A Hybrid Course for Probability and Statistics for Engineers: A Readiness Study at Shahid Beheshti University

Abstract—Probability and Statistics for Engineers covers verities of subjects in the set theory, the combinatorial analysis, probability, statistics, and (in some universities) the stochastic processes. Since, course receives only 3 credits it has to be thought 3 hours/week. This overloading content along with time limitation make course as a challenging and difficult one for students. Also, many instructors, including the first author, found the course very challenging to teach. Two popular on-site and e-learning training systems do not provide any appropriate solution. This article suggests a hybrid training system, which combines some elements of both training systems to reduce the disadvantages of both systems. Readiness of such hybrid course is measured by preparedness of students for online activities. The readiness study at Shahid Beheshti University shows that Internet skills, self-directed learning, learner attitude toward e-learning, e-mail skills, and software ability of students are factors which are significantly affect readiness of students.

Index Terms—Readiness, Hybrid course, Probability and Statistics for Engineers, E-learning.

I. INTRODUCTION

Probability and Statistics for Engineers is one of the challenging courses for both instructors and students in engineering. Overloading of the course content, time limitation, and simultaneous offering the course with several difficult courses (such as fundamentals of physics, multivariate calculus, differential equations) transform an interesting course to a difficult one. Some instructors suggest dropping some less important materials of the course, and teaching the rest with more care. But, the majority of them believe that the course contents have been chosen based upon students' needs in other courses and their research. Therefore, it is reasonable to employ a training system which have no time limitation and can be adapted based upon learners' abilities.

An e-learning training system can provide an interactive, individualized, and repeatable environment to teach a subject. Universities are witnessing many benefits of e-learning, such as cost saving, in creating flexible, productivity, rapidly developing, deploy and update a course, providing an effective training system, availability anytime and anywhere, providing broadly training opportunities, staying competitive, improving motivation and morale, and implementing strategic initiatives more effectively (Bonk, 2002; So and Swatman, 2007; Minton, 2000). On the other hand, there are situations where an e-learning training system is not an appropriate one. Many instructors believe that mathematics and statistics need the traditional face-to-face training system and they cannot teach using an online training system (Broadbent, 2001 and Chapnick, 2000).

To overcome such barriers and limitations, several authors suggest using a hybrid course; see Garnham and Kaleta (2002) and Sands (2002), among others for more detail. Many universities have sought to develop their own hybrid learning courses as another option for students and instructors who prefer to replace some portion of traditional face-to-face meeting time with online instruction (Olapiriyakul & Scher, 2006). In a hybrid training system, similar to the traditional training system, students participate in a class and learn a significant portion of the course on-site. But, some complimentary activities such as advanced topi cs, assignments, quizzes, more examples, and etc are moved to an online part. The goal of hybrid courses is to join the best features of in-class teaching with the best features of online learning to promote active independent learning and reduce class seat time (Garnham and Kaleta, 2002). Moreover, Arbaugh (2000) pointed out that hybrid courses may be accommodated benefits of both on-site and e-learning techniques to reduce disadvantages of both techniques. To have a successful hybrid course an instructor must invest significant time and effort in redesigning a traditional course. Since, online activities require special abilities, equipment, and etc of learners. Garnham and Kaleta (2002) pointed out that readiness of a hybrid course measured by preparedness, mentally or physically, of learners in online activities.

Sands (2002) described how one may integrate online activities with classroom work to obtain a successful hybrid course. Based upon Sands' suggestions, our experience, and several in-depth interview with some experts and instructors, we decide to design a hybrid course, which (i) the course contents teach in the On-site part; (ii) Class materials companies with some new examples and more advanced materials as well as quizzes and assignments are moved to the On-line part.

This article reports the read iness of Shahid Beheshti University (say SB U) students, who registered the course in 2009 winter semester. This article develops as the following. Section 2 reviews some relevant literature regarding readiness. Research's hypotheses as well as statistical methods are given in Section 3. Research's design is given in Section 4. While Section 5 represents the results of the research. Finally, Section 6 provides a conclusion regarding our findings.

doi:10.3991/ijet.v5i3.1211

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II. LITERATURE REVIEW

Webster’s New Collegiate Dictionary defines readiness as being prepared, mentally or physically, for some experience or act. Bortot and Olyumenakou (2004) defined e-learning readiness of an organization as preparedness, mentally or physically, for some e-learning experience or actions.

