Relationship between learning styles and effectiveness of online learning systems

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Abstract: Online learning has become a popular medium to disseminate knowledge for both institutions of learning and for companies. The economic benefits to deliver knowledge and training online are well documented; however, there are still issues as to its effectiveness. One way that online learning may be more effective is by taking into account a student’s learning style. Our research seeks to understand if online learning tools account for learning styles, will users find them useful and easier to use thus resulting in a successful online learning environment? We propose an extended Technology Acceptance Model (TAM) to include learning styles as an external variable. Our results show significance for six of the seven hypotheses. Educators and corporate training departments can use these findings to design a better online learning environment for their students and workforce.

Keywords: VARK; learning styles; TAM; technology acceptance model; online education; business education.


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1 Introduction

Since the creation of web-based technologies, online learning has become a popular way to disseminate knowledge in organisations and in learning institutions. The economic benefits of online learning have driven organisations to invest time and effort into making online learning productive. Organisations rely on the return of investments in online learning to help them stay competitive in the marketplace. In addition to the economic benefits, other advantages of online learning include convenience, standardised delivery, self-paced learning and variety of available content (Strother, 2002).

This behaviour is not unique to corporations since learning institutions also use online learning systems. Based on a survey of 2500 colleges and universities, 63% said that online learning is a critical part of their long-term strategy (Allen and Seaman, 2010). Online learning has seen explosive growth over the past few decades in higher education (Allen and Seaman, 2010) and becoming more popular in elementary and secondary education (McLester, 2002). Despite the growing popularity of online learning, there are still questions regarding its effectiveness. Organisations and universities have spent large amounts of money on online learning and some have not received the desired outcomes (Strother, 2002). One explanation for this shortcoming is online learning systems do not take into account how people learn (Greenagel, 2002). Other possible explanations for such undesired outcomes with online learning systems involve participants that do not think it is useful (Song et al., 2004) or easy to use (Ong et al., 2004).

We seek to understand if online learning environments that account for learning styles will be successful. If online learning tools account for learning styles, will students find them more useful and easier to use resulting in a successful online learning environment? We propose to extend the Technology Acceptance Model (TAM) to include learning styles as an external variable. As such, this research fills a void in the literature in several ways. First, we extend the TAM framework to incorporate learning styles by specifically examining the framework proposed by Zuckweiler and Cao (2009). Second, we describe the implications of our findings within the educational context as well as in professional training. The results indicate that learning styles are important and incorporating them into online learning environments could result in additional gains to students, instructors and trainers.
In Section 2, we review the literature on online learning, learning styles and TAM. In Section 3, we propose an extended TAM model with hypotheses. In Section 4 we then describe our methodology along with our empirical results. In Section 5 we highlight the contributions that we make to the pedagogical literature. Finally, in Section 6 we discuss limitations to our study and suggest several possible avenues for future research.

2 Literature review

2.1 Online learning

Many terms are used to describe online learning including virtual learning environments, distance learning, virtual learning and virtual classroom, but there are differences between each of these terms with regard to delivery, interaction, control and technology (Piccoli et al., 2001). We will focus our attention to online learning. Online learning is defined in which at least 80% of the course content is delivered online (Allen and Seaman, 2010).

In 2010, the growth rate for online learning enrolment was 21% compared to just 2% of the overall growth rate for higher education student population (Allen and Seaman, 2010). In the fall of 2009, online enrolment was 29% of the total enrolment of degree-granting postsecondary institutions and this percent is expected to increase (Allen and Seaman, 2010). This growth is across multiple disciplines. For example, an engineering and computer science has the most growth followed by education, business, psychology, social sciences, liberal arts and then the health profession (Allen and Seaman, 2010).

