# Web-Based Educational Information System for Enhanced Learning, EISEL: Student Assessment

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## Executive Summary

During the last decade, Information Technology (IT) has been the primary force driving the transformation of roles in the education industry. More specifically, the World Wide Web (WWW) and associated technologies provided a new playground with new rules and tools to conduct instruction and create novel approaches to learning. We have seen the application of IT in education in the form of CD-ROMs. With the evolution of the WWW we saw education marketed as long distance learning, web based learner centered environments, internet based learning environments, and self instructed learning. With all the different models used on the web, few have studied their acceptance and their effectiveness on learning. Many educational institutions today have embarked in the development of web based courses. However, they face enormous difficulty in achieving successful strategies including the delivery, effectiveness, and acceptance of the courses. This is mainly due to the fact that the problem of developing a successful web based course involves multiple inter-related dimensions ranging from technology related issues to pedagogical considerations.

Davis (1989) proposed a Technology Assessment Model (TAM) to explain user acceptance of technology. The TAM identifies 'perceived usefulness' and 'perceived ease-of-use' as the antecedents to 'behavioral intentions' to use a technology. Extensive attention in previous TAM research dealt with business software in a business context. More effort is required to investigate research results involving different technologies and user populations. In response, this paper reports on research work that investigated the applicability of a modified version of TAM in explaining students' acceptance of web based technologies for their courses. The target IT presented herein is a web-based Educational Information System for Enhanced Learning (EISEL). The results of the modified version of TAM are discussed. The technology and user group are new to the IT acceptance and adoption research. The TAM constructs were operationalized in the context of the EISEL. This research is a first attempt (using the first version of EISEL) to understand students' beliefs and perceptions in relation to using a web based learning tool.

Our results suggest that TAM was able to provide a relatively reasonable view of students' acceptance of EISEL. However, compared with prior TAM studies, it appears that the TAM has weaker utility for explaining students' intentions in the context of education and learning. 'Perceived usefulness' was found to have a significant positive influence on intentions to use, but perceived ease of use did not. Furthermore, the influence of 'perceived ease of use' on 'perceived usefulness', was found to be strong. Overall, these findings suggest that students will not necessarily intend to use EISEL because it is easy to use, but rather perceive that it is easy to use. Then it will help them perform better in the course. This posits a strong positive relationship between 'perceived ease of use', 'per-



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ceived usefulness' and 'behavioral intention' to use. The relatively low R-squared of the model, suggests both the limitation of the model for the present context, and the need to integrate additional variables. These variables should be consistent in order to improve the TAMs' explanatory utility in the web based student learning context.

**Keywords**: TAM, Information Technology, Web-based, Learning

# Introduction

During the past couple of years, courses offered on the Internet have increased at an exponential rate. In today's world there is a great demand for learning. The Internet is being marketed as the effective vehicle for teaching and learning. And with the global nature of the Internet, this teaching and learning vehicle can reach the mass audience. There is a vast amount of courses, degrees and certificate programs offered on the Internet (e.g. Mind Edge (2003), which lists a total of 13,754 accredited and not for credit different courses). This pressure from the "education industry", which has been felt by the traditional universities since 1996, challenged the Universities to redefine and restructure their strategies for the higher education environment (Association of European Universities, 1996). As a result, higher education institutions are setting up their own Internet based "virtual" campuses (Onay, 1999).

Internet-supported and fully-Internet courses in higher education institutions are common nowadays (Pospisil & Willcoxson, 1998). The main objective of web based course environments is to enhance learning experiences and improve learning outcomes. In the past, students' perceptions on web based learning environments were mixed. While web based environments provided flexibility in time, space and distance and was well received by students in general (Eklund & Eklund, 1996), many students reported feeling isolated, lack of motivation or lack or support and feedback, which consequently led to drop out of the web course (Kum, 1999).

Regardless of the extent of failures or successes in running web-based courses (partially as part of the course or completely online without instructor intervention), the opportunity now exists to look more closely at the effectiveness of a web-based learning environment (Chang, 1999). However, since the web is a new medium (for developers, instructors and students alike) for course delivery and learning, it is not well known what factors in the online environment contribute more to students' perceived learning. As the exponential growth of online courses continue to impact students, it is imperative to gain a better understanding to improve instruction and students' learning (Jiang & Ting, 2000).

