THE EMOTIONAL IN E-LEARNING

Raafat George Saadé
Dennis Kira
Concordia University

ABSTRACT
This study investigates perceived ease of use and overall computer/internet experience as emotional factors that affect e-learning. Results suggest that online learning systems design should address typical software interfaces so that students feel more comfortable using them.

KEY WORDS
Online learning, emotion, conation, affect, affective learning, mediators, technology acceptance model, perceived ease of use

I. INTRODUCTION

Learners seek educational opportunities in formats that meet their lifestyles today, and online learning promises to meet student's learning needs. Positive perceptions and emotions and higher computer self-efficacy are conducive to learning. However, our understanding of the effectiveness of new delivery modes and the appropriate pedagogy is still in its infancy [1].

Despite the increased robustness of the technology and the appeal of the different delivery mechanisms, several challenges remain unresolved. In recent years, many e-learning studies have been published with emphases on web-based learning [2], evaluation of online learning, measurement of student perceptions of online learning [3, 4] and various methods of delivery [5, 6]. A sub-group of these studies aims at better understanding emotions in online learning. This study contributes to the research by investigating the role of affect in the relationship between computer experience and perceived ease of use of a system. Before we discuss our methodology and results, we present a review of relevant literature related to computer/internet experience; learning and emotion; affect; and perceived ease of use.

A. Computer/Internet Experiences

Experience is one factor that influences a user's formation of beliefs about using a system; and experience is one of the most important determinants of self-efficacy. In most cases, experience gained through direct use positively affects the user's perception, attitude, and use of the system.

In past computer usage studies, one of the common threads linking computers to the users is the amount of experience users have had with computers. In general, findings tend to support the proposition that a positive attitude toward computers is associated with greater computer experience. However, researchers have also pointed out that the type of computer experience is important in forming the user's computer attitude [7, 8]. Prior research in end-user computing found that individuals with more computer experience had higher levels of computer skill [9], and computer experience has been shown to have a positive effect on computer attitudes [7,8,10,11]. However, other research has had mixed results [8, 12, 13, 14, 15].

In one study, the influence of various variables on usage was reported to be significantly different among experienced and inexperienced users. For experienced users, there was a stronger link between intentions and usage [16]. The results of Taylor and Todd's study of inexperienced and experienced users confirmed that there is a stronger correlation between behavioral intention and actual usage for experienced users. Venkatesh and Morris [17] found that as direct experience with technology increases over time, individuals have a better assessment of the benefits and costs associated with using technology. Igbaria and Iivary [18] found that computer experience directly and indirectly affects usage, and that individual skills and expertise were related to user beliefs and usage. Igbaria et al. [19] found that the use of computer technology depends on the technology itself and the level of skill or expertise of the individual using it. The relationship between experience and usage, expressed as skills or expertise, is empirically supported [20, 21].

Venkatesh and Davis [22] found that the perceived ease of use (PEU) of a system measured after hands-on experience is system-specific and hence, significantly different from measures taken before hands-on experience. Bajaj and Nidumoli [23] showed that past usage (prior experience) influences ease of using the system, a key factor in determining future usage. Based on these findings on computer experience and its relationship with PEU, we hypothesize the following: Students who believe in the usefulness of the learning tool also believe their performance in the course will improve by using it.

Past experience is a determinant of behavior [24]. Thus, the Technology Acceptance Model (TAM) identifies the relationships between PEU, perceived usefulness (PU), attitude (ATT), and behavioral intention (BI) towards a target system [25]. In the present study, perceived ease of use (PEU) refers to the degree to which the user expects the target system to be free from effort [25]. Thus, students that perceive the system to be useful develop better attitudes towards the learning tool [26, 27, 28]. Moreover, empirical evidence indicates that computer/internet experience leads to the formation of positive attitudes toward computer and internet usage, [7, 8, 10, 11], tending to reduce computer anxiety and help temper individual's anxiety levels in further computer use [29, 30, 31].

B. Learning and Emotion

According to Huitt [32], psychology examines three components of mind: cognition, affect, and conation. Generally cognition refers to the process of coming to know and understand by encoding, storing, processing, and retrieving information. Conation refers to the connection of knowledge and affect to behavior. Conation is the personal, intentional, deliberate, goal-oriented component of motivation [33, 34, 35].

Affect refers to the emotional interpretation of perceptions, information, or knowledge. It is generally associated with one's attachment (positive or negative) to people, objects, and ideas.