Kaur and Abas (2004), Anderson (2002), Bean (2003), Chapnick (2000), Clark and Mayer (2003), and Gold et al. (2001) are authors, among others, who discussed the necessity of a readiness study in an e-learning training system. They believed that without a careful plan of action, users are more inclined to adopt a network-based learning system and earn, significantly, better results.

Hypothesis 1. Skills of users influence learners’ readiness for an online course.

Hypothesis 2. Self-directed ability of learners influences learners’ readiness for an online course.

Hypothesis 3. Learners’ attitude toward an online course influences their readiness for the course.

A two-section survey entitled, “e-Learning Readiness Survey” has been developed to assess e-learning readiness of students at SB University, who registered for the course in 2009. The first section consisted of 5 items to gather data about demographic characteristics, such as gender, scholastic success (which is measured by GPA), major, computer usage, and Internet usage in the week who takes the survey. The second section included 41 items to assess respondents’ self-report perceptions of their readiness for an e-learning training system. Now observe that: (i) the On-line part of the hybrid training system is a new part, which added to the traditional part. Therefore, it is reasonable to measure readiness of learners for an online training system through their readiness for an online training system; (ii) the readiness defined based on mental and physical preparedness of students who will participate the course. From these observations one can conclude that, readiness of the hybrid training system (dependent variable) can be measured, only, by students’ online preparedness, mentally and physically, using questions 1 to 9. It is worth to mention that questions 1 to 5 assesses the mental readiness while questions 6 to 9 assess the physical readiness of students in the survey.

DeVellis (2003) indicated that the first step in developing an instrument is, clearly, determining what it is the researcher wants to measure. The variables, or factors, of this research identified after r and e available e-le arning readiness assessment instrument, and authors’ personal experience. As a result, 12 major factors that can be helped organizations to measure how ready they are for an e-learning training system are identified.

Based upon previous researches, partly given in Section 2, a questionnaire developed to measure readiness of a learner for the online course. Appendix A represents the questionnaire items as well as their sources. Now, the following presents the hypotheses of this research.

Hypothesis 1. Skills of users influence learners’ readiness for an online course.

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Arbaugh (2002), Hong (2002), and Piccoli et al. (2001) are such authors, among others, who believe that learners’ preparedness influences their readiness for an online course. Table 1 presents the hypotheses of this research.

III. VARIABLES AND HYPOTHESES OF RESEARCH

A two-section survey entitled, “e-Learning Readiness Survey” has been developed to assess e-learning readiness of students at SB University, who registered for the course in 2009. The first section consisted of 5 items to gather data about demographic characteristics, such as gender, scholastic success (which is measured by GPA), major, computer usage, and Internet usage in the week who takes the survey. The second section included 41 items to assess respondents’ self-report perceptions of their readiness for an e-learning training system. Now observe that: (i) the On-line part of the hybrid training system is a new part, which added to the traditional part. Therefore, it is reasonable to measure readiness of learners for an online training system through their readiness for an online training system; (ii) the readiness defined based on mental and physical preparedness of students who will participate the course. From these observations one can conclude that, readiness of the hybrid training system (dependent variable) can be measured, only, by students’ online preparedness, mentally and physically, using questions 1 to 9. It is worth to mention that questions 1 to 5 assesses the mental readiness while questions 6 to 9 assess the physical readiness of students in the survey.

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TABLE 1. FACTORS AFFECTING LEARNERS’ READINESS

| Author | Factors |
|--------|---------|
| Schreurs et al (2009) | Resources (technological and human readiness), education, environment |
| Koo (2008) | Individuals’ language, discipline, experience in using e-mail, skill levels |
| So and Swatman (2007) | Students’ preparedness, teachers’ preparedness, infrastructure, management Support, school culture, preference to meet face-to-face. |
| Sun et al (2007) | Learner attitude toward computer, learner computer anxiety, technology quality, Internet quality. |
| Liu (2005) | Trainee characteristics, training content, system design, working environment. |
| Gunawardana (2005) | Instructional material, tutorial support, communication, collaboration |
| Haney (2002) | Employee competency, development needs, career paths and records, course technology, technical support, infrastructure, supporting finance, vendor offerings. |
| Chapnick (2000) | Psychological, sociological, human-resource, financial, technological skill (aptitude), equipment, content readiness. |
| Gastaldo et al (2005) | User characteristics, accessibility to computer equipment, knowledge, attitudes toward ICT |
attitude, towards e-learning, are an important factor in e-learning readiness. Learner’s attitude can be defined as learner’s impression to participate in an e-learning activity. Instructors post their materials on the platform and learners participate through computer networks. A more positive attitude toward e-learning, for example, when students are not afraid of the computer plenitude of using computers, will result in more satisfaction and effectiveness of learners in an e-learning environment (Piccoli et al., 2001). Furthermore, positive attitudes toward e-learning increase the chances of success of an e-learning system, while negative attitudes reduce it. Therefore, this research considers learners’ attitude to towards computers as an important factor in e-learning readiness.

