Journal of Southeast Asian Education Vol. 6, No. 1, 2013, 87-116

WEB-BASED INSTRUCTION FOR ADULT LEARNERS: AN ASYNCHRONOUS DELIVERY MODEL FOR FORMAL LIFELONG LEARNING

NANTHA KUMAR SUBRAMANIAM

Open University Malaysia (OUM)
Jalan Tun Ismail
50480 Kuala Lumpur, Malaysia

ABSTRACT

Web-based Instruction (WBI) is becoming a favored teaching and learning option in higher education. Unfortunately, the effects of WBI on success, perception and gender have not been clearly demonstrated or sufficiently addressed, especially for adult learners who are engaged in the formal lifelong learning via the popular asynchronous WBI (A-WBI). This paper attempts to address the following objectives: (i) to propose a framework for A-WBI to deliver lessons to adult learners who are enrolled in formal lifelong learning; (ii) to implement the proposed framework; (iii) to explore adult learner perceptions of A-WBI and of how gender influences their perception; (iv) to explore the influence of A-WBI on the adult learner summative assessment (final examination component); and (v) o analyze the relationship between adult learner interaction with A-WBI and their final examination marks. Objectives (i) and (ii) are achieved by using the design and implementation approach while objectives (iii), (iv) and (v) are achieved by an interpretive case study methodology approach. The findings indicate: (i) moderate learner responses for the use of A-WBI when studying have led to poor performance in the summative assessment among adult learners; (ii) female learners are the high-risk group in A-WBI; and (iii) quality interaction in the A-WBI discussion forum has a strong relationship with learner final examination scores. The paper concludes with discussions on the findings and recommendations.

Keywords: Adult learners, formal lifelong learning, web-based Instruction

WEB-BASED INSTRUCTION (WBI): OVERVIEW

Advances in technology have been used to propagate distance education as a system of choice especially for adult learners. This has led to terms such as "e-learning" and "online learning". Both e-learning and online learning have been used synonymously with Web-based instruction (WBI). However, there is a clear distinction between e-learning and WBI, where e-learning refers to the use of any electronic applications and processes for instruction, including CBT (computer-based training), WBI, CDs and so on, whereas WBI is defined as instruction via the Internet, Intranet and Web only (Stockley 2012). For the purpose of discussion in this paper, WBI and online learning (or online instruction) are considered synonymous. The expansion of formal lifelong learning (FLL) among adults in recent years, at least in part, is due to the rapid growth of the Internet and increased availability of WBI. Web-based instruction (WBI) is becoming a favored training option in industry, government, and higher education (Sitzmann *et al.*, 2006).

For the purpose of this study, a WBI is an asynchronous Web-based learning environment created to not only deliver course materials to learners, but also to provide collaboration and interaction using an asynchronous discussion forum as the main platform to support learner independent study: http://olc.spsd.sk.ca/de/pd/instr/indepen.html and indirect instruction: http://olc.spsd.sk.ca/de/pd/instr/indirect.html. It supports student self-managed learning by providing an environment with the learning tools, learning materials and opportunities for contextual and collaborative discussions. Asynchronous WBI (A-WBI) is widely adopted compared to synchronous WBI due to its flexibility, practicality and cost.

Asynchronous communication for Web-based learning

Numerous researches have highlighted the effectiveness of asynchronous communication as a learning source. The prominent research in this field was conducted by Harasim (1990) who discovered that the asynchronous environment could be used to enhance the learning process by combining active learning with knowledge construction. According to Harasim, knowledge is constructed through generation, linkage, and structuring of ideas through an online mode of communication.

Research on the use of asynchronous tools such as discussion forums, participation and interaction in the discussion is at least at par with discussions that take place in the classroom. (Hiltz, 1990; Pena-Shaff, Martin & Gay, 2001; Pena-Shaff & Nicholas, 2004). Studies using content analysis of electronic messages show that online discussions support collaborative learning, accept the use of collaborative skills, and promote knowledge construction in a social manner. Hiltz and Wellman (1997) found that asynchronous discussion is sufficient to support the development of the learning community in which students establish both cognitive elements and emotions needed for effective learning. Blanchette (2001) investigated the interaction of students in asynchronous discussion and found students in this category involved in a higher order of cognitive interactivity compared to students from a face-to-face meeting. Dewiyanti *et al*. (2007) conducted an explorative study to solicit responses from distance students on their experience with learning in an asynchronous environment. The results revealed that distance students appreciate the opportunity to work collaboratively in this mode. Nevertheless, the study by Ocker and Yaverbaum (1999) shows that collaboration in the asynchronous learning environment is as effective as face-to-face tutorials even though there are situations in which the students are not happy with the interaction process and the quality of the group discussion. This could be attributed to the fact that merely providing an asynchronous environment, such as discussion forums for students, does not necessarily lead to productive discussions. The learning environment itself needs to be designed in such a way that it promotes meaningful learning.

PROBLEM STATEMENT

According to Kincannon (2000), Web-based instruction is the impetus for the development of distance programs worldwide. This in turn will be a catalyst for lifelong learning. The challenge to educators and researchers is to meet the expectations of adult learners who are enrolled in online and distance education (ODE) as part of their formal lifelong learning agenda and how to incorporate this Web-based instruction, especially asynchronous WBI (which is widely adopted), into their teaching practice and still retain their personal definition of high-quality teaching in a Web-based teaching environment. Gilbert (1996) suggested that Web-based instruction

requires more thoughtful attention to pedagogy and technology and to the settings in which learning can occur than with conventional education. There is great interest, therefore, in exploring how WBI, especially A-WBI, can be designed and implemented for formal lifelong learning (FLL) as there is no one fixed way to implement an asynchronous WBI in order to deliver FLL to adult learners.

Research on online learning and web-based instruction has paid more attention to conventional learners, such as work done by Sitzmann *et al.* (2006), Johnston *et al.* (2005) and Jung *et al.* (2002). Most of these studies have successfully elicited the perception of conventional learners on online learning. There has been little research done to determine the perception and preference of adult learners towards web-based instruction including A-WBI. Therefore, there was an urgent need in the investigation of A-WBI in regard to success and perception among adult learners in formal lifelong learning courses, especially for A-WBI.

Gender is an important factor in formal lifelong learning as participants in formal lifelong learning via ODE are well balanced between male and female. For example, 55% of adult learners at the Open University Malaysia (OUM) are male and the remaining 45% are females. Bekele's (2010) study which investigated the studies carried out on A-WBI found that the effect of WBI on gender was not clearly demonstrated or was insufficiently addressed. This was more so for the adult learners who were engaged in formal lifelong learning. Therefore, there was an urgent need in the investigation of A-WBI to explore issues of gender among adult learners in the formal lifelong learning courses.