There has been little exploration of the extent to which emotion is associated with learning online. O'Regan, [36] points out that twenty years ago Martin and Briggs [37] proposed the integration of the two domains, affective and cognitive, into a more holistic and realistic framework for instructional design. Although separating emotion and cognition contributes to the difficulty of defining perspectives and emotions [38, 39, 40], it is clear that factors such as motivation [41, 42], self-efficacy [43], learning styles [44], and emotional intelligence, [45] play increasingly important roles in educational research as we seek to define affective and conative variables that impact the learning process.

We need to consider the vast range of variables and constructs that support learner diversity and complexity [46]. Affective and conative factors help us understand how to teach and support the whole learner.

C. Affect

Affect has four dimensions: cognitive, affective, behavioral and perceived control. The cognitive component focuses on belief, including whether or not a person believes that computers can significantly increase the quality of learning. The affective component is the emotion or feeling concerned with how much the user likes the computer, and the behavioral component relates to what the user actually does or intends to do with the technology. The fourth dimension considers the perceived control components of computer attitudes, that is, ‘‘the perceived ease or difficulty of performing a particular behavior’’ [47]. By taking affect into account we should be able to explain more variance in users’ intention and behavior [48]. The affective component refers to an individual’s feelings of joy, elation, pleasure, depression, distaste, discontentment, or hatred with respect to a particular behavior [49]. Positive affect towards a learning tool leads to gaining experience, knowledge, and self-efficacy regarding usage. Negative affect causes students to avoid the learning tool, thereby not developing perceived control [50, 51].

Recent findings in learning support new advances in understanding the human brain not as a purely cognitive information processing system, but as a system in which affective functions and cognitive ones are inextricably integrated with one another [52, 53, 54, 55]. A number of educators and educational researchers have recognized that active participations are important factors in the learning process [56, 57, 58]. However, acceptance of these affect-related ideas is too often based on intuition and generalized references to constructivist theorists [59].

Computers have served as tools to aid learning in a wide range of domains and contexts: from the classroom where computers are used to enhance the learning experience via online activities and learning tools, to the research lab where computers help researchers develop and reshape the ways we think about learning. The field of artificial intelligence (with emphasis on ideas such as knowledge representation, modeling of logical processes, and other kinds of important cognitive activities) has prompted thinking about parallel concepts in human learning, and facilitated the development of theories where thinking and learning are viewed as information processing [60].

“The extent to which emotional upsets can interfere with mental life is no news to teachers. Students who are anxious, angry, or depressed don’t learn; people who are caught in these states do not take in information efficiently or deal with it well” [44]. We need to increase efforts to understand the role of affect in e-learning. We believe that new technologies can play a particularly important role in these efforts, helping us to measure, model, study, and support the affective dimension of learning in ways that were not previously possible.

D. Perceived Ease of Use

Many theoretical frameworks have been used to measure technology usage satisfaction; however, few have been used in the online learning context. The Technology Acceptance Model (TAM), the model most widely applied to technology adoption, is useful for studying the acceptance of computer-assisted applications [4, 21]. The goal of TAM is “to provide an explanation of the determinants of computer acceptance that is in general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified” [61, and see also 25, 62]. In general, the TAM theorizes that perceived usefulness (PU) influences attitudes (ATT) towards technology usage and is an important determinant of individuals’ intentions to use the technology.

According to TAM, a person’s intention to use a specific system is jointly determined by one’s attitude toward using the system and PU. This implies that the easier the system is to use, the greater the user’s perceived self efficacy regarding capacity to use the system comfortably will be. External variables represented in TAM provide the bridge between the internal beliefs, perceived usefulness and perceived ease of use (PEU), attitude and intentions as well as individual differences, situational constraints, organizational characteristics and system characteristics impacting on behavior. Both constructs, PU and PEU, were reported to correlate with self reported usage and self predicted future usage, although PU tends to have a greater effect on usage behavior than PEU when users have used the system for a longer time. This is primarily due to how users process PEU. It seems that users perceive ease-of-use early in exposure to the system. Moreover users are more concerned with the likelihood of succeeding in learning to use the system at the early stages of usage [31, 63].

TAM emphasizes the importance of how external variables can affect the individuals' internal decision process when it comes to using a system within organizations. External variables affect PU directly or indirectly through PEU since it influences the user's near-term perception of usefulness and, to a lesser extent, long-term perception [64]. Interaction among systems, direct experience with a system, system characteristics [65], prior experience with similar systems, and domain knowledge determine the user's perception of ease of use of a system [66]. According to previous studies, efficacy, intrinsic motivation, cognitive absorption, and computer anxiety were all determinants of PEU [28, 67, 68, 69, 70]. In addition, researchers have observed that PEU and PU, to some extent, are influenced by external variables, observations leading to the extension of the technology acceptance model [17, 22, 67, 68]. Extensions to the theory proposed that control, intrinsic motivation (such as playfulness), and emotion (such as anxiety) are anchors that influence users' early perceptions about the PEU of a system. These extensions were strongly supported by the empirical results that indicate up to 60% of the variability of PEU is explained by the model [17].