The idea of a learning environment is not new and has been around since the 1930s. However, the web based learning environment is new and was born in the early nineties. This new medium presents us with many challenges as well as opportunities. The web allowed us to disseminate information more effectively, enhance long distance education and create learning tools (such as multimedia learning applications and game based learning modules) focused on specific learning aspects. However, the most important question still remains under investigation: "Does the web enhance the learners' learning experience and improve learning outcomes? If so, then how?"

# Research Objective

Given the importance of information technology for teaching and learning, it is vital that educators in higher education institutions understand better the elements contributing to the successes and failures of web based courses delivery systems. This involves the following:

- Multifaceted background nature of students around the globe,
- Beliefs of students with respect to web technologies,

- Perceptions and attitudes of students with respect to the effectiveness of using web based technologies on their learning and performance,
- Identification of perceived learning construct(s) and antecedents,
- Design issues related to the building of web based learning environments WBLE,
- Mapping or anchoring design elements of the WBLE to learning theories, and
- Evaluation and assessment tools.

Considering the above discussion, the primary objective of this research was to test an adapted version of the technology assessment model (Davis, 1989) as it relates to the perceptions and attitudes of students using a novel Education Information System for Enhanced Learning, EISEL.

# Research Model

## *The Technology Assessment Model (Adapted)*

In this section the research model, which is an adapted version of the TAM model, is presented. The TAM (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) explains user acceptance of a technology based on user perceptions (Venkatesh, 1999). The goal of TAM is to explain the determinants that capture the attitude and behavior of a broad range of users to IT. Two beliefs are posited by TAM: (1) Perceived usefulness and (2) Perceived ease of use. Within the present context, perceived usefulness is defined as the prospective student's subjective probability that using EISEL will increase his or her performance in a course. Perceived ease of use refers to the degree to which the prospective student expects EISEL to be free from cognitive effort. TAM suggests that the actual use of the system is determined by the users' behavioral intentions to use the system, which is in turn jointly determined by the users' attitudes towards using the system and their perceived usefulness of the system (Davis et al. 1989).

Drawing on belief-attitude-behavior models as exemplified by the theory of reasoned action from social psychology (Ajzen & Fishbein, 1980), Davis et al. (1989) suggested that technology use intentions are predicted by perceived usefulness and perceived ease of use. Although the original TAM included attitude as a construct mediating the effects of beliefs on intentions (Davis, 1989), subsequently Davis et al. (1989) dropped attitude from the structural model of TAM (Agarwal, 2000).

While Davis' constructs have been rigorously validated empirically in a number of quantitatively-oriented studies, most of these studies dealt with a business environment, training approach and computer technologies not related to the web (such as Microsoft Word, Excel, and so on). As a matter of fact, very little research of a qualitative nature has been conducted on the TAM constructs (Neville & Fitzgerald, 2002). Furthermore, research in relation to web-based learning environments and the TAM has been rarely investigated.

For simplicity purposes and to minimize the dimensionality of the problem and the number of variables involved, we test the TAM (see Figure 1) without the attitude construct on a novel web based educational information system for enhanced learning (EISEL).

Based on the latter discussion, our research model hypothesizes that student that perceive the system as easier to use will also perceive it be more useful as suggested and supported by the finding from previous technology acceptance research work (Adams, Nelson & Todd, 1992; Agarwal & Karahanna, 2000; Davis et al., 1989; Mathieson, 1991; Szajna, 1996; Venkatesh & Davis, 2000). Drawing upon the literature and based on the present research context, we hypothesize the following:

*Hypothesis 1:*

Students' perceived usefulness of EISEL has a positive effect on behavioral intention to use EISEL.

*Hypothesis 2:*

Students' perceived ease of use of EISEL has a positive effect on behavioral intention to use EISEL.

*Hypothesis 3:*

Students' perceived ease of use of EISEL has a positive effect on students' perceive usefulness of EISEL.