The history of online learning is rooted in the traditional correspondence courses where students and instructors exchanged information through the postal system or other modes of transportation (Harper et al., 2004). As technology grew, so did the capabilities of online learning. The US government got involved by proposing the Internet Equity and Education Act (2001), which addressed regulatory inequities for those (majority online) universities competing against traditional brick and mortar universities (Harper et al., 2004). Ultimately the Internet Equity and Education Act (2001) did not become a law; however, the importance of online learning was propelled into the national media. Students can benefit from online learning by preparing them for certain industries. One research article suggests it is vital that all library and information science students must be trained to think and work in a virtual networked environment by taking at least one class in a web-based virtual classroom (Main, 1998).

Blending online learning and traditional classroom learning is another popular technique in higher education. This blended/hybrid approach is typically defined as 30–79% of the content is delivered online (Allen and Seaman, 2010). The hybrid approach allows greater flexibility in the delivery of content. Professors and instructors try to strike the right balance of online learning and face-to-face interaction to maximise student’s learning (Young, 2002).

Research exists in studying the effects of online learning on student satisfaction and perceived learning (see Arbaugh, 2000b; Piccoli et al., 2001; Swan, 2001; Parker and Martin, 2010). One study compares the perceptions of 57 undergraduate students who used the virtual classroom in a fully online and a blended education course and found that students in the fully online course rated the virtual classroom features and characteristics higher than the students in the blended course (Parker and Martin, 2010). Another study compares a traditional classroom with a web-based learning environment and reports
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no significant differences in performance of students in the context of IT basic skills training (Piccoli et al., 2001). Measurements of success also vary between studies. Student satisfaction and perceived learning are employed in some studies (Swan, 2001), where perceived usefulness, perceived flexibility and instructor efforts are used in others (Arbaugh, 2000b). The mixed results and measurements demonstrate the breadth of online learning. The learning style of the student may also play a role in determining the success of learning programme.

2.2 Learning styles

Learning styles are extensively researched and many different learning style assessments exist (Canfield and Lafferty, 1974; Reichmann and Grasha, 1974; Kolb, 1984; Weinstein et al., 1987; Fleming and Mills, 1992). Learning style research assumes that students learn differently and students experience higher levels of satisfaction and learning outcomes when there is a fit between a student’s learning style and a teaching style (Zuckweiler and Cao, 2009). Learning styles are “biologically and developmentally imposed set of personal characteristics that make the same teaching method effective for some and ineffective for others” (Dunn, 1989, p.50). Online learning allows instructors to deliver content many different ways such that there may be a premium on understanding student’s learning style.

Different learning style assessments and models are introduced in the relevant literature and each one emphasises different characteristics. Kolb introduced the Experimental Learning Model (ELM) (Kolb, 1984) and the Learning Style Inventory (LSI) (Kolb, 1976), which proposes a four-stage learning style in which students will cope with some stages better than others. Another model, the Student Learning Style Scales (SLSS) created by Reichmann and Grasha (1974) emphasise the belief that style, to some degree, is fluid and will alter according to the situation. Other famous models include Weinstein and Palmer’s Learning and Study Strategies Inventory (LASSI) (Weinstein et al., 1987) and Dunn et al.’s (1989) learning-centred preference based approach. The list above is not exhaustive and only highlights a few popular models.

One specific style introduced by Fleming and Mills (1992) – VARK – is based on the premise that students are in a no better position than their instructors to understand and assess the wide varieties of learning styles. By questioning students, they found that many students attributed their learning difficulties to the way the material was presented. Fleming and Mills (1992) focused their attention away from the historical learning inventories and instead developed a technique that promotes reflection on student’s sensory modality. Support for this learning style is rooted in Neuro-Linguistic Programming (NLP), which focuses on three general learning modes: visual, aural and kinesthetic. Fleming and Mills (1992) added a fourth mode, read/write, to complete their model.