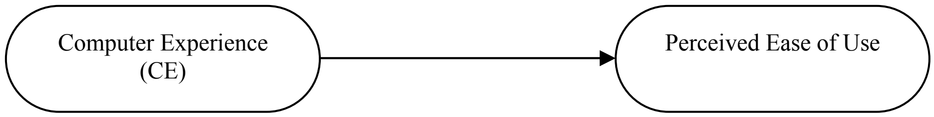
Web-based technologies are designed to facilitate the e-learning process, and therefore their perceived ease of use is a definite necessity, especially where the learners have only recently been introduced to computer and internet technology. Much effort has been devoted to creating user-friendly graphical user interfaces in software development, in recognition of the importance of perceived ease of use [17]. With web-based technologies several studies have pointed out that factors relating to the ease with which information can be found on a web site and the ease with which information can be understood affects web site perceived ease of use [72]. They identified two constructs, ease of finding (navigation) and ease of understanding (cognition), that significantly predict perceived ease of use of a web site.

Taking the cue from other researchers who worked on the extension of TAM model, we hope to provide additional understanding of the role of affect (AFF) as an antecedent to the PEU construct in TAM. We provide results related to the impact of affect on PEU. Our study involves 114 students that used a learning tool (developed in-house) as part of an introductory course in management information systems. We examine the effect of internet (IE) and computer experiences (CE) on PEU and the effect that AFF has on these relationships. Prior research in information systems has investigated the four constructs mentioned herein to understand individual reactions to computer systems [22, 61, 63, 67] however, none has used online learning tools as the target technology or directly compared and contrasted the mediating impact of affect construct on IE/CE and PEU relationships.

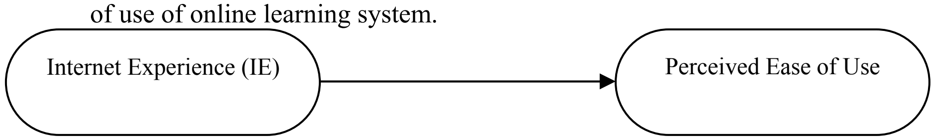
II. RESEARCH HYPOTHESES

Bajaj and Nidumoli [23] showed that past usage (prior experience) influences the ease of use of the system, and is the key factor in determining future usage. Previous studies also indicate that the kind of computer experience influences individuals' feeling toward the use of computer. IE and CE are used to measure differences in computer experiences that individuals may have had in the past. Based on these findings, we hypothesize the following: Students that believe in a use-performance relationship with the learning tool also believe that by using it their performance in the course will improve. Specifically we make the following two hypotheses (H1a; H1b) related to computer/internet experience and PEU, shown in figure 1.

H1a: Computer experience has a significant positive effect on students' perceived ease of use of online learning system.



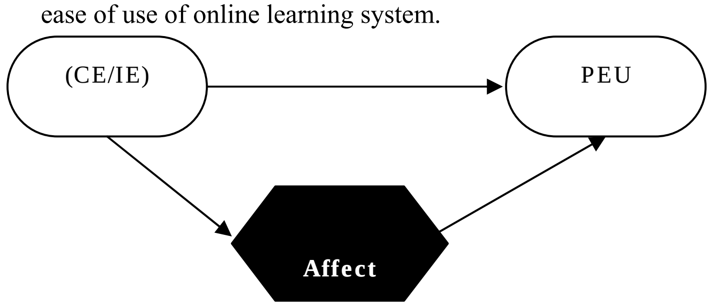
H1b: Internet experience has a significant positive effect on students' perceived ease of use of online learning system.



As pointed out earlier, there is a need to further understand the role that affect plays in students' online learning. To that effect, we consider the following hypotheses (shown in figure 2):

H2a: Affect significantly mediates the effect of computer experience on perceived ease of use of online learning system.

H2b: Affect significantly mediates the effect of Internet experience on perceived ease of use of online learning system.



The study was conducted in an undergraduate course setting spanning one semester, using a web-based interactive 'multiple-choice' and 'true-or-false' learning tool. Throughout the semester, students in an introductory management information systems course at a major university in Canada used this learning tool as part of the course requirements.

Developed in-house, the objective of the learning tool was to help students understand course topics by practicing multiple choice and true or false questions. The learning tool is web-based, and students were able to access it anywhere, anytime. The system monitored the students' activities by storing the time spent on the system, the chapters practiced, and scores.

