knowledge for examples delicious, Digs, Technorati, You-Tube, Pod-casting, blogs, etc. supported by the development of the internet. Web 2.0 includes blogs, wiki, and multimedia sharing services, content syndication, Pod-casting and content tagging services. Many of these applications of web technology are relatively mature have been in use for a number of years (Anderson 2007). Wiki (Wikipedia, Seedwiki, Wetpaint), Blogs (Blogger, Wordpress), social bookmarking (Club penguin, Ning, facebook, Myspace), and video sharing sites (You-tube, U-Stream) are some example of web 2.0 (Richard and Haya 2009). Web 2.0 provides online users with interactive services and control over their own data and information.
The use of computer for learning.	• Providing every student with training in computer learning application allows him/her to have an acceptable knowledge in the use of computer for learning (PowerPoint presentation, interactive learning, etc.).
Having problems in using ICTs (Information and communication technology for learning).	• Teachers must explain for students how to use Internet technology for learning (Research of learning object, the use of research engine, etc.)? How to find an URL address? What are the different Internet protocols? Because there are students who don't have sufficient knowledge in the exploitation of the Internet for learning. • Students must be trained with sufficient knowledge in ICTs for proper operations of distance learning. • The Internet is the principal resource helping students to have knowledge in ICTs.

The adoption of the best structure for the electronic learning process at the e-learning platform	- The learning process directly affects the quality of e-learning of learners at the e-learning platform. The sequence of learning activities and resources should have a defined structure and adopted for all learning object. - The learning process must be prepared and unified by a group of online teachers and with a collaborative teaching strategy. - Online teachers must be trained in the manner of structuring the electronic learning process. - Produce e-learning resource with a peer production that is defined "Peer production as a method in learning resource creation for e-learning can be defined to include the digital content created, edited, enriched and validated by peers, in other words by people on the "same hierarchical level ". (Auvinen 2009). Peer production of e-learning content is an approach to empower a wide variety of professionals to the learning content production.
Cognitive flexibility provided by the electronic learning process	Only a covering of the studied domain with a different point of view, multiple representation of knowledge, connecting abstract concept with a case study, etc. allow and effective learning (Jacobson and al. 1995).
	The theory of the cognitive flexibility is a constructivist theory of education based on the hypothesis according to which the acquisition of the complex knowledge is more effective when there is exposure of learners several times in the same of learning situations, but according to different perspectives (Feltovich, Spiro and Coulson on 1989; Spiro and al. 1988; Spiro, Vispoel, Schmitz, Samarapungavan, and Boerger, on 1987). The authors (Spiro and al. 1992) proposed this constructivist theory of education to treat the complex domains of knowledge to be acquired by learners. The theory of the cognitive flexibility suggests that the learners can face the complexity of the situation of learning more easily with multiple representations of the same information in various contexts to acquire the necessary mental developments. The cognitive flexibility favors the development of the skills and the transfer of knowledge by confronting the learner with multiple representations of case study. The theory of the cognitive flexibility facilitates the useful cognitive development for the learning. Indeed, the learner can acquire a capacity to pass of a type of data processing in the other one in a faster and stiffer way. We suggest the designers of online course to adopt the cognitive flexibility theory.
Hypermedia and hypertext for the electronic learning process	- The learning process based on hypermedia (image, video, sound. etc.) and hypertext systems have added value on the effectiveness of learning. It is advisable to adopt these multimedia learning objects in the learning process. Hypermedia learning resources can be Flash animation, video to present a course, sound, etc., hypertext can be information related by hyperlinks, links to a website, wiki, etc. - Use the peer production (Auvinen 2009) for hypermedia and hypertext for e-learning content. At the moment there are already available a number of technical tools (often in open source environment) supporting the quality

	of peer production in e-learning include, among others, the following: (blogs, Wikis and other text based collaboration format, tagging and social bookmarking, media sharing, Pod-casting, social tagging (Anderson 2007).
Visual and design of the online learning resources	• Adopt a good man machine interface that defines the ergonomics and psychological aspect of presentation of learning object in the learning process. The visual and design, the colours used, etc. have an added value for learning of students. The statistics for our case shows that 51.1% students do not agree with the visual and design of the current didactic content. The platform's administrator and publisher teachers of learning process should improve the visual design of learning content and compare it with the visual and design of contents of other e-learning platforms.