For example, visual learners prefer material that is graphical in nature, such as diagrams, charts, maps, flow charts, etc. Read/write learners prefer material that is displayed in words which includes PowerPoint slides, discussion boards, articles or any other text-based medium. The third mode is aural in which learners prefer material that is heard or spoken. These students learn best from lectures, tutorials and group discussions. The last mode is kinesthetic which is ‘learning by doing’. These learners prefer material that is presented in movies, videos, simulations, demonstrations or case studies. By attaching the material to real world examples, the students are able to learn the material easier. Fleming and Mills (1992) called attention to the fact that kinesthetic can incorporate the other three learning styles. “However, a kinesthetic teaching experience is
defined as one in which all or any of these perceptual modes are used to connect the
student to reality, either through experience, example, practice or simulation. To offer
these experiences, the teachers may present information visually (V), aurally (A) or in a
read/write fashion (R), but the experience is kinesthetic because of the integrative and
real nature of the information” (Fleming and Mills, 1992, p.140).

VARK is used in several research projects to study online learning (Drago and
Wagner, 2004; Eom et al., 2006; Pritchard, 2008; Nemati and Thompson, 2009; Hassan
et al., 2010). Drago and Wagner (2004) applied VARK to suggest that learning styles
play a part in the decision to take online or traditional courses. In another study, Hassan
et al. (2010) suggest VARK is valuable in online learning if it focuses the designer on
using a mix of media in courseware. Eom et al. (2006) suggest online education can be a
superior mode of instruction if it is targeted to learners with specific learning styles
within VARK. In addition, Nemati and Thompson (2009) find that student’s learning
style, their self-efficacy and self-regulation along with their expectations are all factors in
their choice to take web-based courses.

According to the VARK website (Fleming, 2010) in September 2010, of the 76,252
responses to a VARK questionnaire a vast majority of respondents are multi-modal
learners (63%). The study weighted the scores to indicate how many people have some
V, some A, some R and/or some K. The results of those weights show that 16% are
visual learners, 23% are aural learners, 31% are read/write learners and the remaining
30% are kinesthetic learners. By discipline, engineering students show the largest
preference for kinesthetic learning followed by read/write, aural and then visual. In
contrast, business students show a tie for the highest preference of read/write and
kinesthetic followed by aural and visual (Fleming, 2010).

VARK is popular and appealing in studying student’s learning preferences because it
is grounded in the learning styles literature and it has been validated in higher education
(Becker et al., 2007). The simplicity, brevity and applicability of VARK are its strengths.
VARK also provides the ability to encourage students to describe their behaviours in
a manner they could identify with, accept and use to maximise their learning efforts
(Fleming and Mills, 1992).

2.3 Technology acceptance model

The TAM is considered as one of the most influential and commonly used theories in
information systems research (Lee et al., 2003). The model, proposed by Davis (1989), is
based on the Theory of Reasoned Actions (TRA) (Fishbein and Ajzen, 1975) and seeks
to explain user acceptance of information technology. Davis’ (1989) model largely
simplifies TRA making it more efficient to conduct information system research (Benbasat
and Barki, 2007). TAM is based on two primary constructs: perceived usefulness and
perceived ease of use, which are theorised to be fundamental determinants of system use
(Davis, 1989). Perceived usefulness is the degree to which a person using an information
technology believes it will enhance their job performance. Perceived ease of use is the
degree to which a person believes that an information technology will be easy to use and
would be ‘free of effort’ (Davis, 1989). These factors influence the dependent variable –
user acceptance of an information technology.

Although TAM is employed across multiple research topics, our focus is online
learning and learning styles research. Since the explosion of online learning research,
TAM has been used as a model to study online education adoption. These studies range
from analysing software to administer exams (Baker-Eveleth et al., 2006) to the impact
of cognitive absorption (Saadé and Bahli, 2005) to studying the role of technical support to web-based course tools (Ngai et al., 2007). Many researchers have also extended the TAM model with other factors to further explain adoption and use of online learning. In studying student acceptance of web-based courseware, Stoel and Lee (2003) suggest that student experience with the technology may influence their acceptance. Other studies consider factors such as instructor efforts (Arbaugh, 2000a; Arbaugh, 2000b), perceived system quality (Chang and Tung, 2008), autonomous learning styles (Drennan et al., 2005), computing support and training (Lee, 2008) and perceived enjoyment (Lee et al., 2005).

