Situation Analysis of Engineering Institutions for Interactive & Collaborative Web-based e-Learning: Case of Bangladesh

Md. Abu Raihan, Seung Lock Han

Abstract- Aims of the study were to investigate physical facilities of technical and vocational education and training (TVET) classrooms, to assess infrastructural conditions of TVET institutions, to find out existing instructional problems of TVET institutions, and to identify the needs & weakness of TVET students to introduce interactive & collaborative Web-based e-Learning. A great deal of efforts have been made by the researchers to analysis the current situations of TVET in terms of classroom facilities & infrastructural conditions. 210 classrooms from 45 TVET institutions were observed to collect data carried out by the study. 477 students, 187 teachers, & 86 Lab attendants of TVET have given their opinions. Based on findings & results of analysis the needs, weakness & exixting problems of instructions, the study suggests interactive & collaborative methodology. Value of the findings will have to consider to integrate Web-technologies in teaching-learning in future proposed by the study.

Index Terms - Physical facilities & Infrastructural Conditions, Interactive & Collaborative Web-based e-Learning.

I. INTRODUCTION

There has been a significant movement toward Web-based e-Learning in technical and vocational education and training (TVET) in the recent era. The statistics show that 81% of higher education institutions in USA offer at least one online or blended learning course, indicating that e-Learning has been adopted as one of major instructional delivery methods (Allen & Seaman, 2003). However, the interactive and collaborative Web-based e-Learning environment is a new beginning for TVET in Bangladesh. Till now, there have no structured or substantial Web-based e-Learning system in TVET in Bangladesh.

University courses have been restructured by adding Web-based e-Learning components in order to solve problems, related to overworked faculty, over-capacity of classrooms, and lack of interactions in conventional lecture-based courses (Tiangha, 2003).

In the same manner the TVET sectors may reduce the training budgets and staff by converting instructor-led, classroom-based technical training programs to Web-based e-Learning formats. The blended learning concepts also may integrate which is a kind of mix form of face-to-face and online learning. TVET training programs can convey in both Web-based e-Learning and traditional methods.

Revised Manuscript Received on February 06, 2013.

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A more important issue is that Web-based e-Learning has not led to pedagogical changes (Zemsky & Massy, 2004). Most instructors tend to teach online courses in ways that they teach traditional lecture-based courses. Students have difficulty with self-managing their online learning processes. A large percentage of e-Learning courses have been developed to deliver simple factual knowledge through tutorial-based instruction as seen from a wide use of PowerPoint-type lectures with heavy text information and linear navigations. Furthermore, current e-Learning models, based on traditional transmissionist design approaches, have limitations promoting higher-order knowledge and skills required in the 21th century knowledge society (Bereiter & Scardamalia, 2006).

Despite the increasing number of Web-based e-Learning courses, however, there have been several concerns and criticisms related to teaching and learning in e-Learning environments. The previous studies have suggested that students are often dissatisfied and frustrated with their overall learning experiences in Web-based e-Learning courses (Carr-Chellman, Dyer, & Breman, 2000; Hara & Kling, 2000). Thus the environment of Web-based e-Learning should be designed according to the physical facilities of the classrooms and the infrastructural conditions of the institutions.

Objectives of the study: The aim of the study was to integrate an interactive and collaborative Web-based e-Learning environment in TVET to enhance learning. The specific objectives of the study were (i) to investigate the physical facilities of TVET classrooms, (ii) to assess the infrastructural conditions of TVET institutions for Web-based Instruction (WBI), (iii) to identify the needs and weakness of the TVET students to introduce interactive and collaborative Web-based e-Learning in TVET institutions, and (iv) to find out the existing instructional problems of TVET institutions.

Statement of problem: The physical facilities and infrastructural conditions are the significant predictor of good Web-based e-Learning practices. The purpose of this study was to investigate the institutional facilities in terms of needs and weakness of TVET students to introduce Web-based e-Learning environment. Research has proved that teachers with positive attitude towards teaching-learning environment are able to teach effectively. They manage the process of teaching and learning competently. In order to explore practices of teaching-learning in TVET, this study has found out the existing instructional problems of TVET institutions.