Researchers studying the effect of online learning have not paid attention to the impact of online learning or A-WBI on adult learner performance in the final examination. The final examination, or summative assessment, is evidence to the extent a learner has understood the subject matter. On the other hand, researchers studying the effect of online learning paid more attention to factors such as perception and motivation among conventional learners who were engaged in online learning such as work done by Sitzmann *et al.* (2006), Johnston *et al.* (2005) and Jung *et al.* (2002). The impact of WBI (and also of A-WBI) on adult learner final examinations is unknown.

RESEARCH OBJECTIVES

Based on the problem statements highlighted in the previous section, the objectives of this study are as follows:

1. To propose a framework for an asynchronous WBI (A-WBI) to deliver lessons for adult learners who are enrolled in formal lifelong learning;
2. To implement the framework proposed above;
3. To explore adult learners' overall perceptions of A-WBI with regard to learning experience, self-managed learning and preference;

3.1 To explore how gender influences learner perceptions of A-WBI with regard to learning experience, self-managed learning and preference;

4. To explore the influence of A-WBI on the learner summative assessment (i.e., final examination marks);

4.1 To explore the influence of A-WBI on the learner summative assessment (final examination marks) with regard to gender; and

5. To analyze the relationship between learner interaction with A-WBI and the final examination marks.

SIGNIFICANCE OF THE STUDY

Lifelong learning (be it formal or informal) expands life choices and enhances people's quality of life. Thus, it is a critical thrust in ensuring the success of the nation's economic development. In our (Malaysia and ASEAN) desire to achieve Vision 2020 as a developed nation and region, it is imperative that lifelong learning be adopted as a New National Agenda in achieving the nation's human capital development. While formal education at universities and colleges remains an important component of the country's education system, the development of human capital can be further enhanced through formal and informal lifelong learning opportunities. Unfortunately, ASEAN nations cannot afford to provide a "brick-and-mortar" setup of classrooms for all its citizens, as it is too expensive and not pragmatic. Hence, A-WBI, as proposed in this paper, becomes a viable alternative to achieve this objective. But merely using A-WBI for teaching and learning does not guarantee effective learning among adult learners. We should understand how adult learners perceive A-

WBI and whether it will contribute to their increased academic performance. These issues will be addressed in this paper. Another significance of this study is that it will provide a base for the following model of teaching and learning (Figure 1) in the context of social constructivist theories, especially for formal lifelong learning catering to adult learners. Social constructivist theories of learning have made it important for learners to engage in successful learning. It stresses complex problem-solving activities for meaningful learning.

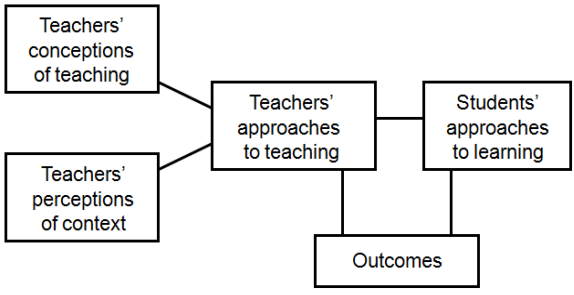

Figure 1: Model of Teaching and Learning for FLL courses

RESEARCH METHODOLOGY

Objectives (1) and (2) of this study are achieved by using the design and implementation approach while the interpretive case study methodology approach has been adopted to achieve objectives (3), (4) and (5). Burns (1997) comments that the case studies have a number of purposes or functions within educational research. Due to their intense and subjective nature, they are particularly suited to acting as preliminaries to major investigations by providing a "source of hypothesis for future research" (Burns, 1997, p.365) or by assisting in developing a deeper understanding "of the class of events from which the case has been drawn". The methodology in this instance allowed researchers to gain deep insight into any value A-WBI held from the students' perspective. An interpretive case study approach was also used by Falloon (2011) for his study concerning WBI.

A-WBI proposed in this study was implemented for CBOP3203-Object Oriented Programming (IT subject) in the May 2012 semester at OUM. A total of 116 learners (Male: 93; Female: 23) took the subject during the semester using the blended learning approach. Adult learners

were given access to A-WBI for their online learning and a limited number of face-to-face (F2F) tutorials (8 hours). Self-managed learning (SML) constituted the larger portion of learner study time followed by online learning and F2F tutorials. Online learning via A-WBI is an important component to support learner SML. There were 15 weeks in the semester in which learners were engaged in teaching and learning through WBI in week 1 to week 14. They took the final examination (summative assessment) in the final week. Table 1 shows the means to achieve the objectives of this study.

Table 1: Objectives and the means to achieve the objectives

	Objective	Means to achieve the objective
1	To propose a framework for an asynchronous WBI (A-WBI) to deliver lessons for adult learners who are enrolled in formal lifelong learning;	Literature Review
2	To implement the framework proposed above;	Platform Development
3	To explore adult learners' overall perceptions of A-WBI with regard to learning experience, self-managed learning and preference;	Questionnaire
3.1	To explore how gender influences learner perceptions of A-WBI with regard to learning experience, self-managed learning and preference;	Questionnaire
4	To explore the influence of A-WBI on the learner summative assessment (final examination marks);	Final Examination Marks
4.1	To explore the influence of A-WBI on the learner summative assessment (final examination marks) with regard to gender; and	Final Examination Marks
5	To analyze the relationship between learner interaction with A-WBI and the final examination marks.	Content analysis using Rubrics

Context of Study: Open University Malaysia (OUM)

This study uses adult learners who were enrolled in the Bachelor of Information Technology Program at Open University Malaysia (OUM) for the course CBOP3203-Object Oriented Programming in the May 2012 semester. As epitomized by its name, OUM has embarked on offering formal lifelong opportunities for self-development of adults while focusing on education, training, and development activities. OUM uses the "blended approach" to deliver its teaching and learning activities for formal lifelong learning. The blended learning

in OUM encompasses face-to-face tutorials, online learning and self-managed learning (Mansor Fadzil & Latifah Abdol Latif, 2010).

Research Questions

Table 2 contains the research questions that guided the data collection process for this study in order to achieve its objectives.