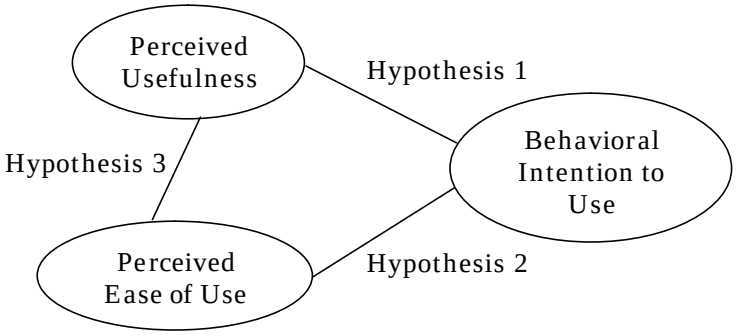



**Figure 1: Research Model.**

## *EISEL*

The EISEL is a web-based application composed of two layers as shown in Figure 2. The first layer includes a system guided navigation panel for the topic that need to be learned. The second layer includes a learning engine for rehearsing content domain knowledge.

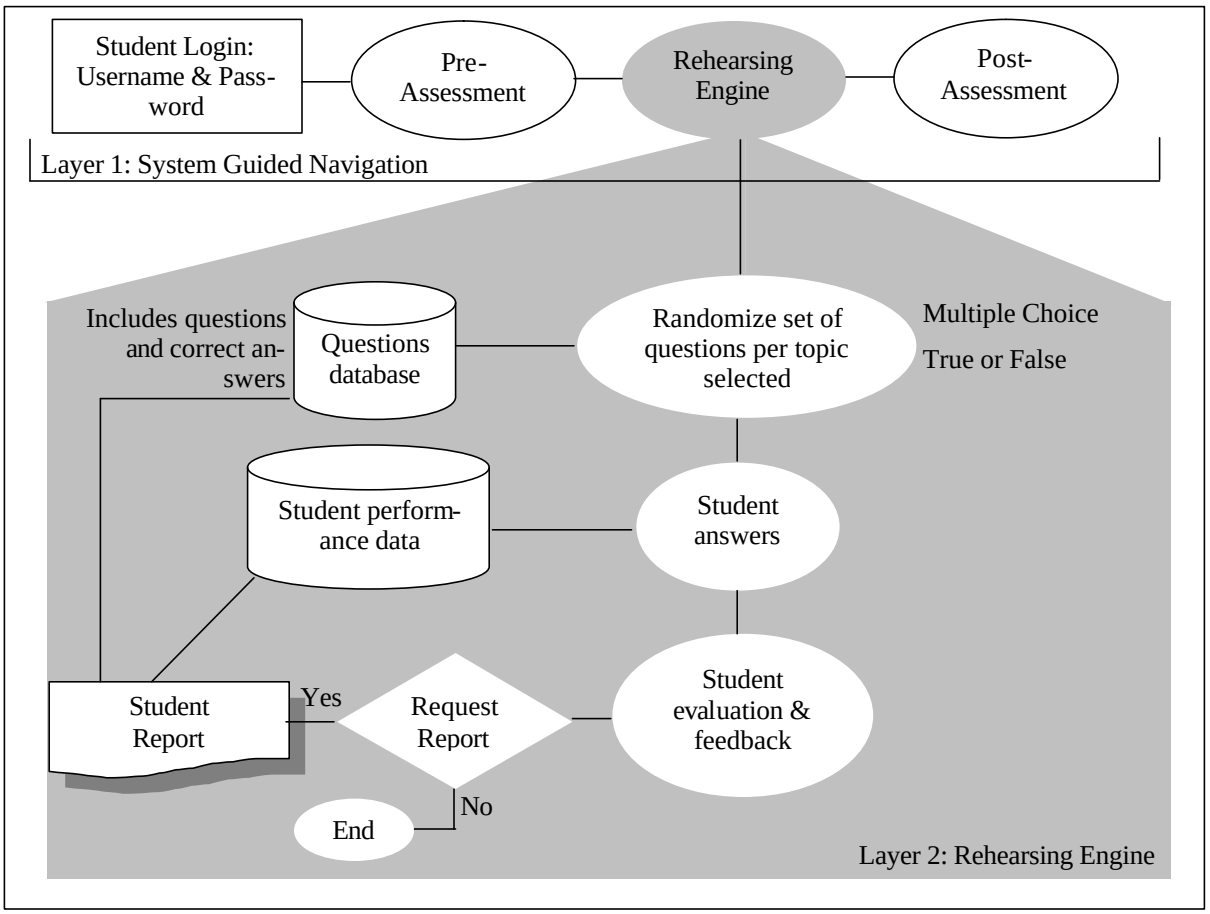



**Figure 2: The Education Information System for Enhanced Learning, EISEL.**

The student is first asked to input his/her user name and password. The student then enters the core of the course where the system guided navigation tool is found. The student at this level does not have a lot of flexibility. More specifically, the student cannot go to chapter 2 unless he/she has completed chapter 1. Therefore initially, the student is required to take a pre-assessment test for chapter 1. The objective of this pre-assessment is to identify how much the student knows about the topic(s) found in the chapter. Once this pre-assessment is completed, the student is allowed to rehearse the content domain knowledge using the rehearsing engine. The rehearsing engine selects randomly a set of 5 questions at a time and prompts them to the student. The types of questions that a student has the option to select are multiple-choice, true or false and fill-in-the-blanks. Once the student answers the questions, he/she can request an evaluation and feedback from the engine. The student then can request another set of questions and so on. At the end of the session, the student can request a report, proceed to the post-assessment test or exit the system. The student has the flexibility to decide when he/she is ready to take the post-assessment test.

## *EISEL: Standalone or Collaborative Environment*

Early computer systems that dealt with human-computer interaction were described as standalones. At that time, the human-computer interactivity was limited due to the low level of technology. As computers gained processing power and became part of large networks, complex work activities (such as cooperation, communication and decision making) were facilitated via the mediation of the information technology. In education, the Internet technology provided a platform for the integration of such complex work activities in the learning environment and gave rise to different types of interaction between learners and instructors (Collis & Breman, 1997; Lowe & Hall, 1999; McCormack & Jones, 1997). Today, many are making use of the Internet technology platform for the development of web-based instructional systems (WbIS) (Retalis & Avgeriou, 2002). Instructional methods that foster learner self-reliance and support collaborative learning have already been established (Bollis & Breman, 1997). However, the use of these instructional methods within a WbIS is a challenge.