Research Questions: To guide the study, the following research questions were posed: (i) To what extent do the physical facilities of TVET classrooms relate to the implementation of Web-based e-Learning environment? (ii)

What are the infrastructural conditions of TVET institutions for Web-based Instruction (WBI)? (iii) What are the needs and weakness of the TVET students if adaptive Web-based e-Learning introduce in TVET institutions?, (iv) What are the existing instructional problems of TVET institutions?

Statement of hypothesis: Teacher is an essential component of any education process. The physical facilities of the classrooms and the infrastructural conditions of the institutions affect not only the performance of teachers teaching but also their students learning performances. On the basis of this it is hypothesized there have a significant relation between the physical facilities & infrastructural conditions and their teaching-learning practice.

Delimitation of the study: In view of time constrain and resources at the disposal of the researcher the study was delimited to government TVET institution in Bangladesh. 45 TVET institutions were investigated to get the data for this study. The researcher has visited 210 TVET classrooms from 45 institutions to get the results for the study.

II. LITERATURE REVIEW

Even though interaction and collaboration are common terms often used in e-Learning contexts, a lack of functional definitions has been a serious problem in forming basic and shared ideas among researchers and practitioners.

Wagner (1994) argued that functional definitions of interaction should be formulated to provide a basis for empirical measurement of interaction. She suggested that conceptual frameworks on interaction are related to (i) learning theory, (ii) instructional theory, (iii) instructional design theory, and (iv) instructional delivery theory. While learning theory describes the role of interaction in the human learning process, instructional theory provides prescriptions as to how to facilitate interaction in specific situations. Instructional design theory, on the other hand, emphasizes a systemic process of analyzing and designing various levels and types of interaction to achieve specific learning outcomes. Instructional delivery theory, such as the Shannon-Weaver Communication Model (1949, as cited in Wagner, 1994), provides an important understanding of communication process among learner, instructor, content, and environment.

Moore's (1989) three types of interaction, probably the most frequently cited framework, focuses on learning events and proposes the following: (i) learner and content interaction, (ii) learner and instructor interaction, and (iii) learner and learner interaction. The interactions between learner and content and between learner and instructor are interactions involving human actors that have been important characteristics in defining learning and teaching processes. The interaction between learner and other learners has been discussed as an effective but challenging instructional strategy. Advances in communication technologies have made online collaborative learning possible (Harasim, 1990).

The social-constructivist view of learning argues that people construct their knowledge through negotiating meanings with others. According to Vygotsky (1978), a person's cognitive development is highly dependent on their relationship with others. The zone of proximal development (ZPD) – "the distance between actual or independent problem solving and performance when provided with learning assistance from adults or more capable peers" (Bonk & Cunningham, 1998, p.36)-implies that people construct their knowledge through social interaction and collaboration with others. As example, students with law ability levels may be able to reach their ZPD with a help of advanced and high-achieving peers or through guidance from their teachers.

Collaborative learning environments provide opportunities for students to experience multiple perspectives for students to experience multiple perspectives from others who have different backgrounds. Students can develop critical thinking skills through the process of judging, valuing, supporting, or opposing different viewpoints (Fung, 2004). Another advantage is that individual students can develop social and interpersonal skills, which are critical to be successful in modern society. In terms of affective advantages, collaborative learning approaches can provide students with an affective support and sense of belonging, promoting student participation and community-building (Stacey, 1999).

The previous literature suggesting that learning outcomes in collaborative Web-based e-Learning could be equal or superior to those in traditional face-to-face courses (Harasim, 1990). In general, the following factors could affect student dissatisfaction and frustration in Web-based e-Learning courses: (i) unclear expectations from instructors, (ii) tight timeline, (iii) workload, (iv) poor software interface, (v) slow access, and (vi) no synchronous communication (Gaddis, Napierkowsk, Guzman, & Muth, 2000; Kitchen & McDougall, 1998).

III. METHODOLOGY

Population: The population of this study consists of all the teachers, students and the lab attendants of government TVET institutions in Bangladesh.

Sample: A sample of 187 teachers, 477 students, 86 Lab attendants were randomly sampled from the population. Thus, the total sample size was 750. The sample was selected from the rural and urban TVET institutions in Bangladesh.

Instrument: For data collection a close ended questionnaire was developed and administered to the selected sample. All the 187 teachers, 477 students, and 86 Lab attendants returned the distributed questionnaire. Thus the rate of return was 100%. As a part of research ethics, the samples were asked through consent letters to participate in the research study.

