

Designing Adaptive Web-based e-Learning Environment for Converging-type Learners' in Engineering Institutions of Bangladesh

Md. Abu Raihan, Seung Lock Han

Abstract- *The trend of using Adaptive Web-based e-Learning (AWBL) as an educational platform is increasing in corporations, universities, and industries. The dream of teaching and learning from anywhere, at anytime becomes reality with the construction of the AWBL environments. Seldom research can be found in the literature to link pedagogy & technology to involve e-Learning subjects to enhance learning. The research aim was to construct a logically design framework of AWBL. The objectives were to identify learning style of engineering students'; to determine learning preferences, experiences & age-levels of learners, and to identify the preferred instructional strategies. 477 students have given the opinions by questionnaires. The findings revealed that TVET learners are converging-type, whose learning preferences were solve problems, theories etc., & experienced on authentic-learning activity and their preferred instructional strategy was problem-solving. This research suggests to address those ingredients in design AWBL environment to increase the value of learning.*

Keywords – *Adaptive Web-based e-Learning, Converging-type learners', Engineering institutions.*

I. INTRODUCTION

In the context of Web-based e-Learning, the adaptation of instruction is affected. Instruction is the form how learner are educated. There exist several possibilities how the instruction is adapted. There have five main theoretical approaches (i) macro-adaptive approach, (ii) aptitude-treatment interaction approach, (iii) TTTI (Task-Trait-Treatment by Interaction) approach, (iv) micro-adaptive approach, and (v) constructivist-collaborative approach (Park & Lee, 2003). The driving force behind the creation of information environments and delivery systems is that a Task needs to be accomplished (Cohen, 1999). At least four distinct theoretical frameworks for studying tasks have been proposed: (i) in stimulus-response terms, (ii) as a set of required behaviors, (iii) as a set of resultant behaviors, and (iv) as a set of abilities requirements (Wood, 2010).

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Thus, this study takes TTTI approach to design the adaptive Web-based e-Learning environment (A-WBLE) which considers the learning tasks. A-WBLE is designed for Engineering students of technical and vocational education and training (TVET) in Bangladesh. Adaptive instruction means creating a learning environment and finding instructional approaches and techniques that conform to meet students' individual needs (Park & Lee, 2003). Adaptive Web-based learning environments are one form of adaptive instruction that tailor individual differences in the online environment (Inan & Grant, 2004, 2005). In A-WBLEs, the fundamental focus is the individual differences of learners, because individual differences such as prior knowledge, instructional strategies and learning styles have demonstrated significant effects on students' learning (Chen & Paul, 2003).

An adaptive e-Learning environment is an interactive system that personalizes and adapts e-Learning content, pedagogical models, and interactions between participants in the environment to meet the individual needs and preferences of users if and when they arise. The adaptation entails presenting different structured e-Learning resources in a variety of ways including, when appropriate, advice on using the materials available.

This research has identified the learning style of TVET students by using the scientific theory of Kolb's. Kolb (1971, 1977) identified four learning styles and a desirable learning experience for each style: (a) *Feeling* or enthusiastic students' may benefit more from concrete experiences, (b) *Watching* or imaginative students' prefer reflective observations, (c) *Thinking* or logical students' are strong in abstract conceptualizations, and (d) *Doing* or practical students' like active-experimentation.

From a constructivist perspective, learning is an active process of knowledge building through social interactions and electronic collaboration. From this point of view, educational technologies (e.g. file folders, e-mail, asynchronous discussion board, real time chat like Skype, Facebook, Web conferencing, data uploading and retrieving the videos like from U-tube, etc.) should support the restructuring of key content knowledge for individual learners as well as the creation of knowledge resources or repositories, and the associated pooling together of that content, across learners of a particular course (Dabbagh & Schmitt, 1998).

Objectives of the study: The aim of the study was to design an adaptive Web-based e-Learning environment for converging-types in light of their traits and treatment (learning strategies) characteristics.