Self-reliance can be viewed as individual learning which is fostered by standalone systems. Collaborative learning involves interaction with peers and other members of the learning community. In recent years, the constructivist view of learning, which has become widely accepted within the education community, entails two major principles: One that is attributed to Piaget, where people learn through active experience and that learning occurs when the learner's exploration uncovers an inconsistency between their current knowledge representation and their experience; the other is attributed to Vygotsky, where learning occurs within a social context, between two learners, their peers and other members of the learning community (Dalgarno, 2001).

Specifically, individual learning (or learning using a standalone instructional system), involving exploration of learning objects, a computerized simulation or a rehearsing engine is consistent with Piaget's theories. On the other hand, collaborative learning involving the use of the internet to mediate the communication process is consistent with Vygotsky's theories (Dalgarno, 2001). Although EISEL may be considered as a standalone system, it is however consistent with the constructivist view of learning.

The EISEL was designed to include some of the elements of constructivism for learning. Piaget (1928, 1932) suggests that knowledge construction within the mind of each individual depends on perception and experiences. In addition, the process of learning involves the linking of new knowledge to old knowledge already internalized.

Some of the various types of computer assisted learning resources that has been considered as constructivist are (Dalgarno, 2001): Hypermedia environments consisting of static text, graphics and other media (Low interactivity); Resources (High interactivity) that allow learner to explore conceptual ideas, allow learner to manipulate information, allow learner to construct their own representation of knowledge, and

provide feedback to learner. Such resources include simulations, intelligent agents, adaptive systems, cognitive tools and practice tools.

Web instructions have been shown to positively impact student learning (Wegner, Holloway, & Garton, 1999). Computers are able to process repetitive operations continuously. Providing immediate feedback was shown to increase the rate of learning (Lhyle & Kulhavy, 1987). Effective feedback provides the student with verification of correct answer and elaboration by providing clues to distinguish the correct answer (Crippen & Brooks, 2002). Research suggested that students who practice quizzes score higher in exams than those who use traditional study methods (Hall, Pilant, & Strader, 1999).

In general, EISEL as a whole contains many of the constructivist elements. Moreover, the instructional elements of the rehearsing engine sub-components are supported by previous research which has shown the value of the embedded strategy for learning.

## Methodology

Validated TAM constructs adopted from different relevant prior research work (Davis, 1989; Agarwal, 2000; Venkatesh & Davis, 2000) were operationalized such that the wording was changed to account for the context of the study. All items were measured using a five-point Likert-type scale with anchors from "Strongly disagree" to "Strongly agree". The questionnaire included items worded with proper negation and a shuffle of the items to reduce monotony of questions measuring the same construct.