While few studies have examined student’s learning style on user technology acceptance to online learning systems (Nemati and Thompson, 2009; Zuckweiler and Cao, 2009), we extend TAM by incorporating the VARK typology to examine the relationship between learning styles and intention to use online learning systems.

3 Research model and hypotheses

Prior studies have extended TAM to study online learning. For example, Gibson et al. (2008) surveyed faculty from two colleges in a university to understand their attitudes towards online education. Their results suggest that perceived usefulness measures appear to be a better predictor of technology acceptance compared to ease of use. In another study, Stoel and Lee (2003) explored the relationship between student experience and their acceptance of online learning. They found that student experience was a good predictor of perceived ease of use but did not predict perceived usefulness.

We seek to combine the two streams of research to study the influence of learning styles, specifically VARK, to both perceived usefulness and perceived ease of use. In this model, we control for user experience. Following the original TAM, we will test perceived usefulness and perceived ease of use on attitude towards using online learning tools. We will also test the influence of these variables on intent to use the online learning tools. This extended TAM model was first introduced by Zuckweiler and Cao (2009) is shown in Figure 1.

Figure 1  Research model
According to the learning styles literature (Canfield and Lafferty, 1974; Kolb, 1976; Fleming and Mills, 1992; Grasha and Yangarber-Hicks, 2000), when an educational tool is developed with learning styles in mind, students will experience higher levels of satisfaction and learning outcomes. If online learning tools provide different types of delivery to accommodate different learning styles, then students tend to find it useful. Perceived usefulness is the degree to which a person believes that a particular system would enhance his or her job performance (Davis, 1989). In this study, perceived usefulness relates to the extent to which online learning tools that accommodate different learning styles assist in student learning. For example, if a student is a bimodal learner with visual (V in VARK) and kinesthetic (K in VARK) learning styles, then the student would find online tools with discussion boards, links to web content and video clips useful to his or her learning objectives. Therefore we propose:

\textit{H1: An online learning tool that matches a student’s learning style will increase his or her perceptions of usefulness.}

Perceived ease of use is the degree to which a person believes that using a particular system would be free of effort (Davis, 1989). In this study, perceived ease of use is connected with the ease with which students are able to use the online learning tool that accommodates different learning styles. We propose that if an online learning tool is designed with all four different learning styles, then a student will find the system easy to use. Therefore we propose:

\textit{H2: An online learning tool that matches a student’s learning style will increase his or her perceived ease of use.}

Researchers have applied TAM in a variety of ways and among different technology fields of applications (see Davis, 1989; Chau, 1996; Lin and Lu, 2000; Moon and Kim, 2001; Nemati and Thompson, 2009). These studies tend to support TAM and its hypotheses. According to TAM, perceived usefulness will positively influence attitude and intention to use the web-based learning technology and perceived ease of use will positively influence perceived usefulness and attitude for the technology. Attitude will positively influence intention to use and intention to use will positively influence the actual behavioural variable, online learning tool usage. In the context of an online learning tool accommodating for different learning styles and consistent with the literature and TAM theoretical framework, we propose:

\textit{H3: Perceptions of ease of use will positively influence perceptions of usefulness.}

\textit{H4: Perceptions of usefulness will positively influence attitude towards the application.}

\textit{H5: Perceptions of ease of use will positively influence attitude towards the application.}

\textit{H6: Attitude towards the application will increase intention to use.}

\textit{H7: Perceived usefulness will directly influence intention to use.}

4 Methodology

4.1 Research design

To test our model, we conducted a survey consisting of two major components. The first component is the official VARK survey conducted by Fleming (2010). The second
component of the survey involved our proposed research model. For this part, we employed a two-stage research design in order to increase the reliability and validity of the data collected. Stage one involved constructing a questionnaire. This process included reviewing and analysing the literature. A pilot study was conducted by distributing the preliminary questionnaire to several graduate students in the business college of a large research university. Graduate students were asked to examine the degree to which the preliminary questionnaire captured the measured constructs and its relative ease to complete. In stage two, the revised questionnaire based on the pilot study was used to gather responses from students of various backgrounds (e.g. business, engineering and education). The responses were then collected and analysed. The analyses included descriptive statistics, factor analysis, extensive reliability and validity analysis and structural equation modelling.