At the end of the semester, a survey instrument was administered to the one hundred and fourteen students who participated in this study. Respondents were 52% female and 48% male with a mean age of twenty-three years. The respondents had an average of two years of work experience, used the internet close to one hour a day and claimed to have strong knowledge of basic software utilization.

Items (presented in Table 1) used to measure the present model constructs were adopted from the research work of Davis [65] and Venkatesh [70]. Some wording was changed to account for the context of using learning tools. All items, with the exception of computer and internet experience, were measured using a five-point Likert-type scale with answers from “Strongly disagree” to “Strongly agree.”

Construct	Item	Measure
Perceived Ease of Use (PEU)	PEU1	I think that learning to navigate the on-line learning system will be easy for me.
	PEU2	I think that I will find it easy to get the on-line learning system to do what I want it to do.
	PEU3	I think that it would be easy for me to become skillful at using the on-line learning system.
	PEU4	I think that I will find the on-line learning system easy to use.
Affect (AFF)	AFF1	I like working with computers.
	AFF2	I look forward to those aspects of my course work that require me to use a computer.
	AFF3	Once I start working on a computer, I find it hard to stop.
	AFF4	Using a computer is frustrating for me.
	AFF5	I get bored quickly when working on a computer.
Computer and Internet Experience (CE/IE)*	CE1	See scale below
	CE2	See scale below
	IE1	See scale below
	IE2	See scale below

Scale →	**1**	**2**	**3**	**4**	**5**
Question ↓					
CE1: Knowledge about computers.	V.K.	S.K.	N.	S.U.	V.U.
CE2: Experience with at least one of Microsoft products.	V.H.	H.	N.	L.	V.L.
IE1: Time using the internet.	< 6 m	6m–1yr	1-2yrs	2-5yrs	>5 yrs
IE2:Daily internet usage.	< 15 min	15min-1hr	1hr-2hrs	2-5hrs	>5 hrs

Table1. Measures of Study Variables
Scale for Computer and Internet and Experience
V/S = Very/Somewhat; K=Knowledgeable; H=High; L=Low

IV. RESULTS, ANALYSIS AND FINDINGS

The 114 usable questionnaires were examined for missing data (6 missing data were found). In our preliminary replaced the missing values [74] b7 first assessing the Cronbach’s alpha coefficient for internal consistency reliability. We found, as summarized in Table 2, the reliability of PEU and AFF constructs are acceptable [74, 75]. Although the normally acceptable lower limit for alpha value indicating the consistency of the scale is .7, in exploratory research one can accept alpha value close to .6 [76].

Variables	Cronbach's alpha	Mean	Variance
Perceived Ease of Use (PEU)	0.929	3.60	.0122
Affect (AFF)	0.901	3.59	.0655
Computer Experience (CE/IE)	0.584	3.14	.0406

Table 2. Reliability Assessment

Second, reliabilities of individual items were assessed by examining the loadings of the items on their respective constructs presented in Table 3. These loadings should be higher than 0.5, following the criterion suggested by Pedersen and Nysveen [28] to indicate that significant variance was shared between each item and the construct. It is expected that the loadings of all items within a construct should be high on that construct, ensuring high convergent validity, and should be low on the others. The factors, underlying variables that reflect combinations of observable variables, were extracted using the principal components method (varimax rotation) which is an optimum approach to condensation prior to rotation. Table 3 clearly shows that the three-factor solution is appropriate, and the items display desirable convergent and discriminant validity.

	Factor 1	Factor 2	Factor 3
PEU1	**.853**	.274	.163
PEU2	**.900**	.218	.020
PEU3	**.836**	.183	.029
PEU4	**.868**	.192	.153
AFF1	.297	**.813**	.221
AFF2	.220	**.873**	.071
AFF3	.057	**.807**	.202
AFF4	.447	**.681**	.089
AFF5	.280	**.798**	.081
CE1	.514	.241	**.496**
CE2	.400	.161	**.426**
IE1	.091	-.014	**.788**
IE2	-.046	.334	**.525**

Table 3. Factor Analysis

The proposed mediation hypotheses are often tested by using a statistical technique suggested by Baron and Kenny [80]. Mediation is considered to be established based on the following criteria: (1) A significant relationship exists between the independent variable and the dependent variable; (2) a significant relationship exists between the independent variable and the presumed mediator; and (3) in the presence of a significant relationship, the previous significant relationship between the independent variable and the dependent variable is no longer significant or the strength of the relationship is significantly decreased. However, tests can be conducted to calculate the indirect effect and its statistical significance to ascertain whether affect mediates the relationship between the experience and PEU.