Table 2: Research questions

	Objective	**Research Questions**
1	To propose a framework for an asynchronous WBI (A-WBI) to deliver lessons for adult learners who are enrolled in formal lifelong learning;	• What is the effective framework for asynchronous WBI to deliver lessons for adult learners enrolled in formal lifelong learning?
2	To implement the framework proposed above;	Not applicable
3	To explore adult learners' overall perceptions of A-WBI with regard to learning experience, self-managed learning and preference;	**LEARNING** •Do adult learners experience a higher level of understanding of the lesson through A-WBI? •Do adult learners manage to achieve the learning outcomes for this course by using A-WBI? •Do adult learners experience learning the subject in a new mode through this A-WBI? •Does adult learner knowledge increase after following A-WBI? **SELF-MANAGED LEARNING** •Does A-WBI support self-managed learning? **PREFERENCE** •Is it possible for A-WBI to become the primary learning source? •Is it interesting to learn the subject through A-WBI? •Can face-to-cafe tutorials be eliminated as a result of A-WBI? •Does A-WBI encourage participation from lifelong learners? •Is A-WBI in blended pedagogy an ideal way to deliver courses on a lifelong basis? •Are there differences in the responses to any of the above questions because of gender?
3.1	To explore how gender influences learner perceptions of A-WBI with regard to learning experience, self-managed learning and preference;	

	Objective	Research Questions
4	To explore the influence of A-WBI on the learner summative assessment (final examination marks);	• Does A-WBI enable adult learners to perform better in the final examination? • How does A-WBI influence adult learner gender performance in the final examination?
4.1	To explore the influence of A-WBI on the learner summative assessment (final examination marks) with regard to gender; and	
5	To analyze the relationship between learner interaction with A-WBI and the final examination marks.	• Is there a relationship between adult learner interaction with A-WBI and the final examination?

Gender is the independent variable in this study while mean scores of perception for WBI, rubrics, and the final examination scores are the dependent variables.

Data Collection

At the end of the semester, a questionnaire was distributed to all 116 adult learners taking this subject. This represents 100% of the population registered for the course throughout Malaysia. Forty-seven learners (40.5% of the population) responded to the survey. The questionnaire had three sections. The first section elicited adult learner perception of their learning experience with A-WBI. There were four items in this section. All items were based on the courseware assessment instrument developed by the Center of Instructional Design and Technology (CIDT) at OUM. The second section had one item that measured adult learner perception on whether the A-WBI helped their self-managed learning. The third section elicited adult learner perceptions of their preference for A-WBI over face-to-face interaction. There were five items in this section. All these items were measured using the Likert scale of 1 (strongly disagree) to 5 (strongly agree). In addition, adult learner final examination marks (summative assessment) were obtained from the Examination Unit of Open University Malaysia. The final examination consisted of two sections. The first section (Section A) had five short subjective knowledge-based questions, and learners needed to answer all questions. The second section (Section B) consisted of five long subjective, application-based questions in which they needed to

answer any three questions. Data was analyzed with SPSS software using descriptive statistics (mean (M), standard deviation (SD)), the Pearson correlation test, one-sample T-test, and the Independent-samples T-test.

A-WBI FRAMEWORK FOR FORMAL LIFELONG LEARNING TO CATER TO ADULT LEARNERS

Based on the author's own experiences of conducting online courses for almost 10 years and through reference to the work done by Jochems, Merrienboer, Jeroen, and Koper (2003) and Garrison, Anderson and Archer (2001a), online learning in the form of A-WBI will be effective if it is implemented in an integrated manner that incorporates the following six critical principles to empower adult learner learning:

1. A-WBI has to take pedagogical and technical aspects into account.
2. A-WBI has to be learner-centered whereby learners are the primary focus of attention as opposed to the traditional emphasis on instructors.
3. The best approach to teaching and learning is the bi-instructional method where online learning is utilized for independent study to support self-managed learning (SML) and indirect instruction to support peer collaboration and interaction and eliminate isolation.
4. Assessment must become an integral part of A-WBI so that learners are able to self-assess and think of ways to improve their assessment.
5. A successful A-WBI must support instructor presence, social presence and cognitive presence as proposed in the Community of Inquiry (CoI) model.
6. A successful WBI must support learner-learner, learner-instructor and learner-content interactions.

Thus, the following framework for A-WBI in Figure 2 is proposed and its implementation is provided in Figure 3.

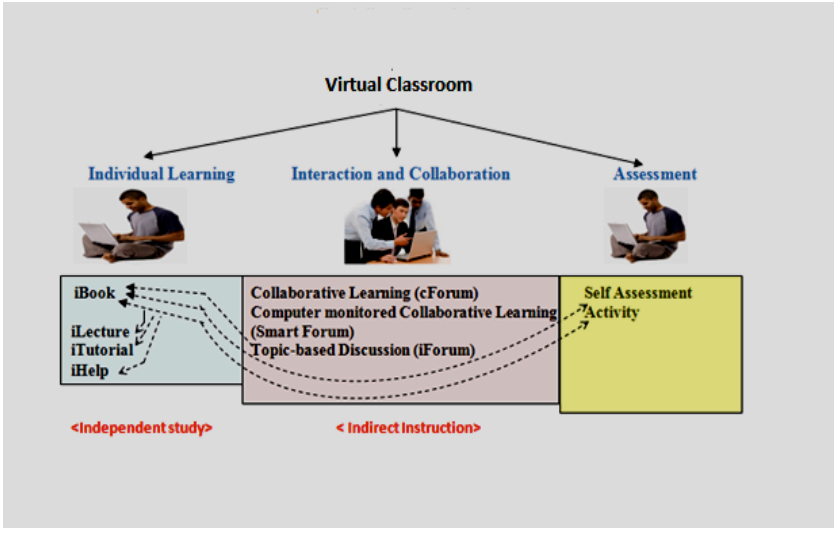

Figure 2: The A-WBI Framework

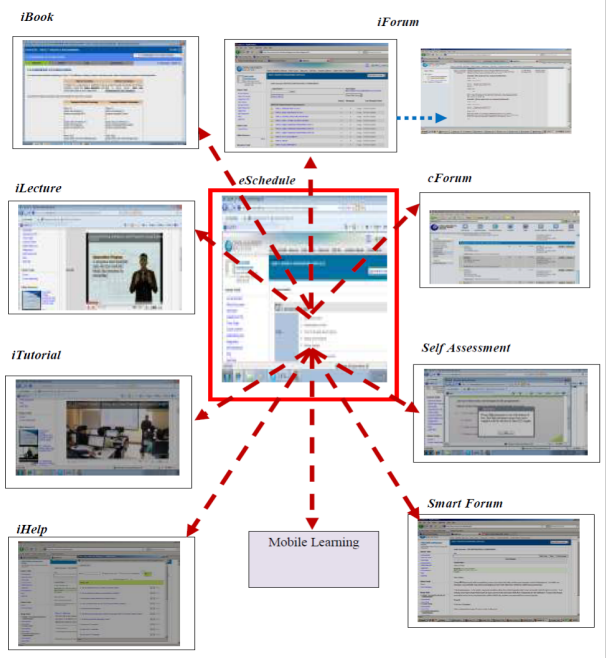

Figure 3: A-WBI implementation via myVLE (OUM's Learning Management System)

Through this framework, maximum learning opportunities are provided via integration of recorded tutorials (iTutorials) and lectures (iLectures) for problem-based learning and knowledge learning respectively, discussion forums in the form of smart forums, collaborative forums (cForum) and knowledge forums (iForum) for the opportunity to formulate and articulate higher order questions, enriched online notes (ibook) for knowledge learning, self assessment with embedded feedback, and other supplementary resources such as help system (iHelp) and mobile learning using QR codes. This framework enables learners to enjoy the learning experience anytime and anywhere. Table 3 below shows the e-learning principles and their corresponding A-WBI tools.