Hypothesis 4. Learners’ computer anxiety influences on their readiness for an online course.

Piccoli et al. (2001) believe computer anxiety, significantly affects an e-learning environment. Computers are communication tools in an e-learning environment. Therefore, any fear in computer usage would certainly hamper learning (Piccoli et al., 2001). Computer anxiety is an emotional fear when a user is uncomfortable using a computer, even though they may understand how to use it (Barbeite and Weiss, 2004). The higher computer anxiety causes the lower level of e-learning readiness. The definition of computer anxiety in this research is the level of learners’ anxiety, when they apply computers.

Hypothesis 5. Equipments influence on learners’ readiness for an online course.

Other factors contributing to an increase in e-learning readiness are the infrastructure of the system and technical support of an e-learning system. It is important to bring into account the reliability and quality of the system, because they play an important role in e-learning readiness. To build an acceptable e-learning environment, one has to maintain and update technological equipment and material represented by the environment (Folorunso et al., 2006; Poon et al., 2004; Selim, 2005).

Hypothesis 6. Scholastic success of learners, influence on learners’ readiness for an online course.

Carmel and Gold (2007) pointed out those learners who reported higher readiness tended to be more successful, scholastically.

Hypothesis 7. Gender of learners influences on learners’ readiness for an online course.

Summer (1990) and D Mahon and D Gardner (1995) found out that male students experience less anxiety about ICT than female students. Moreover, O’Lever (1993) and Van Braak (2001) discovered that female students have lower confidence or knowledge abilities than males regarding computer usage. However, many other authors (such as Kooi, 1989; Kav, 1993; Huttan and Bohlin, 1993; Marshall and Bannon, 1986; Woodrow, 1991 among others) are agree with the claim that “there are no significant different between attitude of male and female students regarding ICT usage”.

Hypothesis 8. Major of learners influences on their readiness for an online course.

Summers and Easdown (1996) mentioned that student’s major and specialization are such factors which influence on e-learning’s readiness.

IV. Research Design

A series of deep in-depth interviews, with various experienced e-learning and instructor students of the course, have been conducted to examine the validity of our research model. After that, questionnaire items developed based upon previous literature and comments gathered from the interviews. Questionnaires were revised with help from experts (including academic and practitioners) with significant experience in e-learning and Probability and Statistics. A 5-point Likert scale ranging from 1, as strongly disagrees, to 5, as strongly agrees, is used for the measurement.

A pretest, to measure validity and reliability of the study, was conducted with 3 instructors and 2 e-learning’s experts. For lowing by pretest to verify reliability of questionnaire, a pilot test has been conducted with 20 randomly chosen students from the target population. Questions regarding skills of users, online audio/video, self-directed learning, learner attitudes toward learning, learner computer anxiety, equipment, and e-learning readiness can be summarized into 7 single factors $F_1$, ..., $F_7$. The Cronbach’s alpha of these factors are 80.2%, 75.34%, 95.01%, 89.32%, 73.02%, 89.54%, and 78.93% respectively, which indicate an acceptable reliability of the questionnaire.

The research population included all undergraduate students in computer and electronic majors, who registered in the Probability and Statistics course in 2009 winter semester at SBU (with the popularization size of N=130). After a pilot test, a census study was conducted by distributing the questionnaire among all students. The survey generated 109 usable responses from students resulting in a response rate of 83.8%, which is indicated that the respondents found the topic interesting and relevant.

This research used two statistical packages, Minitab 13, SPSS 16, to analyze the data. Data was analyzed using the following two techniques.