H1a and H1b hypothesized that CE and IE have a significant effect on PEU. As shown in figure 3, the effect of IE on PEU was significant (□ = 0.224, t=2.438, p = 0.016), supporting H1a; the effect of CE on PEU was significant (□ = 0.556, t=7.079, p = 0.000).

H2a and H2b hypothesized that the effect of IE and CE on PEU would be mediated by affect. The relationship between IE and AFF was significant (□ = 0.343, t=3.870, p = 0.000). When PEU was regressed on both IE and AFF, no significant relationship was found between IE and PEU (□ = 0.051, t=.051, p =.556) but the relationship between AFF and PEU was significant (□ = .506, t=5.883, p =0.000). Thus we can conclude that affect does not mediate the relationship between IE and PEU.

The relationship between CE and AFF was significant (□ = 0.724, t=11.119, p = 0.000). When PEU was regressed on both CE and AFF, a significant relationship was found between CE and PEU (□ = 0.396, t=4.707, p =.000) and the relationship between AFF and PEU was significant (□ = .333, t=3.960, p =0.000). Thus we can conclude that affect mediates the relationship between CE and PEU since the strength of relationships between the CE and PEU was reduced from 0.724 to 0.396.

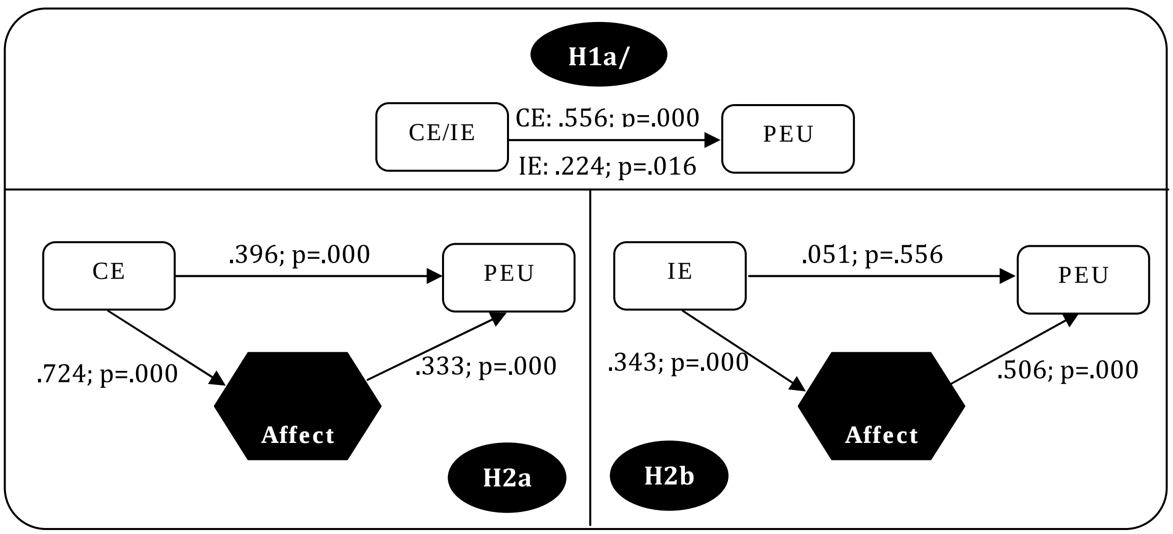


Figure3. Mediation of Affect (Hypotheses supported) Between CE/IE and PEU

Although the construct CE/IE has been used to represent technology experiences related to computer usage, IE1 (time using the internet) and IE2 (daily internet usage) have limited influence on the users' perception of the ease of use. The decision to use these items for the construct is mainly based on inconclusive results of the past studies concerning the impact of computer experience on attitude. Past research indicates that computer experience positively correlates with computer attitudes [29, 78, 79, 80, 81, 82, 83] and computer use [78, 82]. But in fact, some results indicate that the greater exposure or increase in computer experience may exacerbate computer anxiety and promote more negative attitudes toward computers [84]. This pattern of results suggests the presence of some third, unaccounted for factor, which may mediate or moderate the effects of computer experience on attitude [84]. In addition, the challenge in understanding the impact of computer usage on user perception is due to the inappropriate measures used to measure computer experience. Often, the amount of time users spend on computer and computer experience are used interchangeably [85, 86, 87, 88, 89]. Thus, we have included two objective items (IE1, IE2) and subjective items (CE1, CE2) to measure the concept of computer experience. Our data indicate that the time spent on the internet regularly does influence users' perception of how they may be able to use online tools designed to enhance their learning experience. Based on factor analysis, the only items with higher than .5 loading are IE1 (duration of usage) and IE2 (frequency of use). However, we chose to include CE1 and CE2 to represent users' total "computer experience". To further investigate how individual variables are related to PEU, we have considered the following relationships:

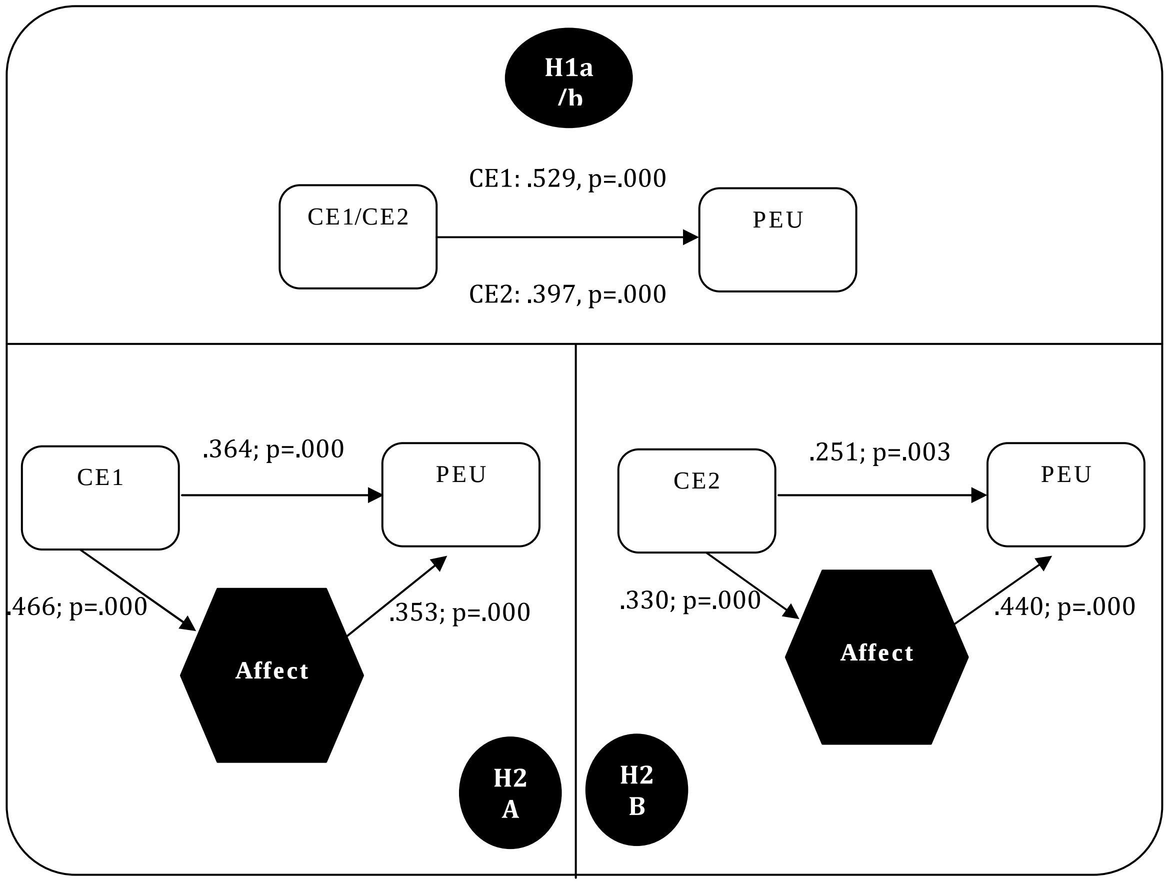


Figure3a. Mediation of Affect (Hypotheses Supported) Between CE and PEU

H1a and H1b hypothesized that CE1and CE2 have a significant effect on PEU. As shown in figure 3a, the effect of CE1 on PEU was significant (□ = 0.529, t=6.597, p = 0.000), supporting H1a; the effect of CE2 on PEU was significant (□ = 0.397, t=4.576, p = 0.000).

H2a and H2b hypothesized that the effect of CE1 and CE2 on PEU would be mediated by affect. The relationship between CE1 and AFF was significant (□ = 0.466, t=5.578, p = 0.000). When PEU was regressed on both CE1 and AFF, a significant relationship was found between CE1 and PEU (□ = 0.364, t=4.302, p =.000), and the relationship between AFF and PEU was significant (□ = .353, t=4.176, p =0.000). Thus we can conclude that affect does mediate the relationship between CE1 and PEU since the strength of relationships between the CE1 and PEU was reduced from 0.529 to 0.364.