4.2 Data gathering

A total of 320 questionnaires were distributed to the student respondents on-site (in classrooms). To ensure that the respondents understood the survey items, we presented an overview of VARK and various online learning tools.

From the survey, 279 responses constituted a 78.2% response rate. Out of 279 responses, 247 were usable resulting in an actual response rate of 77.2%. The remaining 32 responses did not contain sufficient data for further analysis and were discarded. The high response rate is due to the fact the survey was conducted in a class setting. Student demographic information is shown in Table 1.

Table 1: Demographic information of respondents

<table>
<thead>
<tr>
<th>Levels of students</th>
<th>Number of respondents</th>
<th>Percentage of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate students</td>
<td>94</td>
<td>38%</td>
</tr>
<tr>
<td>Undergraduate students</td>
<td>153</td>
<td>62%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of majors</th>
<th>Number of respondents</th>
<th>Percentage of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>103</td>
<td>42%</td>
</tr>
<tr>
<td>Engineering</td>
<td>62</td>
<td>25%</td>
</tr>
<tr>
<td>Education</td>
<td>45</td>
<td>18%</td>
</tr>
<tr>
<td>Health sciences</td>
<td>31</td>
<td>13%</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>2%</td>
</tr>
</tbody>
</table>

5 Results and discussion

We employ Structural Equation Modelling (SEM via LISREL) to assess the seven hypotheses proposed in the paper. In each case, our statistical results support our hypothesised positive relationships with the exception of H3. Figure 2 illustrates the structural relationships and p-values among the study variables. The data show an online learning tool that matches a student’s learning style is positively related to his or her
perceptions of usefulness (H1) and his or her perception of ease of use (H2) supporting H1 and H2 ($\beta = 0.32, p < 0.01$ and $\beta = 0.38, p < 0.001$, respectively). We do not find support for H3, where perceptions of ease of use positively influence perceptions of usefulness ($\beta = 0.14, p = 0.12$). Perceived usefulness has a strong direct effect on attitude towards using the online tool ($\beta = 0.30, p < 0.01$) supporting H4. Perceived ease of use has a strong direct effect on attitude towards using the online tool ($\beta = 0.25, p < 0.01$), and the attitude towards using the online tool has a strong direct effect on the intention to use the tool ($\beta = 0.44, p < 0.001$) supporting both H5 and H6, respectively. Finally, the perceived usefulness of the online tool has a strong direct effect on the intention to use the online tool ($\beta = 0.36, p < 0.001$) providing support for H7.

Figure 2   SEM results ($R^2 = 0.37$)

Table 2 reports the mean scores of the variables broken down by majors, while Table 3 presents the correlations among the study constructs. In all of the ten entries examined, the squared correlations, representing the shared variance among variables, were found not to exceed the average variance explained ($R^2 = 0.37$). This suggests that our measures are distinct and unidimensional measures. In summary, the convergent and discriminant validity of the measures are satisfactory.

Table 2   Mean score of variables by demographic

<table>
<thead>
<tr>
<th>Type of majors</th>
<th>Number of respondents</th>
<th>Perceived usefulness</th>
<th>Perceived ease of use</th>
<th>Attitude toward using</th>
<th>Intent to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>62</td>
<td>8.41</td>
<td>8.52</td>
<td>8.44</td>
<td>9.07</td>
</tr>
<tr>
<td>Education</td>
<td>45</td>
<td>5.72</td>
<td>6.31</td>
<td>5.72</td>
<td>6.16</td>
</tr>
<tr>
<td>Health sciences</td>
<td>31</td>
<td>8.19</td>
<td>8.30</td>
<td>8.44</td>
<td>7.32</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>6.21</td>
<td>5.97</td>
<td>5.77</td>
<td>6.21</td>
</tr>
</tbody>
</table>
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Table 3  Correlations