A. Ordinal Logistic Regression

The binary logistic regression is a well-known technique to set up a general linear model for the binary dependent variable. If the multiple or ordinal dependent variable, the binary logistic regression on the does not work properly. St atisticians design a linear logistic regression to model the multiplicity of the dependent variable. Minitab 13 is a statistical software package that can fit an ordinal logistic regression model to data. The output of the statistical package includes: (1) Response and Factor Information, which displays the number of observations and the response variable, (2) Logistic Regression Table, which shows the estimated coefficients, p-values (related to a test that the corresponding coefficient is zero), and odds ratio (which shows the effect of each variable on the m odel); (3) Goodness-of-Fit Tests, which dichotomous spaly both Pearson goodness-of-fit test of the model to data. The steps in model building for an ordinal logistic model are similar to those for the binary logistic regression model. Unfortunately, the a r row $x^2$ is not available in the software packages. So, one has to choose the final and appropriate model by entering variables with significant coefficients (p-value < 0.05) and ordering effect of variables from their Odds ratio (negative coefficient along smallest odds ratio indicate more impact of the variable on the dependent variable, M Cullagh and Nel der, 1992). Finally, appropriative of model is evaluated by (I) a
The chi-square test whose null hypothesis states all the coefficients associated with predictors equal zero versus at least one coefficient is not zero (we prefer to reject its null hypothesis, i.e., p-value < 0.05) and (ii) at least one coefficient is not zero (we prefer to reject its null hypothesis, i.e., p-value > 0.1), more can be found in Hosmer and Lemeshow (2000) and McCullagh and Nelder (1992), among others.

B. Contingency Table

A contingency table (or cross tabulation) describes the distribution of two or more variables simultaneously. Each cell shows the number of respondents, who gave a specific combination of responses. Since contingency table is easy to understand, can be used with any kind of data, (the contingency tables treat nominal, ordinal, interval, and ratio scales as a nominal scale), provides greater insight than single statistics, and can be used as a tool to measure association among variables is one of most popular techniques in statistics. In a two-way contingency table, there are several statistical tests employed. The following table represents coefficients, p-values and odds ratios of such ordinal logistic regression.

Results of Table 4 (below) can be summarized as the following:

1. There is significant evidence to conclude that skills of users (Internet sk ills), sk ills of users (software ability), sk ills of users (In ternet sk ills), se lf-directed learn ing, and learn er attitu de to ward e-learning ar e such variables whose a ffect learning readiness, the dependent variable (their p-values is smaller than 0.05).

2. Small odds ratio indicates that impact of significant factors can be ordered as (1) sk ills of users (Internet sk ills), (2) self-directed learning, (3) learner attitude toward e-learning, (4) skills of users (e-mail skills), and (5) skills of users (software ability).

3. P-value= 0.00 for r test th at “al l coe ffi cients are zero” al ong with th e p-va lue 0.89 9 f or r “the Goodness-of-Fit Test s” i ndicate th at the ordinal logistic regression is an appropriate model to analyze the data.

4. The ordinal logistic regression on gi ves 8 p arallel equations (i = 1,2,...,8)

\[ \gamma_i = \exp(\alpha_i - 3.212X_{i1} - 3.321X_{i2} - 0.232X_{i3} - 1.232X_{i4} - 2.330X_{i5}) / [1 + \exp(\alpha_i - 3.212X_{i1} - 3.321X_{i2} - 0.232X_{i3} - 1.232X_{i4} - 2.330X_{i5})] \]

where \( \gamma_i \) is the cumulative probability of ith level of the dependent variable and \( \alpha_1, \alpha_2, \ldots, \alpha_8 \) are constant values, which given in Table 5.
TABLE IV.
ORDINAL LOGISTIC REGRESSION

| Dependent variable, i.e., efficiency of the model. | Coefficient | P-value | Odds ratio | Rank order |
|--------------------------------------------------|-------------|---------|------------|------------|
| \( \alpha_1 \)                                  | 0.842 0.    | 0.042   | ___        | ___        |
| \( \alpha_2 \)                                  | 1.805 0.    | 0.000   | ___        | ___        |
| \( \alpha_3 \)                                  | 0.345 0.    | 0.001   | ___        | ___        |
| \( \alpha_4 \)                                  | 0.352 0.    | 0.000   | ___        | ___        |
| \( \alpha_5 \)                                  | 0.452 0.    | 0.000   | ___        | ___        |
| \( \alpha_6 \)                                  | 2.452 0.    | 0.005   | ___        | ___        |
| \( \alpha_7 \)                                  | 3.452 0.    | 0.021   | ___        | ___        |
| \( \alpha_8 \)                                  | 4.320 0.    | 0.000   | ___        | ___        |