The specific objectives of the study were (i) to identify the learning style of engineering students' (ii) to determine the learning preferences, learning experiences and age-levels of converging-type of learners, and (iii) to identify the preferred instructional strategies of converging-type learners to design adaptive Web-based e-Learning Environment.

Statement of problem: The tasks, traits and treatments identification results are the significant predictor to design an effective adaptive Web-based e-Learning environment. The purpose of this study was to identify the important traits and treatment characteristics of the TVET students for adaptive Web-based e-Learning environment. The research revealed that the adaptive Web-based e-Learning environments are always effective if it could be designed according to the learners' traits. The students learnt best if the students learning styles are matched with the learning environment. Thus, this study has determined the important traits of the engineering students.

Research Questions: To guide the study, the following research questions were posed: (i) what are the learning differences of TVET students? (ii) What are the preferred learning materials, preferred assessment tools, learning preferences, learning experiences and age-levels of converging-type of learners in TVET, and (iii) What are the preferred instructional strategies of converging-type learners of TVET in Bangladesh.

Statement of hypothesis: Learning environment is a vital part and an important ingredient of any educational process. The learning environment affects not only the performance of teachers teaching but also their students learning performances. On the basis of this it is hypothesized that there have the significant relations among the learning-tasks, students-traits, and students preferred-treatments in adaptive Web-based e-Learning process.

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 distribute the research questionnaires and to get the results for the study. 477 TVET students have given the opinion in this study.

II. LITERATURE REVIEW

Adaptive instruction means creating a learning environment and finding instructional approaches and techniques that conform to meet students' individual needs (Park & Lee, 2003). Adaptive Web-based e-Learning environments are one form of adaptive instruction that tailor individual differences in the online environment (Inan & Grant, 2004, 2005).

Many researchers consider learning-style and cognitive style to be important characteristics to take into consideration when developing adaptive Web-based instruction (AWBI) (Gilbert & Han, 1999; Magoulas, Chen, & Dimakopoulos, 2004; Papanikolaou, Grigoriadou, Kornilakis, & Magoulas, 2003). Brickell (1993) suggested the more enriched learning experiences occurred when the materials developed considered students' learning styles. Furthermore, Triantafillou, Pomportsis, & Demetriadis (2003) reported the majority of students were satisfied with the adaptations of learning strategies in relationship to their cognitive styles.

Another trait, students' prior knowledge and experiences, is also popular in designing adaptive systems (Brusilovsky, 2010). Students' prior knowledge contains their previous understanding of the content area and level of readiness for learning new content. Many studies have considered prior knowledge in WBI (Chen & Paul, 2003; Milne, Cook, Shiu, & McFadyen, 1997). Far & Hashimoto (2009) found a student's background and motivational state had strong influence on learning outcomes. Moreover, prior technical knowledge may have an effect as well. Learners have different degrees of familiarity with Web browsers and communication tools, which can affect their learning in an online setting (Magoulas, Papanikolaou, & Grigoriadou, 2003; Muir, 2010).

Unquestionably, designing an adaptive instruction requires an established model or process; the development, management and maintenance adaptive Web-instruction required for revising and to supplementing necessary steps; the central change in the framework is moving its focus from developing and providing a high quality instruction that 'fits all learners' to one that 'fits each learner' (Inan & Grant, 2008).

This study does not make any judgments regarding the relative suitability of these different approaches to defining a task for TVET. Indeed, researcher believes consistent task complexity definitions can be established using any of the task conceptions, so long as they are not mixed. This study adopts a definition of task that has been widely used in the past (Hackman, 1969): a task is a set of assigned (a) goals to be achieved, (b) instructions to be performed, or (c) a mix of the two. The learning style, experiences, preferences are widely chosen as the trait variables. It is complex to define learning styles as different authors views "the way in which learners perceive, process, store and recall attempts of learning" (James & Gardner, 1995); "distinctive behaviors which serve as indicators of how a person learns from and adapts to his/her environment, and provide clues as to how a person's mind operates" (Gregorc, 1979).