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VARK</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Perceived usefulness</td>
<td>0.30</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Perceived ease of use</td>
<td>0.24</td>
<td>0.14</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Attitude toward using</td>
<td>0.16</td>
<td>0.23</td>
<td>0.35</td>
<td>1.00</td>
</tr>
<tr>
<td>5</td>
<td>Intent to use</td>
<td>0.15</td>
<td>0.32</td>
<td>0.27</td>
<td>0.40</td>
</tr>
</tbody>
</table>

Table 4 reports the results from the SEM indicating that our model is a good fit based on the data collected (RMSEA = 0.051, IFI = 0.92, CFI = 0.94, GFI = 0.97, \( \chi^2 = 1.60 \), df = 82).

Table 4  Summary of CFA fit indices for the conceptual model

<table>
<thead>
<tr>
<th></th>
<th>( \chi^2 ) (p &lt; 0.01)</th>
<th>df</th>
<th>( \chi^2/df )</th>
<th>GFI</th>
<th>AGFI</th>
<th>CFI</th>
<th>IFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended values</td>
<td>&lt; 3.0</td>
<td>&gt; 0.90</td>
<td>&gt; 0.90</td>
<td>&gt; 0.90</td>
<td>&gt; 0.90</td>
<td>&lt; 0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recorded values</td>
<td>131.12</td>
<td>82</td>
<td>1.60</td>
<td>0.97</td>
<td>0.92</td>
<td>0.94</td>
<td>0.92</td>
<td>0.051</td>
</tr>
</tbody>
</table>

Notes: GFI = goodness-of-fit index, AGFI = adjusted goodness-of-fit index, CFI = comparative fit index, IFI = incremental fit index and RMSEA = root mean square error of approximation.

Our findings provide evidence that learning style is a valuable determinant of technology acceptance (as it applies to online learning systems). Our results also suggest differences in how learning styles affect acceptance of online learning systems, which have several implications for educators as well as for corporate training. First, the student learning experience can be enhanced when designers understand the student’s respective learning style and design the online learning systems with appropriate tools. For example, a student that is a visual learner would prefer information that is presented in graphs or charts compared to the same information presented in a podcast as an aural learner would. As universities and their instructors develop online learning systems, there are different online tools that could be employed depending on the learning style of the respective student (leading to more effective outcomes).

Another implication of these findings extends beyond the traditional educational use. Corporate trainers are looking to develop cost-effective and convenient ways of training their workforce. While e-learning is relatively inexpensive compared to traditional classroom training, understanding learning styles of their customers or clients (and incorporating that information in the development of training aids) may provide even greater gains. This is especially true when developing online tools for different departments where learning styles may differ among the different groups. Likewise, as companies look to market new (technology-related) products, understanding learning styles can assist in formulating strategies on how to present instructions on use. Aligning appropriate online tools with the respective learning styles will yield perceived ease of use and perceived usefulness, which ultimately leads to intention to use.
Overall, our study shows the importance of learning styles as a determinant to technology acceptance. One key point worth mentioning is how one determines a student’s or client’s learning style. There are many learning style assessments available that can be employed through questionnaires or interviews. In a classroom setting, knowing the type of class or the distribution of majors within a class can assist in selecting the appropriate online learning tools. Since we have shown that learning styles matter in terms of technology acceptance, in a corporate setting, it may benefit the company to develop a battery of online learning tools. As such, employees can then self-select the appropriate online tool(s) that best fit their learning style. While students as well as employees may not specifically know their learning style, we believe they will gravitate towards the tools that best suit them.

6 Conclusions and future research

This study presents the importance of designing and delivering online learning tools to match different learning styles. We propose an extended TAM model that examines online tools to account for unique learning styles. We developed seven hypotheses from our model with empirical support for six of those hypotheses. These findings are relevant for learning institutions and for companies that incorporate online learning tools to train their employees or their customers.