Table 3: The e-learning principles and corresponding tools

Principle	Tools in A-WBI to support the principle
Individual Learning	iBook, iLecture, iTutorial, iHelp
Interaction and Collaboration	Collaborative Forum (cForum), Smart Forum, iForum
Assessment	Self-Assessment, Activity

A-WBI for the CBOP3203 subject was implemented via the OUM's learning management system known as myVLE. When adult learners access the A-WBI for the CBOP3203 subject, the main page of the A-WBI containing the eSchedule appears. This eSchedule guides the adult learner on the activities that they should complete in the 14-week period (Figure 4). By doing so, the learner can determine the best time to access the A-WBI content.

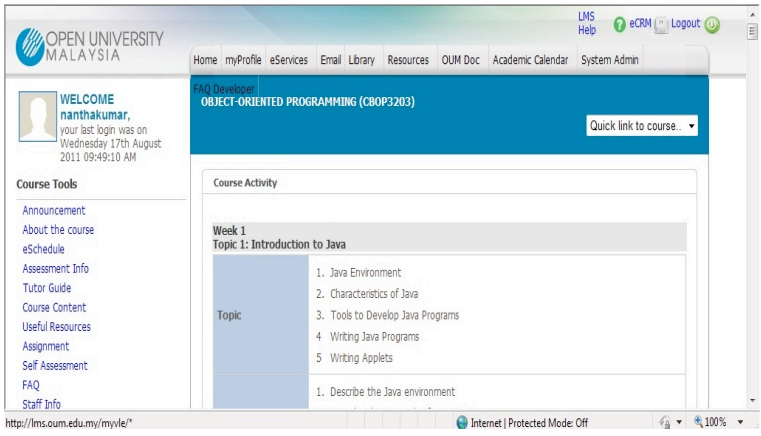

Figure 4: Main page of the A-WBI in myVLE

Various learning materials are supported in myVLE to achieve the A-WBI concept as shown in Figure 3. Ten iLectures for a total of six hours were developed to cater to the difficult concepts in a subject. Five iTutorials with a total time of ten hours were developed, and fourteen flash-based activities were developed to support learner self-assessment.

RESULTS

Adult Learners Perceptions of A-WBI

As stated earlier, data was collected using a questionnaire to elicit adult learner perceptions of their learning, self-managed learning and preference. Forty-seven learners (male: 34, representing 37% of the male population and female: 13, representing 57% of the female population) who took the CBOP3203 course in the May 2012 semester responded to the questionnaire. This sample represents 40.5% of the entire population. The average age of the respondents was 30.5. The maximum age of the respondents was 41. The reliability level for the items in the questionnaire is high which is 0.901 based on Cronbach's Alpha test. The mean score for all items (Q1-Q10) in the questionnaire is provided in Table 4.

Table 4: Objectives and the means to achieve those objectives

Item in the questionnaire	**Overall Mean$_{overall}$ (*M*)**	**Std. deviation (SD)**
Q1 [I experienced a higher level of understanding of the lesson through WBI for this subject]	3.70	0.88
Q2 [I managed to achieve the learning outcomes for this subject through WBI]	3.49	0.80
Q3 [I experienced learning the subject in a new mode through WBI]	3.68	0.86
Q4 [My knowledge increased after going through WBI for this course]	3.77	0.84
Q5 [WBI for this subject supported my self-managed learning]	3.64	0.82
Q6 [It is possible for WBI for this subject to become the primary learning source]	3.46	0.96
Q7 [It is interesting to learn the subject through WBI]	3.55	0.93
Q8 [Face-to-face tutorials can be eliminated for this subject as a result of having this WBI]	1.96	1.23
Q9 [WBI such as for this subject encourages participation from lifelong learners like me]	3.61	0.93
Q10 [WBI in blended pedagogy is an ideal way to deliver courses on a lifelong basis]	3.73	1.02

The above table is presented in a graph format in Figure 5 below.

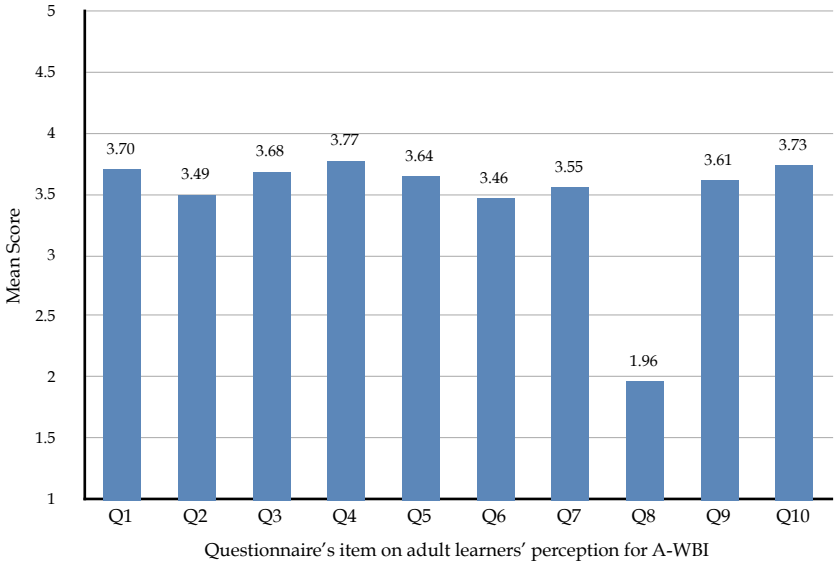

Figure 5: Mean score for all items in the questionnaire

The results show that adult learners gave mean (M) scores between 1.96 to 3.77 on the Likert scale of 1 to 5 (1: strongly disagree; 5: strongly agree), which indicates moderate responses for all questions/ items in the questionnaire. In addition, the mean scores shown in Figure 5 are significantly lower than the highest mean score that can be attained (at $p < 0.05$). The result for Q8 is not encouraging having been rated 1.96 on the Likert scale. All mean scores for Q1 to Q10 are significantly lower than the highest mean score that can be attained (at $p < 0.05$). This indicates that there are areas for improvement in the dynamics of A-WBI and that adult learners still prefer face-to-face tutorials to A-WBI. This could be in line with Asian culture where attendance in a classroom is considered a must in teaching (Miliszewska, 2007).