The relationship between CE2 and AFF was significant (□ = 0.330, t= 3.706, p = 0.000). When PEU was regressed on both CE2 and AFF, a significant relationship was found between CE2 and PEU (□ = 0.251, t=3.055, p =.003) and the relationship between AFF and PEU was significant (□ = .440, t=5.348, p =0.000). Thus, we can conclude that affect mediates the relationship between CE2 and PEU since the strength of relationships between the CE2 and PEU was reduced from 0.397 to 0.251.

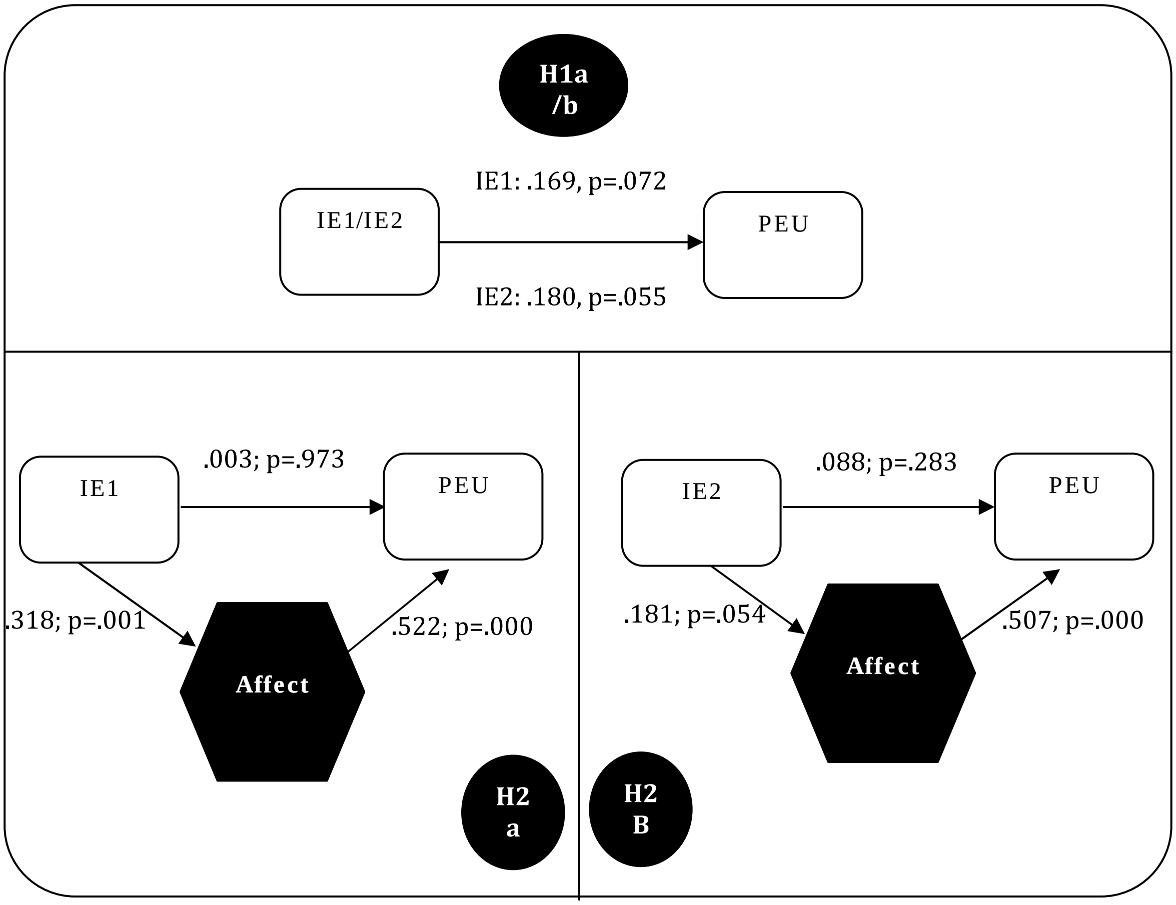


Figure 3b. Mediation of Affect (Hypotheses Not Supported) Between IE and PEU

H1a and H1b hypothesized that IE1and IE2 have a significant effect on PEU. As shown in figure 3b, the effect of IE1 on PEU was marginally significant (□ = 0.169, t=1.816, p = 0.072), supporting H1a; the effect of IE2 on PEU was marginally significant (□ = 0.180, t=1.937, p = 0.055).

H2a and H2b hypothesized that the effect of IE1 and IE2 on PEU would be mediated by affect. The relationship between IE1 and AFF was significant (□ = 0.318, t=3.553, p = 0.000). When PEU was regressed on both IE1 and AFF, no significant relationship was found between IE1 and PEU (□ = 0.003, t=.034, p =.973), and the relationship between AFF and PEU was significant (□ = .522, t=6.122, p =0.). Thus we can conclude that affect does not mediate the relationship between IE1 and PEU.