A survey methodology was used for data collection. Students from Concordia University, John Molson School of Business, department of decision sciences and MIS, enrolled in an introductory undergraduate database management course were asked to use EISEL. Forty five (45) students were enrolled in the course, in two separate sections. The primary objective of EISEL was to help them understand content domain knowledge and practice answering questions. The course is required as part of their undergraduate bachelors degree. Students taking the course are all MIS majors.

Students were asked to use EISEL to count for 10% of their final course grade. The final mark from EISEL is calculated as the overall average from all activities with the exception of the pre-assessment test score. For example, if a student obtains a 70% on the first chapter post-assessment and then scores 75% and 90% in two practices, then the final assessment score up to this point would be 78.33%. The same applies for all the other chapters of the course.

This learning strategy, which encourages students to use the system, draws upon both intrinsic and extrinsic motivation. Students are extrinsically motivated to use the leaning tool due to the fact that it counts for 10% of the course final grade. Intrinsic motivation is not straight forward in this case but can be justified by looking at where the students will perceive their gains will be. Students are required to make specific efforts towards each chapter of the course in terms of pre-assessment, practice questions and post-assessment. These efforts will require the student to review the content, practice answering the questions and cross-examine the results with the book and notes. These efforts are only possible if done systematically throughout the semester and surely the amount of effort inputted into these activities do not justify the 10%. Yet most students applied themselves and committed to the required efforts (understandably to different degrees) for the simple reason that they perceive their efforts to enhance their performance in the course via the midterm and final exam and not the 10% allocated to the learning activities alone.

At the end of the semester, students were asked to respond to the survey as candidly as possible. They were instructed that there were no right or wrong answers and that we were interested primarily in their beliefs and perceptions about the EISEL and their experiences with it as a tool for learning.

A total of 22 out of 45 students (all from the same section) participated in the course during a regular session. This number represented the total number of students taking this class. The students' character-

istics are shown in Table 1. On average, the students sample represents a group: with an average age of around 24 years; contains a relatively equal mix among English, French and Arabic speaking students who believe that their knowledge of the English language is high; which has close to 5 years of internet experience and use it approximately 2 hours a day; and with students that have a high level of experience and knowledge in computing technologies. Therefore, based on the students' web and computer technology answers, it is expected that they are likely to possess well-formed beliefs and positive perceptions about information technologies, hence web based learning tools.

| ? *Questions / Scale* ? | From | To | Mean | S.D. |
|---|---|---|---|---|
| How would you rate yourself with respect to your knowledge about computers? | V.K. | V.U. | 2.05 | 0.84 |
| How long have you been using the internet? | < 6 m | > 5 years | 4.27 | 0.77 |
| How much time daily do you spend using the internet? | < 15 min | > 5 hrs | 3.13 | 0.83 |
| What age group do you belong to? | < 18 y | > 26 yrs | 3.59 | 1.30 |
| My knowledge of the English language is: | V. high | Very low | 1.73 | 0.70 |
| How much experience do you have with at least one of the following software products: Microsoft Word, Microsoft Excel, Word Perfect, Visual Basic. | V. high | Very low | 1.96 | 0.84 |
| How much work experience do you have? | < 6 m | > 5 years | 3.64 | 1.00 |
| What is your mother tongue? | English | Other | 2.77 | 1.72 |

V.K. = Very Knowledgeable; V.U. = Very Unknowledgeable.

**Table 1: Student Characteristics and Corresponding Descriptive Statistics.**

## Discussion and Analysis of Results

The constructs specified in the research model were evaluated in terms of reliability, convergent validity and discriminant validity. Specifically, reliability was evaluated using the Cronbach's alpha. As summarized in Table 2, all constructs had Cronbach's alpha values above 0.70 which is the required threshold value for constructs to be considered reliable (Teo, Lim, & Lai, 1999).