Table 5 shows the perceptions according to gender for all questions in the questionnaire. Analysis shows that males have higher mean scores than females with the exception of Q8. These mean scores (for Q1-Q10 for the gender-based analysis) did not differ significantly at the $p < 0.05$. Levene's test for homogeneity of variance was not significant for these item**s.**

Table 5: Objectives and the means to achieve those objectives

Item in the questionnaire	Male Mean (M_{male})	Female Mean (M_{female})
Q1 [I experienced a higher level of understanding of the lesson through WBI for this subject]	3.76 (SD: 0.96)	3.54 (SD:0.66)
Q2 [I managed to achieve the learning outcomes for this subject through WBI]	3.53 (SD:0.90)	3.38 (SD:0.51)
Q3 [I experienced learning the subject in a new mode through WBI]	3.82 (SD:0.94)	3.31 (SD: 0.48)
Q4 [My knowledge increased after going through WBI for this course]	3.82 (SD:0.94)	3.62 (SD:0.51)
Q5 [WBI for this subject supported my self-managed learning]	3.68 (SD:0.91)	3.54 (SD:0.52)
Q6 [It is possible for WBI for this subject to become the primary learning source]	3.56 (SD:1.02)	3.17 (SD:0.72)
Q7 [It is interesting to learn the subject through WBI]	3.59 (SD: 1.02)	3.46 (SD:0.66)
Q8 [Face-to-face tutorials can be eliminated for this subject as a result of having this WBI]	1.79 (SD:1.17)	2.38 (SD:1.33)
Q9 [WBI such as for this subject encourages participation from lifelong learners like me]	3.64 (SD:1.03)	3.54 (SD:0.66)
Q10 [WBI in blended pedagogy is an ideal way to deliver courses on a lifelong basis]	3.81 (SD:1.14)	3.54 (SD:0.66)

Overall, adult learners have a moderate perception of A-WBI. Possible reasons for this are discussed below.

- The nature of the subject

CBOP3203 is a technical subject that requires problem solving and critical thinking skills with many pre-requisite knowledge chunks (McGill *et al*., 1997). A-WBI for such a subject may need to have support to address these concerns.

- No synchronous support

The exclusion of synchronous support in A-WBI may have prohibited real-time interaction among learners and between instructor and learner. Learners may have had problems or enquiries that required urgent and immediate attention from peers or instructors. Asynchronous tools currently available in A-WBI do not support such interaction. We hypothesize that A-WBI may need to have a certain level of synchronous communication.

- General perception of face-to-face interaction

Media Richness Theory (Daft & Lengel, 1986) suggests that face-to-face communication is considered to be the richest, while other forms of media are thought to be less learner-based, since they have fewer contextual cues and slower feedback compared to face-to-face (Daft & Lengel, 1986). Thus, students even in the online learning environment naturally perceived face-to-face discussion to be faster, easier and more convenient. In order to obtain views from learners on how A-WBI for this subject can be improved, we randomly interviewed 10 learners. All these learners highlighted the need to have synchronous communication between learners and instructors in the form of a live classroom.

It is also interesting to note that male learners have a higher preference for A-WBI than their female counterparts. Learners viewed A-WBI as supplementary learning and classroom learning as the primary learning method. Nevertheless, female students have fewer tendencies toward face-to-face (f2f) interactions than their male counterparts. Despite this, females still have a lower perception of A-WBI than their male counterparts. It shows that female learners prefer to engage in "self-managed learning". This may be due to their family commitments. Thus, A-WBI needs to consider this factor, and learning through WBI needs to be structured so that it motivates female learners to take part in the learning process via A-WBI.

A-WBI and adult learners performance in summative assessment

In order to determine whether A-WBI in this study had contributed effectively towards the adult learner learning process with regard to their final examination, we analyzed adult learners from the entire learner population who took the course. Figure 6 shows the performance of adult learners (overall and based on gender). It can be concluded from the diagram that males and females exhibit a similar pattern in their performance as both of these groups fared poorly in the final examination (76% of male and 90% of female learners fared poorly in the final exam, while only 5.6% of male and 5% of female learners obtained excellent scores in the final exam). The majority of adult learners are skewed toward the left and the distribution is not normal, indicating poor performance of the majority of learners. This is a reflection of the moderate perception by learners on A-WBI toward the learning outcome and the understanding of the subject matter.

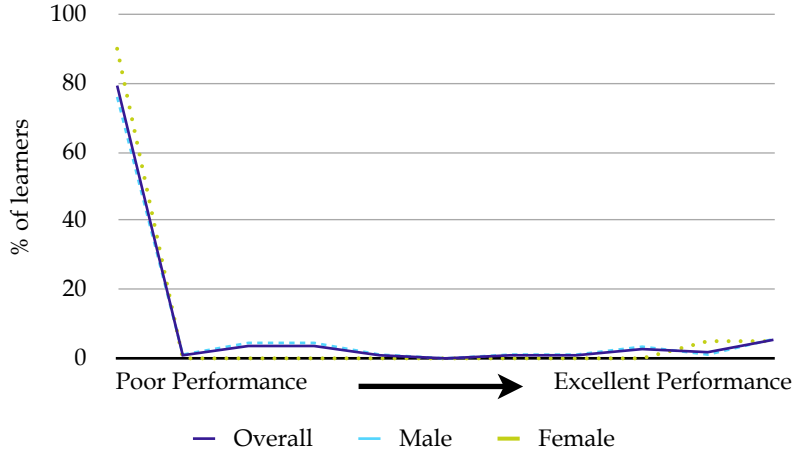

Figure 6: Overall and gender-based performance in the final examination (summative assessment) [Entire population]

Overall (from Figure 6), the average (M) final examination mark was 23.6% (SD: 24.36). On the other hand, male learners achieved a higher mean score (M=24.03%; SD: 24.04) than female learners (M=19.53%; SD: 23.98) and the means did not differ significantly at the $p<0.05$

(p=0.41). Levene's test for homogeneity of variance was not significant. In order to determine whether there is a correlation between adult learner perception on the achievement of the learning outcome and understanding of the subject matter, we conducted a correlation test between the final examination marks and Q1, Q2 and Q4 of the questionnaire survey. The result of the correlation test is shown in Table 6 below.