Skills of users (e-mail skills), say \( X_5 \):
\( -2.330 0. \) 0.040 1.3335 5

Skills of users (hardware ability):
\( -0.321 \) 0.091 0.211 -

Skills of users (software ability), say \( X_4 \):
\( -1.232 0. \) 0.000 1.321 4

Skills of users (Internet skills), say \( X_1 \):
\( -3.212 0. \) 0.003 0.210 1

Self-directed learning, say \( X_2 \):
\( -3.321 0. \) 0.000 0.321 2

Learner attitude toward e-learning, say \( X_3 \):
\( -0.232 0. \) 0.001 0.983 3

Learner computer anxiety:
\( -0.302 \) 0.230 0.442 -

Equipments (hardware):
\( -2.132 \) 0.410 0.662 -

Equipments (software):
\( -0.091 \) 0.621 0.421 -

Equipments (Internet):
\( -0.001 \) 0.832 0.321 -

Online audio video:
\( -0.129 \) 0.785 3.211 -

p-value of goodness-of-fit test = 0.899
p-value of test that “all coefficients are zero” = 0.002

TABLE V.
HYPOTHESIS’S RESULT

| Hypothesis number | Chi-square statistic | Degree of freedom | p-value | Result on \( H_\alpha \) at significant level \( \alpha = 0.05 \) |
|-------------------|----------------------|------------------|--------|----------------------|
| 1                 | 13.114               | 8                | 0.892  | Accepted             |
| 2                 | 4.893                | 8                | 0.231  | Accepted             |
| 3                 | 9.817                | 16               | 0.124  | Accepted             |
| 4.3               | 942                  | 16               | 0.001  | Rejected             |
| 5                 | 464                  | 8                | 0.000  | Rejected             |
| 6                 | 3.515                | 8                | 0.102  | Accepted             |
| 7                 | 596                  | 8                | 0.009  | Rejected             |
| 8                 | 17.435               | 16               | 0.642  | Accepted             |

B. Hypothesis tests:

As pointed out the above, readiness of each learners is a 9 level variable to test the given hypotheses, one has to categorize the second variable in each hypotheses into some levels. Population can be categorized into some groups regarding skills (low and high), self-directed ability (low and high), learners’ attitude toward the online course (negative, neutral, and positive), learners’ computer anxiety (negative, neutral, and positive), ICT’s equipments (enough and lack), gender (male and female), major (computer sciences and Electronic), and scholastic success, according to their GPA (week, GPA<12, average, 12 ≤ GPA<17, and strong, GPA ≥ 17). The contingency analysis has been conducted.
ducted to see if the given hypotheses. Results summarized in Table 4.

From Table 4, one can observe that:
1. Computer anxiety, equipment, and gender of students do not affect their readiness reading the online training system.
2. Skills, self-directed ability, attitude toward the online training system, scholastic, and major of students affect their readiness reading the training system.

In order to help managers of universities, we introduce a discriminative index to identify level of readiness of each individual. Figure 2 duplicates such index.

The bar chart above duplicates level of readiness of the target population, regarding the above discriminative index.

Using the discriminative index, provided by Figure 2, one can observe that, more than 80% of the target population is ready for the online course and consequently for the hybrid course. But, they need some improvement, which vary from an individual to another one.

VI. CONCLUSION AND SUGGESTION
This study made theoretical and practical contributions to the literature of the hybrid course readiness and more specifically on students' perceptions of the hybrid course implementation at SBU. The empirical results showed that the most of factors that were extracted from the data were genuine and significant in predicting the criterion variable. Our findings could have practical importance for any university as whose planning to implement such hybrid course. Universities, in their rush to implement the hybrid courses often place too much emphasis on the equipment and too little on the human part. So, this research comes up with authorizes must take a hard look at skills of users (Internet skills), self-directed learning, learner attitude toward e-learning, skills of users (e-mail skills), and skills of users (soft ware abilities) even though other non-significant, statistically, fact ors should be tak en into account to have effective and sd successful hybrid training system.

This study was the first part of a long term project, which designation and implementation of the hybrid course and study satisfaction and follow-up study are the last part of such project. Already, the second part of the project has been started. The Online part of the hybrid course available at: http://faculties.sbu.ac.ir/~payandeh/efront/www/index.php?logout=true, where students in summer semester, in 2009, used it to write quizzes, download and upload assignments, and review the course materials.