Some researchers argue that applications of more advanced communication technologies hold promise for enhancing education (Bates, 1995; Bonk & King, 1998). Chickering and Ehrmann (1996) were arguing that educational technologies could advance learning by providing tools and resources for increased faculty-student contact as well as opportunities for spontaneous collaborative learning and apprenticeship activities with or without face-to-face instruction. In addition, they noted that such technologies increase time on learning tasks by reducing inefficiencies, expectations, and encouraging multiple presentation modes to accommodate diversified talents, preferences and needs.

III. METHODOLOGY

Population: The adaptive Web-based e-Learning environment or e-Learning model is the student model. Thus, the population of this study was all the students from the government TVET institutions (like Polytechnic institutions, Technical Training Center, Technical School and College, Technical Teachers Training College, TVE department of IUT) in Bangladesh.

Sample: A sample of 477 final-years TVET students were randomly sampled from the population. The sample was selected from the rural and urban TVET institutions in Bangladesh.

Instrument: For data collection the questionnaire with close-ended and open-ended questions were developed and administered to the selected sample. All the 477 students 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 477 questionnaires were sent to each sample schools for data collection in Bangladesh.

Data analysis: The data was collected, and interpreted in simple percentages by using the *task-traits-treatment by interaction* (TTTI) approach (in figure. 1). Finally, the results were explicitly shown by using bar-graphs. The tasks of TVET are fixed. The required *traits* and *treatment* characteristics of TVET students were identified by conforming tasks of TVET. To match the traits and treatment with TVET tasks in terms of students' preference and prior knowledge were the main purpose. In this fashion the adaptive Web-based e-Learning environment designed data were identified and analyzed.

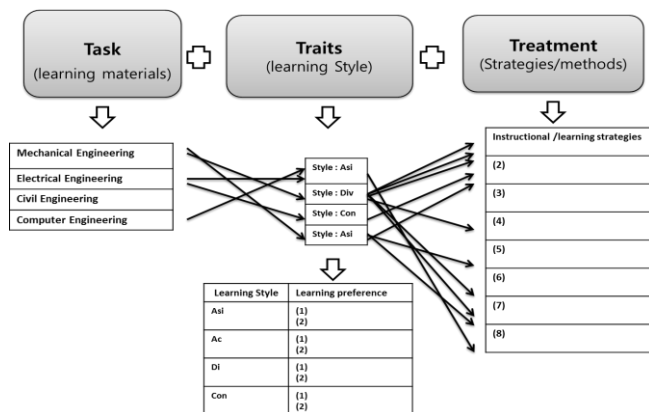


Figure 1. TTTI-approach

IV. RESULTS & DISCUSSIONS

Adaptivity results (relation with TTTI) of the students'

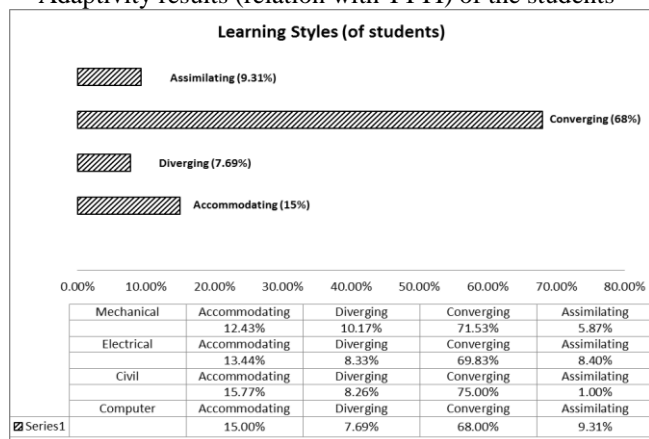


Figure 2. Learning-style of TVET students'

The figure 2 shows the learning style of TVET students. It is revealed that the TVET students are mostly converging-type (68%) of learner.