Table 6: Correlation test between the final examination marks and Q1, Q2 and Q4 of the questionnaire survey

Correlation between **Q1**[*I experienced a higher level of understanding of the lesson through WBI for this subject*] and Final Examination Marks	**Pearson Correlation**	**-0.106**
	Significance	0.500
Correlation between **Q2** [*I managed to achieve the learning outcomes for this subject through WBI*] and Final Examination Marks	**Pearson Correlation**	**0.184**
	Significance	0.237
Correlation between **Q4** [*My knowledge increased after going through WBI for this course*] and Final Examination Marks	**Pearson Correlation**	**0.046**
	Significance	0.770

It can be concluded from the table above that there is an extremely weak correlation between the final examination marks and Q1, Q2 and Q4 of the questionnaire.

The final examination paper for this subject consists of two sections: knowledge-based and application-based. Thus, we conducted further analysis by considering Section A of the examination paper (knowledge-based questions) and Section B of examination paper (application-based questions). Figure 7 shows the performance of adult learners (based on gender) for the knowledge-based questions. It can be concluded from the diagram that males and females exhibit a similar pattern in performance in which both of these groups fared poorly on the final examination (62.4% of male and 56.5% of female learners fared poorly on the final exam, while only 4.3% of male and 8.7% of female learners obtained excellent scores on the final exam). The majority of adult learners are skewed towards the left and it is not normally distributed, indicating poor performance of the majority of learners even for the knowledge-based questions.

The average mark for this knowledge-based section was 31% (SD: 24.3). On the other hand, male learners achieved a lower mean score (M=30%; SD: 23.5) than female learners (M=32%; SD: 27.6) and the means did not differ significantly at the $p < 0.05$ ($p = 0.75$). Levene's test for homogeneity of variance was not significant.

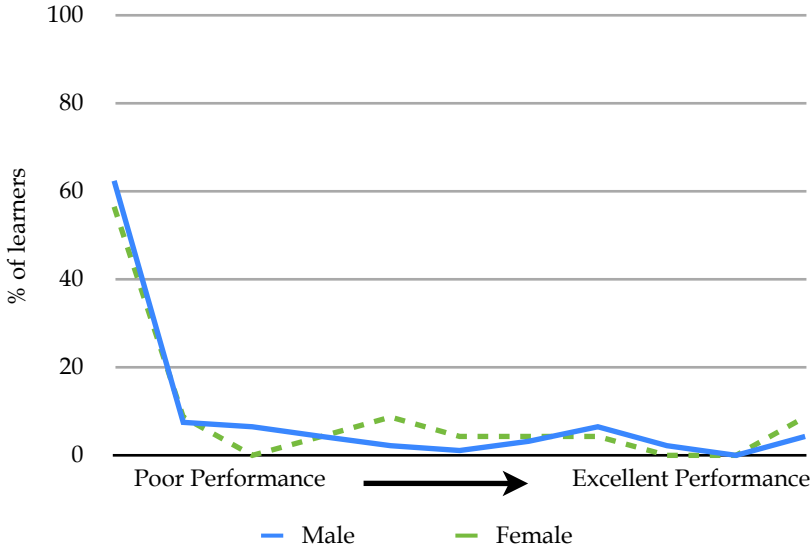

Figure 7: Gender-based performance of adult learners in the population for the final examination (knowledge section)

Figure 8 shows the performance of adult learners (based on gender) for the application-based or higher-order questions. As in Figure 7, it can be concluded from the diagram that males and females exhibit a similar pattern in the performance in which both of these groups fared poorly on the final examination (80% of male and 91% of female learners fared poorly on the final exam, while only 6.5% of male and 4.3 % of female learners obtained excellent scores on the final exam). The majority of learners are skewed towards the left and the distribution is not normal, indicating poor performance of the majority of learners even for the application-based questions.

The average (M) mark for this application-based section was 19.4% (SD: 27). Male learners achieved a higher mean score (M=21%; SD: 27) than female learners (M=13%; SD: 25) and the means did not differ significantly at the $p < 0.05$ ($p = 0.22$). Levene's test for homogeneity of variance was not significant.

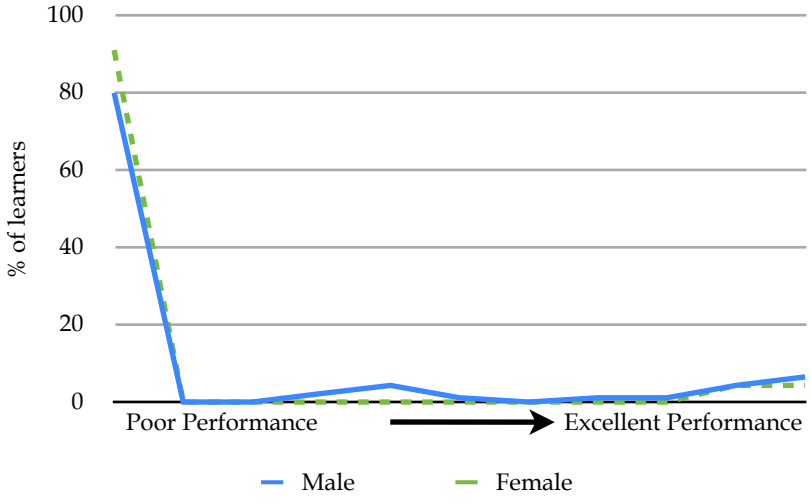

Figure 8: Gender based performance of adult learners in the population for the final examination (application section)

In order to determine whether there is a correlation between learner scores for the knowledge-based questions and those of the application-based questions, we conducted a correlation test. The result of the correlation test is shown in Table 7 below.

Table 7: Correlation test between the scores of the knowledge-based and application-based questions

Correlation test between the scores of the knowledge-based and application based questions	**Pearson Correlation**	***0.642**
	Sig.	0.000
	N	116 [Entire population of learners who took the course]
* Correlation is significant at the 0.01 level		

It can be concluded from the table above that there is a strong and significant (at $p < 0.01$) correlation between these two scores. This is not surprising as knowledge is the enabler for higher-order thinking such as application/synthesis of a problem.

The main conclusions that can be drawn from the findings are listed below:

- The poor performance of adult learners on the final examination (summative assessment) was a reflection of the earlier moderate perception of A-WBI.
- Male and female adult learners have a similar performance pattern.
- Male learners have a higher mean score for the final examination marks.
- Learner scores in the knowledge-based questions are strongly correlated with their scores in the application-based questions.

We believe adult learner performance on the final examination can improve if we elevate learner perception of A-WBI. This can be done by increasing the level of knowledge that they gain from A-WBI as it is capable of influencing their higher-order thinking, eventually resulting in adult learners being more confident with A-WBI. We believe that A-WBI can be upgraded by incorporating minimal synchronous communication in the form of a live classroom to promote learning experience among adult learners.