Construct validity of the survey instrument was evaluated by examining convergent and discriminant

| Construct | Mean | S.D. | Cronbach's Alpha |
|---|---|---|---|
| Perceived Usefulness | 3.57 | 1.03 | 0.92 |
| Perceived Ease of Use | 3.14 | 0.67 | 0.86 |

**Table 2: Analysis of Measurement Reliability.**

| | PU1 | PU2 | PU3 | PU4 | PEU1 | PEU2 | PEU3 | PEU4 | BI1 | BI2 |
|---|---|---|---|---|---|---|---|---|---|---|
| PU1 | **1.00** | | | | | | | | | |
| PU2 | **0.85** | **1.00** | | | | | | | | |
| PU3 | **0.73** | **0.62** | **1.00** | | | | | | | |
| PU4 | **0.78** | **0.86** | **0.62** | **1.00** | | | | | | |
| PEU1 | 0.36 | 0.33 | 0.53 | 0.41 | **1.00** | | | | | |
| PEU2 | 0.60 | 0.62 | 0.40 | 0.51 | **0.52** | **1.00** | | | | |
| PEU3 | 0.15 | 0.09 | 0.06 | 0.21 | **0.47** | **0.56** | **1.00** | | | |
| PEU4 | 0.48 | 0.50 | 0.53 | 0.60 | **0.70** | **0.75** | **0.65** | **1.00** | | |
| BI1 | 0.25 | 0.15 | 0.47 | 0.30 | 0.25 | -0.11 | 0.06 | 0.21 | **1.00** | |
| BI1 | 0.30 | 0.22 | 0.53 | 0.42 | 0.21 | -0.18 | 0.03 | 0.35 | **0.68** | **1.00** |

**Table 3: Analysis of Inter-measurement Correlation.**

validity using both inter-item correlation analysis and factor analysis. As shown in Table 3, the group of items intended to measure the same construct have higher correlation values among themselves than with other items designed to measure other constructs, with the exception of 3 namely PU1-PEU2, PU2-PEU2 and PU4-PEU4 with correlations close to 0.60. This suggests that acceptable convergent and discriminant validity of measurements.

The factor analysis after a varimax rotation showed three orthogonal factors with eigenvalues above 1.0, accounting for 86.2% of the variation (see in Table 4). The item communalities ranged between 0.75 and 0.94. Loadings below 0.6 are set to zero. Overall, the factor analysis shows that three components matching the number of constructs included in our research model are extracted with higher loading among the items measuring the same construct. The loading pattern suggests adequate convergent and discriminant validity of the measurements.

| | Factor 1 | Factor 2 | Factor 3 |
|---|---|---|---|
| Perceived Usefulness (PU) | | | |
| PU1 | ***0.86*** | 0.00 | 0.00 |
| PU2 | ***0.90*** | 0.00 | 0.00 |
| PU3 | ***0.83*** | 0.00 | 0.00 |
| PU4 | ***0.69*** | 0.00 | 0.00 |
| Perceived Ease of Use (PEU) | | | |
| PEU1 | 0.00 | ***0.92*** | 0.00 |
| PEU2 | 0.00 | ***0.79*** | 0.00 |
| PEU3 | 0.00 | ***0.72*** | 0.00 |
| PEU4 | 0.00 | ***0.70*** | 0.00 |
| Behavioral Intention to Use (BI) | | | |
| BI1 | 0.00 | 0.00 | ***0.89*** |
| BI1 | 0.00 | 0.00 | ***0.88*** |

**Table 4: Factor Analysis Results.**

After establishing that items loaded appropriately on their expected constructs, the hypotheses were examined using linear regression. The results are superimposed on the research model as shown in Figure 3 where $R^2$ is used to show the power of the model in explaining the variances and the standardized path coefficients to explain the cause-effect relationship between the constructs (hypotheses). Together, perceived ease of use and perceived usefulness explain 20% of