In this study, we control for personal experience in using online learning tools. A future study can examine the influence of personal experience in the acceptance of an online learning tool. Another future study could develop laboratory experiments to measure actual learning outcomes using online learning tools developed for that student’s specific learning style.

References


Appendix A: Questionnaire

1. **Prior experience with the online learning system (e.g. Blackboard, WebCT)**

Have you ever used an online-learning system before (check one)

- No
- For one class
- For two classes
- For three classes
- For four classes
- For more than four classes

2. **Features of online learning system**

What is your most favourite feature(s) of the online learning system you have used (check one)?

- Movies, videos and PowerPoint slide presentations
- Audios (e.g. Podcasting)
- Text based materials (e.g. course announcements, email, tests and quizzes and assignments)
- Interactive learning (e.g. discussion boards, online chatting and online simulations)
- All the above

3. **Perceived usefulness (Using online learning system)**

Please indicate the degree to which you agree or disagree with the following statements. (Please circle the appropriate number from 0 to 10. Here 0 signifies ‘Completely Disagree’ and 10 signifies ‘Completely Agree’)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 It enabled me to accomplish study tasks more quickly</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2 It improved my grade</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>3 It gave me greater control over my studies</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>4 It improved the quality of the assignments I did</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5 It improved my learning productivities</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>6 It enhanced the effectiveness of my study activities</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>7 It made it easy for me to study/learn</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
4. Perceived ease of use
Please indicate the degree to which you agree or disagree with the following statements. (Please circle the appropriate number from 0 to 10. Here 0 signifies ‘Completely Disagree’ and 10 signifies ‘Completely Agree’)

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It was easy for me to remember how to perform tasks using the system</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>2</td>
<td>I believe that it was easy to get the system to do what I wanted it to do</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>3</td>
<td>My interaction with the system was clear and understandable</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>4</td>
<td>Getting the information from the system was easy</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>5</td>
<td>Learning to use the system was easy</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>6</td>
<td>Becoming skillful at using the system was easy</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

5. Attitude
Please indicate the degree to which you agree or disagree with the following statements. (Please circle the appropriate number from 0 to 10. Here 0 signifies ‘Completely Disagree’ and 10 signifies ‘Completely Agree’)

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I liked using the system</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>2</td>
<td>The system was fun to use</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>3</td>
<td>The system provided an attractive learning environment</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

6. Intention to use the online learning system (I would use the system in the future.)
Please indicate the degree to which you agree or disagree with the following statements. (Please circle the appropriate number from 0 to 10. Here 0 signifies ‘Completely Disagree’ and 10 signifies ‘Completely Agree’)

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>For guided outlines in my classes</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>2</td>
<td>To email TAs and instructor</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>3</td>
<td>To access class information</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>4</td>
<td>To access readings and reference materials</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>5</td>
<td>To discuss results of assignments</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>6</td>
<td>To look at my grades</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>7</td>
<td>To study for projects/assignments in the class</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>8</td>
<td>To study for quizzes/exams in this class</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>
Demographic Information
1. What is your gender? Circle one of the following:
   ▪ Male
   ▪ Female
2. What is your age? Circle one of the following:
   ▪ Below 21 years
   ▪ 21–30 years old
   ▪ 31–40 years old
   ▪ 41–50 years old
   ▪ 51–60 years old
   ▪ 61 years old and above
3. What is your current education level? Circle one of the following:
   ▪ Freshman
   ▪ Sophomore
   ▪ Junior
   ▪ Senior
   ▪ Graduate student
4. What is your major? Circle one of the following:
   ▪ Undecided
   ▪ Accounting
   ▪ Economics
   ▪ Energy Commerce
   ▪ Finance
   ▪ General Business
   ▪ International Business
   ▪ Management
   ▪ Management Information Systems
   ▪ Marketing
   ▪ Operations Management
   ▪ Supply Chain Management
   ▪ Other Please Specify