Reliability and validity of instrument: Besides, to ensure validity and reliability of the content, the questionnaire was piloted in Department of education in Kongju National University in South Korea. After piloting the questionnaire, it was refined and revised. Finally 750 questionnaires were sent to each sample schools for data collection.

Data analysis: The data was collected, and interpreted in simple percentages. Furthermore, the results were also shown in graphic tables for more explanations. This helped in clear presentations of the data. Five point Likert Scale 5(Strongly Agree)= SA, 4(Agree) =A, 3(Undecided)=U, 2(Disagree)=D, and 1(Strongly Disagree)=SD was used as criterion to know the degree of agreeability and disagreeability of the respondents to the statements given in the questionnaire.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

This study mostly has quantitative data. The data were tabulated in the form of percentage (%) and weighted averages (WA or W). It was calculated for each item following the Likert-Scale. The Weighted Average has computed for each item of the questionnaire using the following formula (Gay & Airasian, 2003).

$$W = \frac{N_1 + 2N_2 + 3N_3 + 4N_4 + 5N_5}{N_1 + N_2 + N_3 + N_4 + N_5}$$

Where, WA ≥ 4.5 is Strongly Agree (SA); 4.5 >WA ≥ 3 is Agree (A); 3.5 >WA ≥ 2.5 is Undecided (U); 2.5 > WA ≥1 is Disagree (D); and 1.5 > WA is Strongly Disagree (SD). This study has considered, strongly agree & agree is same category; undecided is different category; disagree & strongly disagree is also same category.

IV. FINDINGS

Results in table-1 shows that in Bangladesh, Internet facilities in TVET classrooms are average type. However the Intranet facilities are very poor. On the other hand, the facilities of Multimedia, PDF files and PPT uses and update software installation are excellent in TVET. The computer set-up in the classrooms is also good but e-Learning (Web-based) is poor in the classrooms.

Results in table-2 shows that the observed TVET institutions have the excellent infrastructural conditions in terms of their buildings, lands, properties, and the availability of computer operating software. The economic conditions were good. The internet connectivity, the number of teachers' and the conditions of electricity in TVET institutions were average-type. The physical facilities of TVET Classrooms and the infrastructural conditions of TVET institutions are shows below:

Table.1 Physical facilities of TVET Institutions (Classrooms)
(No of observed institutions, N=45 and Classrooms=210) in 2012

Physical facilities in	Observation List	EX (5)	GD (4)	AV (3)	PR (2)	VP (1)	WA
Classrooms	Internet facilities	3 7%	14 31%	27 60%	1 2%	-	3.38 (Avg)
	Intranet facilities	-	-	-	-	45 100%	1.00 (v.poor)
	Multimedia	26 58%	16 35%	3 7%	-	-	4.51 (Excl)
	PDF files and PPT uses	41 91%	4 9%	-	-	-	4.91 (Excl)
	Computer set-up	18 40%	6 13%	14 32%	1 2%	6 13%	3.64 (good)
	e-Learning (Web-based)	-	-	-	30 67%	15 33%	1.67 (poor)
	Update Software installation	41 91%	4 9%	-	-	-	4.91 (Excl)

Table 2. Infrastructural conditions of TVET institutions
(No of observed TVET institutions, N= 30) in 2012

Conditions	Observation List	EX (5)	GD (4)	AV (3)	PR (2)	VP (1)	WA
Infrastructural	Buildings, lands and properties	25 83.33%	5 16.67%	-	-	-	4.83 (Excl)
	Human resources (number of teachers)	-	5 16.67%	25 83.33%	-	-	3.16 (avg)
	Economy (funding)	-	30 100%	-	-	-	4.00 (good)
	Internet connectivity	-	-	30 100%	-	-	3.00 (avg)
	Electricity	-	-	25 83.33%	5 16.67%	-	2.83 (avg)
	Availability of Computer operating software	25 83.33%	5 16.67%	-	-	-	4.83 (Excl)