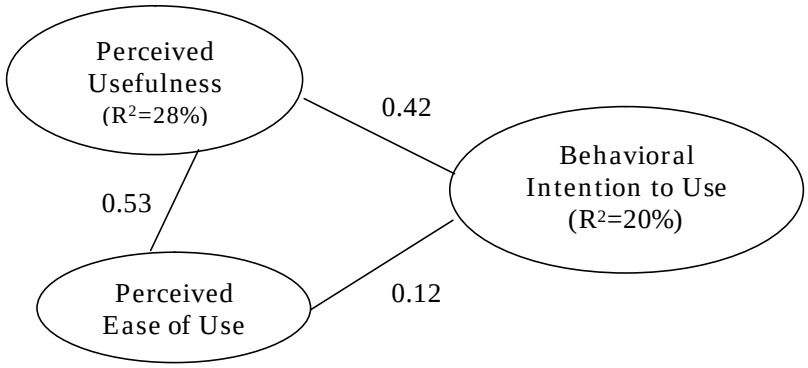



**Figure 3: Research Model Testing Results.**

the variances measured in relation to the students intention to use learning tools similar to EISEL. It is evident though that perceived usefulness have contributed significantly more to intentions that perceived ease of use. These results support hypotheses 1 and 2 which were adopted from the specification of the technology assessment model (Davis, 1989). Furthermore, hypothesis 3 with posited that PEU would influence PU was also supported. This finding is not consistent with that obtained by Davis et al. (1989).

# Conclusion

This study examined TAM constructs within the context of students' acceptance of web based education systems for enhanced learning. Based on data collected via a survey, the applicability of some of the TAM constructs, with respect to explaining intentions of students in using learning technologies was evaluated. The results suggested general adequacy and applicability of the considered TAM constructs in this learning context, with the following exceptions: Perceived ease of use has a strong influence of perceived usefulness and a weak influence on behavioral intentions. Furthermore, TAMs power to explain behavioral intention was limited compared to that reported by some prior studies. However, these studies were conducted for different technologies and in a different context. In agreement with TAM, this study results show a strong influence of PU on BI.

Contrary to what TAM hypothesizes, PEU was found to have little (not significant) effect on BI. However, it was found that PEU has a strong significant effect on PU. This might suggest that PEU has an influence on BI via PU. In the present context, this might reflect on the TAM design by eliminating the cause-effect link between PEU and BI. This might explain that students are not significantly influenced by the ease of use of an educational tool and actually put more weight on its usefulness in making them perform better. However, this also explains that if students find the EISEL to be difficult to use, then they might associate it as being a barrier for them to learn, hence compromise their performance.

Finally, this paper reports on the results of a pilot study. The web based educational system was developed in-house and was assessed using a small sample size. The author acknowledges this limitation. As a first assessment to obtain guidance, this could be considered acceptable. However, the papers' findings confirm that it deserves further study.

# References

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS Quarterly, 16* (2), 227-247.

Agarwal, R. & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly, 24* (4), 665-694.

Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Association of European Universities. (1996). *Restructuring the university: Universities and the challenge of new technologies* (CRE Document No. 1).

Chang, V. (1999). Students' perceptions of the efficacy of web-based learning environment: The emergence of a new learning instrument. *HERDSA ANNUAL International Conference, Melbourne*, 12 – 15 July.

Collis, B. & Breman, J. (1997). Information technology education in cooperative environment: Design and evaluation. *Annual Meeting of the Association for Educational Communications and Technology, Albuquerque, NM*, 12-16.

Crippen, K. J., & Brooks, D. W. (2002). An analysis of student learning at a testing web site emphasizing descriptive chemistry. *Journal of Computers in Mathematics and Science Teaching, 21* (2), 183-201.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly, 13,* (3), 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35* (8), 982-1003.

Dalgarno, B. (2001). Technologies supporting highly interactive learning resources on the web: An analysis. *Journal of Interactive Learning Research, (12)* 2/3, 153-171.

Eklund, J. & Eklund, P. (1996). Integrating the Web and the teaching of technology: Cases across two universities. *Proceedings of the AusWeb96. The Second Australian WorldWideWeb Conference, Gold Coast, Australia.* Available online at: http://wwwdev.scu.edu.au/sponsored/ausweb/ausweb96/educn/eklund2

Hall, R. J., Pilant, M. S. & Strader, R. A. (1999). The impact of web-based instruction on performance in an applied statistics course. *International conference on Mathematics/Science Education and Technology, San Antonio, TX.*

Jiang, M. & Ting, E. (2000). A study of factors influencing students' perceived learning in a web-based course environment. *International Journal of Educational Telecommunications, 6* (4), 317-338.

Kum, L. C. (1999). A study into students' perceptions of web-based learning environment. *HERDSA ANNUAL International Conference, Melbourne*, 12 – 15 July.

Lhyle, K. C. & Kulhavy, R. W. (1987). Feedback processing and error correction. *Journal of Educational Psychology, 79,* 320-322.

Lowe, D. & Hall, W. (1999). *Hypermedia and the Web: An engineering approach*. John Wiley.

Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research, 2* (3) 173-191.

McCormack, C. & Jones, J. D. (1997). *Building a web-based education system.* Wiley Computer.

Mind Edge. (2003). *Online education*. Accessed November 20, 2003 at http://www.caso.com

Neville, K. & Fitzgerald, B. (2002). An innovative training model for an organizational embracing technology. *Journal of Information Technology Education, 1* (3), 193-200.

Onay, Z. (1999). Building an Internet-based learning environment in higher education: Learner informing systems and the life cycle approach. *Informing Science Journal, 2* (2), 45-52.

Piaget, J. (1928). *Judgment and reasoning in the child*. New York: Harcourt Brace.

Piaget, J. (1932). *The moral judgment of the child*. London: Routledge and Kegan Paul.

Pospisil, R. & Willcoxson, L. (1998). Online teaching: Implications for institutional and academic staff development. *Proceedings EdTech'98, Perth: Australian Society for Educational Technology*. Available online at: http://wwwtlc1.murdoch.edu.au/gen/aset/confs/edtech98/pubs/articles/p/pospisil.html

Retalis, S. & Avgeriou, P. (2002). Modelling web-based instructional systems. *Journal of Information Technology Education, 1* (1), 25-41.

Szajna, B. (1996). Empirical evaluation of the revised technology acceptance model. *Management Science, 42* (1), 85-92.

Teo, T., Lim, V. & Lai, R. (1999). Intrinsic and extrinsic motivation in Internet usage, Omega. *International Journal of Management Science, 27* (1), 25-37.

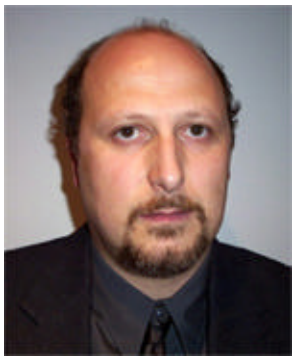
Venkatesh, V. (1999). Creation of favorable user perceptions: Exploring the role of intrinsic motivation. *MIS Quarterly, 23* (2), 239-260.

Venkatesh, V. & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46* (2), 186-204.

Wegner, S. B., Holloway, K. C. & Garton, E. M. (1999). The effects of Internet-based instruction on student learning. *Journal of Asynchronous Learning Networks, 3* (2), 98-106.

# Biography

Dr. Raafat Saadé is a lecturer at the Department of decision sciences and management information systems, John Molson School of Business, Concordia University, Montréal, Québec, Canada. He completed his Ph.D. degree in 1995 (Engineering) from the same University. He was then awarded the national research Council postdoctoral fellowship for two years and which he completed at McGill University. Dr. Saadé has over 10 years of relevant industrial experience. Most of his academic and industrial works entailed the development and use of: simulation systems, computational models and intelligent systems (healthcare and learning). During the past seven years, his work focused on the development and use of



intelligent elearning and ehealth applications. Dr. Saadé is a founder of a non-profit organization (Viéquilibré/BalancedLife) targeting the health (mainly malnutrition screening), educational (mainly reading) and spiritual needs of seniors, for a balanced and optimum life. At present, Dr. Saadé is involved in the implementation of: (1) an Osteoporosis Expert System, (2) a program for Seniors malnutrition screening and intervention, (3) implementation of web-based information system for a complete online course and (4) the testing of a three-tier pedagogical architecture for eLearning.

## Appendix A: Measurement Items Used in the Study

| Construct | Item | Measure |
|---|---|---|
| Perceived Usefulness PU) | PU1 | Using the EISEL in the course enables me to accomplish better grades. |
| | PU2 | Using the EISEL in the course would enhance my performance in the course. |
| | PU3 | Using the EISEL in the course would make it easier for me to study for tests and exams. |
| | PU4 | Using the EISEL in the course would make it easier for me to do my assignments. |
| Perceived Ease of Use (PEU) | PEU1 | Learning to use the EISEL is hard for me? |
| | PEU2 | I find that the process of using the EISEL was clear, understandable and straight forward? |
| | PEU3 | Navigating through the EISEL was easy for me? |
| | PEU4 | I find the EISEL easy to use? |
| Intention to Use | IU1 | I intend to take more courses using online 'learning tools' in the future. |
| | IU2 | Using EISEL would make a course more interesting. |