Conclusion

To conclude, results of the present study clearly show that the influencing factors of students positive opinion about the use of e-learning technology is recapitalized in three important factors. The first factor is the expertise of learners in ICTs (information and communication technologies) for learning. The second factor is the design of the electronic learning process adopted by online teachers (The structure adopted for the learning process, cognitive Flexibility provided by the learning process, visual and design of electronic learning process, hypermedia and hypertext for the electronic learning process). The third factor is the adoption of the e-learning (The ease of the use of the features of the e-learning platform).

The first and the third factors are linked to efforts of learners to have a high expertise in educative information and communication technologies and the adoption of e-learning system through the ease of use of the features of the e-learning platform. The second factor is linked to role of online teachers to provide an acceptable design of the electronic learning process.

In order to solve e-learning problems of students, it is recommended that the online teachers should adopt harmonized learning processes to all teachers at the university and adopt the cognitive flexibility in the design of the e-learning process. The recommended learning process based on hierarchical navigation begins with a video to introduce the objective of the module, after the video, the use of a map image is useful to introduce all chapters of the module and show learners all the content of the module. From the map image, it is possible for the learners to visit any chapter of the module and return to the map. As for chapters, it is possible to insert a video introducing them along with the PDF file or hypertext file or any other type of file pertinent to the content. It is also possible to insert multiple choice questions or practice work or exercises as a way of evaluation. This learning process is very flexible with regard to the learning style of students based on hierarchical navigation and

contains more a variety of file (video, PDF, hypertext, etc.). It is also very structured and based on hypermedia and hypertext with a good visual and design for learning resources. The results also show that exposing students to technologies of information and communication for learning helps learners to solve more learning problems and facilitate technologies that support e-learning. Motivating students to access the computer from home, from university or from Internet clubs; familiarizing students with internet search for documents useful for learning, using search engines and using e-mail address to send or to receive learning objects for knowledge sharing and to receive news of learning help students to optimize the effectiveness of learning and teaching.

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Appendices
Questionnaire for exploring opinions of students about the influencing factors of the adoption of the e-learning technology in teaching and learning
Name and Surname of the learner……………………………………

Socio-demographic characters
How old are you?

- o   Less than 22
- o   Between 23 and 25
- o   More than 25

 What is you gender?

- o   Male
- o   Female

Items of the questionnaire
1. I believe that e-learning technology is very useful for learning the online courses.

- o   I agree strongly.
- o   I agree.
- o   Neutral.
- o   I disagree.
- o   I disagree strongly.

2. I believe that the features of the Moodle e-learning platform are easy to use.

- o   I agree strongly.
- o   I agree.
- o   Neutral.
- o   I disagree.
- o   I disagree strongly.

3. I have a high expertise in general web surfing. The moduleiseasy to learnin thee-learning platform

- o   I agree strongly.
- o   I agree.
- o   Neutral.
- o   I disagree.
- o   I disagree strongly.

4. Ihave a high expertise in using Internet for learning.

- o   I agree strongly.
- o   I agree.

  o Neutral.

  o I disagree.

  o I disagree strongly.

5. I have a high expertise in using computer for learning.

  o I agree strongly.

  o I agree.

  o Neutral.

  o I disagree.

  o I disagree strongly.

6. I possess an email address and I use it in the learning context.

  o I agree strongly.

  o I agree.

  o Neutral.

  o I disagree.

  o I disagree strongly.

7. I have problems in using ICTs (Information and communication technology for learning).

  o I agree strongly.

  o I agree.

  o Neutral.

  o I disagree.

  o I disagree strongly.

8. The learning process at the e-learning platform is clear and structured?

  o I agree strongly.

  o I agree.

  o Neutral.

  o I disagree.

  o I disagree strongly.

9. The e-learning process gives us flexibility to navigate in learning resources?

  o I agree strongly.

  o I agree.

  o Neutral.

  o I disagree.

  o I disagree strongly.

10. I prefer learning process based on hypermedia and hypertext?

- o I agree strongly.

- o I agree.

- o Neutral.

- o I disagree.

- o I disagree strongly.

11. The visual and design of the learning resources in the learning process is acceptable?

- o I agree strongly.

- o I agree.

- o Neutral.

- o I disagree.

- o I disagree strongly.