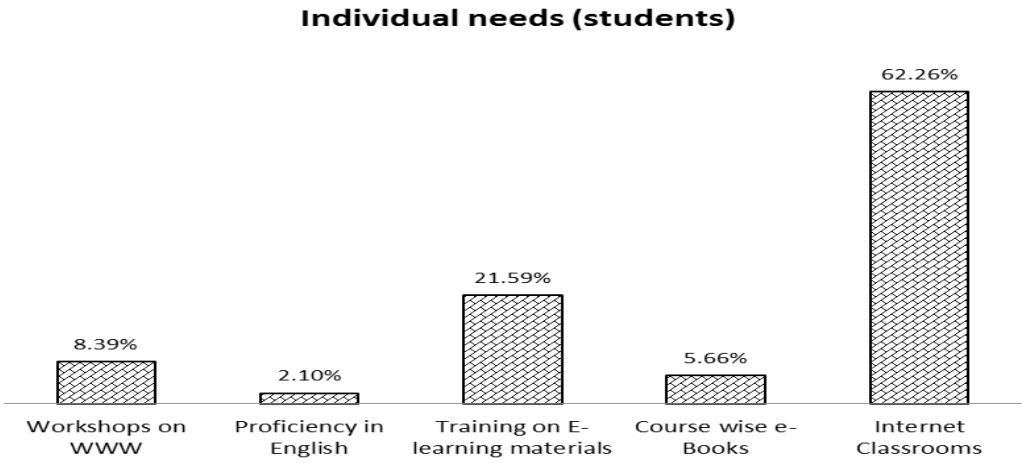

Figure.1 Students' needs for WBLE

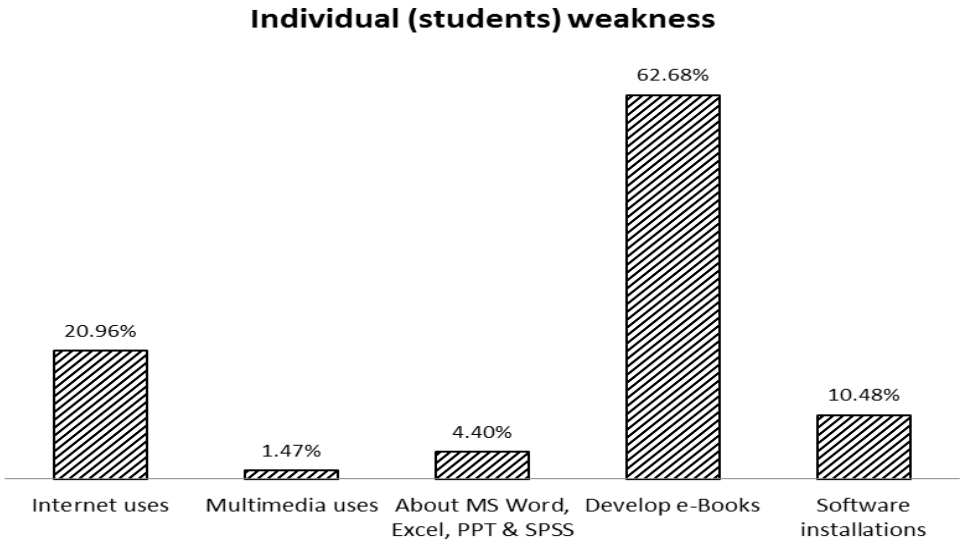

Figure 2. Students' weakness on WBLE

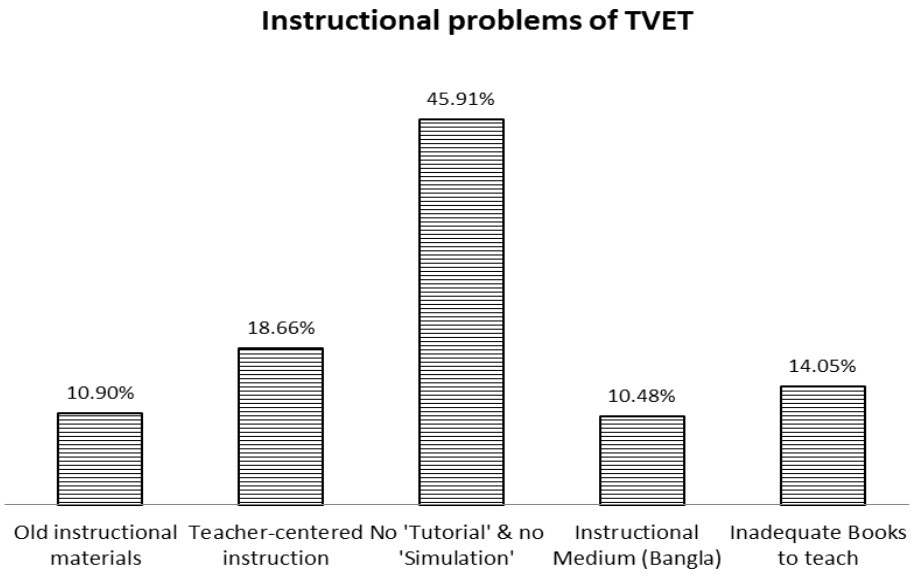

Figure 3. Instructional problems of TVET, Bangladesh

In figure-1, the number of total respondent (student) was n = 477. Among them 62.26% (n = 297) demands 'Internet Classrooms', 21.59% (n = 103) have given opinion on 'Training on e-Learning materials', 8.39% (n = 40) needs Workshops on WWW, 5.66% (n = 27) needs 'Course-wise e-Books' and 2.10% (n = 10) needs 'Proficiency in English'. The overall results of need analysis shows that that Internet Classrooms and the appropriate training on e-Learning materials are required in TVET for Web-based e-Learning. **In figure-2,** TVET students' have most weakness on 'develop e-Books' (62.68%, n = 299), and less weakness on the uses of multimedia (1.47%, n = 7), 20.96% (n = 100) students have the weakness on 'Internet uses' and 4.40% (n = 21) have the weaknesses about 'MS Word, Excel, PPT & SPSS' and 10.48% (n = 50) have the weakness on 'Software installations'. The overall results suggests to provide students in training to develop e-Book for Web-based e-Learning. **In figure-3,** the number of total respondent, N= 477+187+86 = 750. The research showed that the students', teachers' and Lab attendents' have the problems in teaching-learning because of absent of 'tutorials and simulation' softwate (45.91%, n = 344). Some other problems of existing instructional systems are 'Teacher-centered instruction' (18.66%, n = 140); 'Inadequate Books to teach' (14.05%, n = 105); 'Old instructional materials' (10.90%, n = 82); and 'Instructional Medium (Bangla)' (10.48%, n = 79).

V. CONCLUSIONS AND DISCUSSION

The development and implementation of Web-based e-Learning is a complex process which requires great investments of cost and time. It has been frequently reported that planning e-Learning takes more time than the amount of traditional face-to-face instruction would take (Johnson, 2002). Nevertheless, poor planning and implementation in several Web-based e-Learning initiatives resulted in wasting more time and money than those that organizations expected (Troha, 2002).