Learning is a form of experience. To learn to think, one needs to experience processes of inquiring, analyzing and concluding by oneself as opposed to becoming familiar with conclusions from

another's investigation. To extend the scope of learning is to create situations that make possible such experiences in an active state. These processes are usually either completely absent or inadequately developed in the education process, which is demonstrated by the ideal of the standardized product and is a concept of learning which emphasizes the acquisition of the correct answer through feedback rather than creative inquiry.

Learning consists of content that is learnable or adaptable to student experiences. When one considers the ability to learn, it is the adjustment of the curriculum content and the forms of learning experiences that must be in line with the abilities of the learners. For effective learning and suitable activities for students, one must take into account at every point the selection and organization of content and also relevant experiences designed to develop the power to discover general ideas and concepts. Students need to learn beyond their power to master learning by themselves. Thus, it is appropriate that experiences are used as stepping-stones towards the final outcome. The live classroom is well positioned to address these issues. On the other hand, in order to be effective, A-WBI must also support Piaget's idea of assimilation and accommodation. Assimilation is a kind of matching between learner cognitive structure and the physical environment, while accommodation is the process by which cognitive structure is modified. We hypothesize that the inclusion of assimilation and accommodation factors in A-WBI can further boost the learning process using A-WBI with incorporation of synchronous communication in the form of a live classroom.

Influence of Adult Learners Participation in the A-WBI Forum on their summative assessments

Adult learner interaction with their peers and instructors in the A-WBI takes place in the discussion forum. In order to determine whether learner interaction in the forum influenced their final examination marks, we randomly selected postings of 40 learners (male: 31, representing 33% of the male population) and female: 9, representing 39% of the female population) and analyzed the contents of the posting. We were particularly interested in the quality of the posting. The analysis of these postings was done using quality rubrics, which places emphasis on the quality of the posting (refer to Appendix 1 for the rubrics). Each learner who is selected in this

content analysis will get marks in the range of 0 to 10. Zero indicates poor performance in the forum while 10 indicates excellent performance. The results of this content analysis are shown in Figure 9.

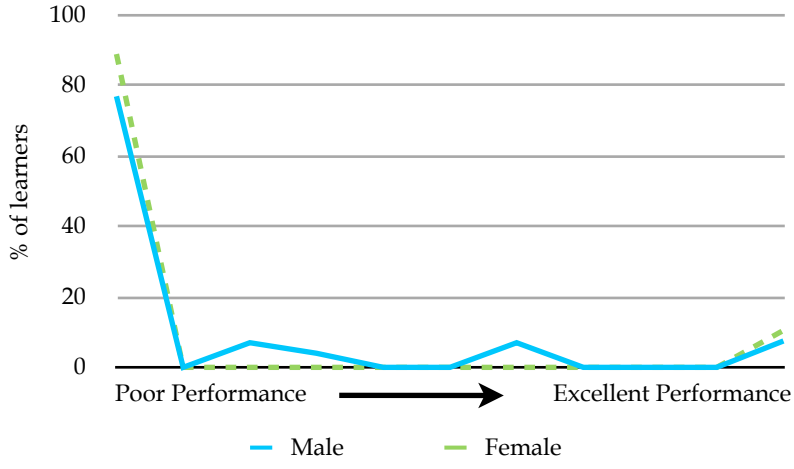

Figure 9: The performance of the respondents (gender-based) in the quality of the postings in the forum

Based on the above figure, 77% of male and 89% of female learners failed to post quality messages in the forum, while only 8% of male and 12% of female learners managed to post quality messages. The mean score of male adult learners was M = 20.3%, SD = 28.0, and was higher than female adult learners, M = 14.8%, SD = 32.9 and the means did not differ significantly at the $p < 0.05$ ($p = 0.62$). Levene's test for homogeneity of variance was not significant.

An interesting discovery was that Figure 9 exhibits a similar pattern to that of Figure 6. Accordingly, we conducted a Pearson correlation test between learner rubric scores for the forum's posting and the final examination marks. Results show that there is good and significant (at $p<0.005$) correlation between these two dependent variables ($r=0.65$, $p=0.00$).

Based on Figure 9, it can be concluded that:

- Most adult learners (both female and male) did not contribute effectively in the discussion forum available in A-WBI in regard to the "quality of posting".
- Male and female adult learners exhibit the same pattern in the quality of the posting.
- Male learners contributed more toward the quality discussion. Hence, they have higher mean scores for the rubric.

These findings reaffirm the importance of the discussion forum as an important component of A-WBI. However, the forum needs to be structured in a way that it can promote meaningful interaction and creative inquiry. This eventually will help adult learner performance on the summative assessment. Instructors need to give special attention to female learners so that they can actively engage in the discussion forum. In order to enable the forum as a platform for creative inquiry and promote higher order thinking, the forum needs to be viewed as a "Community of Inquiry" as proposed by Garrison (2001).

An educational community of inquiry is a group of individuals who collaboratively engage in purposeful critical discourse and reflection to construct personal meaning and confirm mutual understanding. The Community of Inquiry theoretical framework represents a process of creating a deep and meaningful (collaborative-constructivist) learning experience through the development of three interdependent elements: social, cognitive and teaching presence.

IMPLICATION OF THIS STUDY

In today's age of information communication technology, it can be observed that many traditional practices are being tried and replaced with modern alternatives that are perceived as more convenient and effective. It has been indicated by proponents of these new technologies that they increase work efficiency and accuracy and make studies more interesting and motivating. In countries where access to formal education at universities and colleges is limited, the development of human capital has been further enhanced through lifelong learning opportunities provided by the rapid growth of the Internet and increased availability of WBI. This current study on the

effects of WBI has been limited to a case study at the Open University Malaysia. Though it is difficult to draw implications and form generalizations from one study, we believe the findings from this study do lead to some broader ramifications. Four broad implications can be concluded from this study in the context of A-WBI to deliver formal lifelong learning for adult learners.

First, the study shows that the female sample was more high-risk as compared to the male counterpart. The proliferation of information technology presents implications on the issue of access to education. Adult learners whose homes are beyond any commutable distance to a college or university have been able to find enrolment options. For these students, particularly women, time available for study comes only in the middle of the night where new technologies present breakthrough access. Thus, their preference for participation in online forums and face-to-face activities was lower than what was accorded by males.