To design the website, we use an open source Web designer named Efront. Efront provides ability to the Web administrator to orient e-learners' activities by (i) defining some rules for e-learners; (ii) providing a complete database about activities of e-learners on the webpage; (iii) ability to assign, randomly, a quizzes to learners. Other Efront's abilities may be found in Zafar (2007) and its official website available at http://www.epignosis.com.gr/.

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Manuscript received January 31st, 2010. Published as resubmitted by the authors August 4th, 2010.

APPENDIX A. QUESTIONNAIRE ITEMS AND SOURCES

| Independent variables | Items | Sources |
|-----------------------|-------|---------|
| **Skills of users**   | How confident do you feel about: | Nakhoda et al (2006), Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| Email skills          | 1. Logging in and out of your account? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| 2. Sending and receiving mail? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| 3. Attaching and downloading files? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| Hardware ability      | How confident do you feel about: | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| 1. Using a keyboard and mouse? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| 2. Basic troubleshooting skills, such as rebooting the computer in case of a crash and resolving printer errors? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| 3. Changing printer ink cartridges? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| Software ability      | How confident do you feel about: | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| 1. Working with files, such as creating, saving, and printing documents? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| 2. Installing software? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| Internet ability      | How confident do you feel about: | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| 1. Logging on to your Internet service provider and navigating to different Web addresses? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| 2. The advanced Internet skills, such as using a search engine, identifying and downloading appropriate files, or updating software via Internet? | Nakhoda et al (2006), SORT website, Joo et al (2000), SORT website |
| **Online Audio/Video**| I think that I would be able to: | Watkins et al (2004) |
| 1. Relate the content of short video clips (1—3 minutes typically) to the information I have read online or in books. | Watkins et al (2004) |
| 2. Take notes while watching a video on the computer. | Watkins et al (2004) |
| 3. Understand course related information when it’s presented in video formats. | Watkins et al (2004) |
### Self-directed learning

Are you able to:

1. Learn without assistance of instructors?
2. Resist distractions and stay on task while working or studying?
3. Keep up with your assignments, and meet deadlines?
4. Manage your time appropriately?
5. Complete things on time?

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### Learner attitude toward e-learning

I believe that e-learning:

1. is very difficult (R)
2. is very complicated (R)
3. requires technical ability (R)
4. let me feel psychological stress very greatly (R)
5. can be done only if one knows a programming language such as Basic (R)
6. is only advisable for people with a lot of patience (R)
7. makes a person more productive at his/her job
8. is for young people only (R)

(Likert’s scale 1, strongly disagree; 5, strongly agree)

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### Learner computer anxiety

I think:

1. Working with a computer would make me very nervous
2. I get a sinking feeling when I think of trying to use a computer
3. Computers make me feel uncomfortable
4. Computers make me feel uneasy and confused

(Likert’s scale 1, strongly disagree; 5, strongly agree)

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### Equipments

Do you have:

**Hardware**

1. A consistent and convenient access to a computer?
2. A sound phones or speakers and microphone?
3. A working printer?
4. A CD-ROM drive?
5. A flash-stick memory?
6. A laptop?

**Software**

1. A Web browser, such as safari, fire-fox, Internet explorer, on your computer?
2. A virus protection software on your computer?
3. The Microsoft package on your computer?

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### Internet

Do you have:

1. A reliable Internet connection?
2. A high-speed Internet connection?

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### Dependent variables

| Items | Sources |
|-------|---------|
| readiness | I have enough IT skills to use e-learning technologies. | Arbaugh(2000) Thurmond et al (2002) So and Swatman (2007) And self-development |
| | My parents are ready to support the use of e-learning at home. | |
| | I think I am ready for e-learning | |
| | I think I am ready to take my quizzes, assignments, extra examples from the web. | |
| | I think I am ready to communicate with instructors and students via the web. | |
| | I think it is the right time to promote e-learning in universities | |
| | Taking this class in this manner allow me to arrange my work for the class more effectively. | |
| | The advantages of taking this class in this manner outweigh any disadvantages | |
| | Taking this class in this manner allow me to see course lectures which I was absent in that lessons (Likert’s scale 1, strongly disagree; 5, strongly agree) | |