However, one of the prominent trends in TVET and corporate training is the convergence of distance and traditional education. Bleed (2001) suggested that the future model of higher education is a hybrid campus with "half bricks and half clicks" (p.18). In TVET settings, many people also expect that Web-based e-Learning can be a pragmatic and cost-effective approach that meets the needs of fast-changing business environments. While accessibility, flexibility, and efficiency are the most frequently mentioned advantages of Web-based e-Learning more and more people are realizing that simply turning classroom courses into online learning formats do not necessarily provide students with more accessible and flexible learning experiences.

Student perceptions of collaborative learning can be positively influenced by group members' accountability. Individual accountability includes two aspects: (i) learners' responsibility for their own learning, and (ii) learners' responsibility for their helping group members' learning (Abrami, 2001). Scardamalia (2002) contended that the culture of knowledge building should be fostered in learning environments for collaborative and intentional learning. She suggested that the following characteristics are essential in socio-cognitive and technological knowledge building environment: (i) knowledge building discourse, (ii) symmetric knowledge advancement, (iii) constructive uses of authoritative sources, (iv) real ideas, authentic problems, (v) improvable ideas, (vi) idea diversity, (vii) rise above, (viii) students as epistemic agency, (ix) community knowledge, collaborative responsibility, (x) pervasive knowledge building, (xi) democratizing knowledge, and (xii) embedded and transformative assessment. These principles of knowledge building can be implemented in Web-based e-Learning environments to support collaborative learning.

ACKNOWLEDGEMENTS

A great many people contributed, directly and indirectly, to this research. The authors would like to take this opportunity to thank them all, particularly those most immediately involved. Particular thanks go to TVET institutions from where the research data have collected. Finally, very special thanks go to the instructors (teachers') of TVET institutions in Bangladesh.

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