Secondly, asynchronous WBI as described in this study must also support synchronous communication (live classroom contexts) to reinforce assimilation and accommodation of adult learners. Many educators make commitments to the Vygotskian (1978) notion of a zone of proximal development (ZPD) (Puntambekar & Hubscher 2005). The ZPD is defined as the "distance between the child's actual developmental level as determined by independent problem solving and the higher level of potential development as determined through problem solving under adult guidance and in collaboration with more capable peers" (Vygotsky 1978). Enabling the learner to bridge this gap between the actual and the potential requires the provision of support structures which need not necessarily be in the form of a more capable person (e.g., a teacher, expert) but may also include tools such as WBI. It is not surprising, then, that the concept of A-WBI has become linked with the notion of ZPD.

Third, learner higher-order thinking is strongly influenced by the knowledge they possess on the subject matter. Thus, A-WBI should position itself as a knowledge creator.

Finally, discussion forums remain an important tool in A-WBI. They are the predictor that can determine upfront a prospective learner's performance on the summative assessment. Thus, instructor

intervention can occur early when needed. This will reduce the attrition rate. John Keats once stated that nothing becomes real until it is experienced. Thus, the pursuit of education should be pursued as a means to a practical end, which is translated in different ways by students according to their education, environment and career goals.

SUMMARY

In this paper, an A-WBI that supports three modes of interaction, namely peer-peer, student-instructor and student-content, was introduced capitalizing on the asynchronous mode of communication. A-WBI with its egalitarian environment of open access provides greater opportunities for the learner, particularly the adult learner. Learner-centered educational opportunities through the use of A-WBI could satisfy learner need for convenient offerings and at the same time maximize the use of online learning. This will invariably reduce the physical presence in the classroom environment. A-WBI also implies that there is less dependence on rote learning, repetitive tests and a 'one size fits all' type of instruction and more on experiential discovery, engaged learning, differentiated teaching, and the building of character through innovative and effective teaching approaches and strategies (http://www.moe.gov.sg/about/yearbooks/2005/teach.html). In doing so, the elements of content, interactivity, collaboration, and assessment become the pillars to realize the concept of A-WBI. It must also be noted that in formal lifelong learning courses, design and assessment are important factors that must be considered. Invariably the key factor in any teaching-learning situation is effective instruction based on grounded pedagogical theory. In this article on the use of the A-WBI environment for the teaching and learning in formal lifelong learning, this would be possible as indicated by learner evaluation. However, the model needs to be further refined and defined so that A-WBI becomes the primary source for learning, and subsequently classroom learning can be considered an alternative for both male and female adult learners. This can be achieved if recommendations given in this paper are incorporated in A-WBI. This will be our focus for future research work.

REFERENCES

Bekele, T. A. (2010). Motivation and satisfaction in internet-supported learning environments: A review. *Educational Technology & Society, 13(2), 116–127.*

Blanchette, J. (2001). Questions in the online learning environment. Journal of Distance Education, 16(2).

Burns, R. B. (1997). Introduction to research methods (3rd ed.). Melbourne: Addison Wesley Longman.

Dewiyanti, S., Brand-Gruwel, S., Jochems, W. and Broers, N.J. (2007). Students' experience with collaborative learning in asynchronous computers Supported collaborative learning environments. *Computers in Human Behaviour, 23, 496-514.*

Daft, R. L. and Lengel, R. H. (1986). Organizational information requirements, media richness and structural design. *Management Science, 32 (5), 554-571.*

Falloon, G. (2011). Making the connection: Moore's theory of transactional distance and its relevance to the use of a virtual classroom in postgraduate online teacher education. *Journal of Research on Technology in Education, 43(3), 187.*

Garrison, D.R., Anderson, T. and Archer, W. (2001a). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2(2-3), 87-105.*

Garrison, D.R., Anderson, T. and Archer, W. (2001b). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education, 15(1), 7-23.*

Gilbert, C. (1996). Teaching and learning on the web at Queensland University of Technology. Proceeding of the Second Australian World Wide Web Conference (AusWeb96).

Harasim, L. (1990). Online education: An environment for collaboration and intellectual amplification. In L. Harasim (Eds.), Online education: Perspectives on a new environment, (pp. 39-66). New York: Praeger Publishers.

Hiltz, S. (1990). Evaluating the virtual classroom. In L. Harasim (Eds.), Online education: Perspectives on a new environment, (pp. 133–169). New York: Praeger.

Hiltz, S.R. and Wellman, B. (1997). Asynchronous learning networks as a virtual classroom. Commun. ACM, 40(9), 44-49.

Jochems, W., Merrienboer,V., Jeroen & Koper, R. (Ed). (1991). Integrated e-Learning: Implications for pedagogy, technology and organization. London, UK: Routledge Falmer.

Johnston, J., Killion, J. and Oomen, J. (2005). Student satisfaction in the virtual classroom. *The Internet Journal of Allied Health Sciences and Practice, 3(2), 1-7.* Retrieved 18 August, 2009, from http://ijahsp.nova.edu/articles/vol3num2/johnston.pdf.

Jung, I., Seonghee, C., Lim, C. and Leem, J. (2002). Effect of different type of interaction on learning achievement, satisfaction and participation in web based instruction. *Innovation in Education and Teaching International, 39(2), 153-162.*

Kincannon, J. M. (2000). From classroom to the web: A study of faculty change. PhD dissertation. Florida State University,

Mansor, Fadzil and Latifah, Abdol Latif. (2010). Enhancing teaching and learning : Development of a new e-learning model at Open University Malaysia. In: 6th Pan-Commonwealth Forum on Open Learning. Kochi: COL.

McGill, T.J., Volet, S.E. & Hobbs, V.J. (1997). Studying computer programming externally: Who succeeds? *Distance Education 18(2), 236-256*

Miliszewska, I. (2007). Is it fully 'On' or partly 'Off'? The case of fully-online provision of transnational education. *Journal of Information Technology Education, 6(2007), 499- 514*

Ocker, R.J. and Yaverbaum, G.J. (1999). Asynchronous computer-mediated communication versus face-to-face collaboration: Results on student learning, quality and satisfaction. *Group Decision and Negotiation, 8(5), 427-440.*

Pena-Shaff, J., Martin, W. and Gay, G. (2001). An epistemological framework for analyzing student interactions in computer-mediated communication environments. *Journal of Interactive Learning Research, 12, 41–68.*

Pena-Shaff, J. and Nicholls, C. (2004). Analyzing student interactions and meaning construction in Computer Bulletin Board (BBS) discussions. *Computers and Education, 42, 243–265*.

Sitzmann, T., Kraiger, K., Stewart, D. and Robert Wisher. (2006).The Comparative Effectiveness of Web-Based And Classroom Instruction: A Meta-Analysis. Personnel Psychology, Vol. 59, No.3, pp. 623-664

Stockley, D. (2012). E-learning definition and explanation. Retrieved Nov 15, 2012 from http://www.derekstockley.com.au/elearning-definition.html