The relationship between IE2 and AFF was marginally significant (□ = 0.181, t= 1.948, p = 0.054). When PEU was regressed on both IE2 and AFF, no significant relationship was found between IE2 and PEU (□ = 0.088, t=1.078, p =.283) and the relationship between AFF and PEU was significant (□ = .507, t=6.201, p =0.000). Thus we can conclude that affect does not mediate the relationship between CE2 and PEU.

V. CONCLUSIONS, IMPLICATIONS AND LIMITATIONS

The primary objective of this study was to investigate the role that affect plays in mediating the impact of computer experience on perceived ease of use in the context of learning tool utilization. Affect was shown to mediate the impact of CE on PEU thereby supporting H1a, H1b and H2a but not H2b. Similar conclusions are reached when the internet computer experiences and general computer experiences were separated for the analysis. When the general computer experience is considered, the affect was shown to mediate the impact of computer experience on PEU but not when the internet experience was considered. The results suggest that computer related personality traits influence perceived ease of use in some cases. However, this assertion is not as straightforward as it seems because the quality of support in terms of professionalism, friendliness and enthusiasm also has a profound influence on computer acceptance [66]. This alone has major significant impact on how educational information systems in general, and learning tools in specific, should be designed and implemented.

A few limitations to this study exist and should be noted. First, the questionnaire approach is not free of respondent subjectivity, and the survey was taken at one point in time. User reactions change in time and may depend on the environment such as the classroom location and time of course. Second, caution must to be taken in generalizing the results due to the fact that participants in this study were from different cultural backgrounds with different cultural beliefs influencing their perceptions and attitudes.

Also, previous studies have shown that perceptions and attitudes differ between the mandatory or voluntary use of information technology (in this case, the learning tool). This study is limited in that respect because it did not differentiate between mandatory or voluntary use. In fact, students were given the choice to use the learning tool either for practice with no score value to the overall course grade or for 10% value of the course grade.

Finally, conclusions are based on the use of a specific learning tool which was developed in-house. Other learning tools can have different designs, be developed for different platforms (in this case it was web-based) and used under different settings. This therefore may not generalize across a wide set of learning tools.

This research was motivated by an interest in understanding the role that personal level of anxiety and affect play in mediating perceived ease of use. Our study shows that positive affect has a strong significant mediating influence on perceptions of the learning tool being easy to use. Our findings suggest that prior to introducing prospective students to learning tools they should be tested for the type of computer experiences they have had. In the context where the learning tool usage is motivated by the score obtained, affect does mediate the CE-PEU relationship. In other words, individuals who are more joyful on the web have better attitude about the ease of use of learning tools. However, direct internet experiences (IE) and PEU relationship is not mediated by the affect variable.

The findings demonstrate the value of the contribution of affect as a mediator to perceived ease of use of learning tools. With the continuous development of richer and more appealing interfaces, this study stresses the importance of intrinsically motivating experiences such as ‘affect’ for learning. As a means to better understand the dynamics of human computer interactions, the feelings a person ascribes to some previous computer experience need to be understood [31, 57]. This construct might dominate as a predictor of usage intentions. Course designers and managers who desire to successfully implement new learning tools in a higher education or training context need to be aware of this relationship to create an environment supportive of subjective attitudes.

Another key implication for designers/managers relates to guidelines for the design of learning tools. Positive attitude is more likely to be experienced with learning tools that are interactive and motivating. Paying close attention to integrating interactive features in the design of learning tools and providing incentives to motivate usage assists those responsible for diffusion of the learning tools.

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VII. ABOUT THE AUTHORS

Dr. Raafat George Saadé is currently assistant professor in the John Molson School of Business, Concordia University, in Montreal, Canada, specializing in intelligent e-learning tools. Dr. Saadé is now running two online courses at the undergraduate level. The first has been running successfully for four years with 250-300 students enrolled in every semester. The second is running for two semesters and is in the reflective design lifecycle. Dr. Saadé has published in many journals including JISE, JITE, I&M and Expert Systems with Applications. His publications are part of a plan leading to the eventual development of his research dream: A Generic Model for Effective e-learning Delivery.

Dr. Dennis Kira is a chairman of Department of Decision Sciences & Management Information Systems in the John Molson School of Business, Concordia University, in Montreal, Canada. His main research interest is in asynchronous online learning, Data mining and neural networks as well as management modeling. He has published in Distance Learning Technologies, JIST, and Management Sciences.