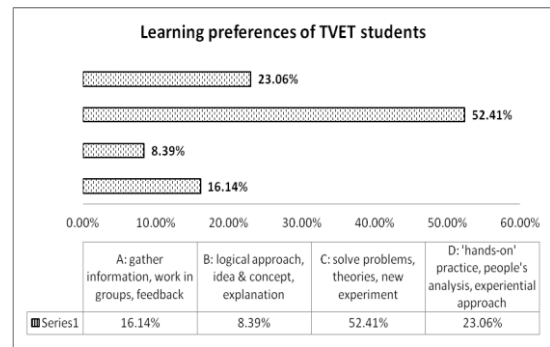


Figure 3. Learning preferences of Converging-type learners'

The figure 3 shows that most of the Converging-types learners (52.41%) learning preferences are solve problems, theories, new experiment.

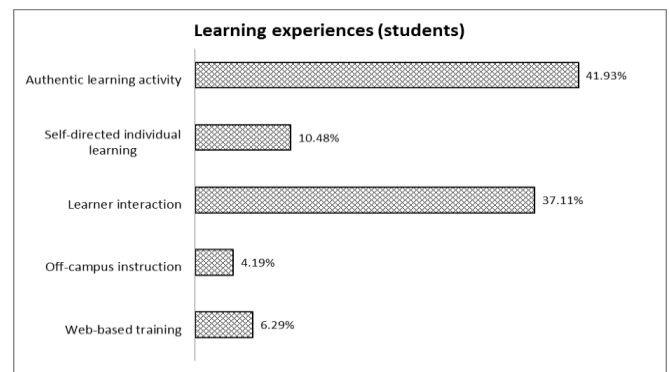


Figure 4. Learning experiences of Converging-type learners'

The figure 4 shows that most of the Converging-types learners (41.93%) have the learning experiences on Authentic learning activity.

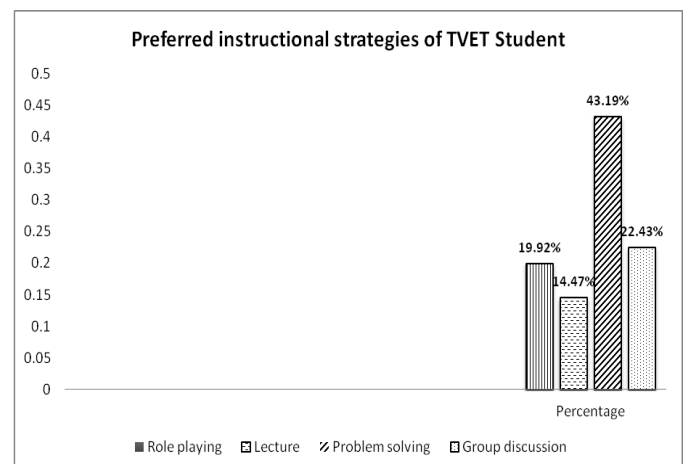


Figure 5. Preferred instructional strategies of Converging-type learners'

The figure 5 shows that most of the Converging-type learners (43.19%) preferred instructional strategies are problem solving.

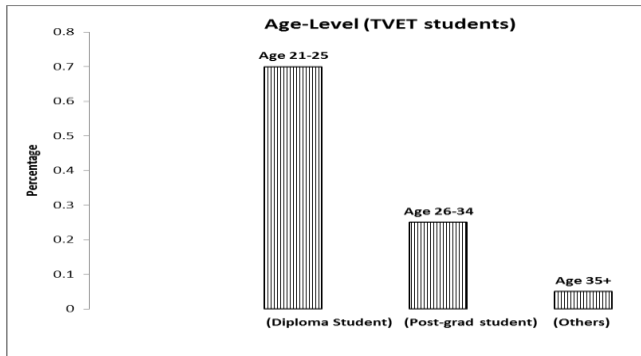


Figure 6. Age-Level of Converging-type learners'

The figure 6 The learning style of 'converging' belongs to 336 students out of 477 students. Among them 235 students age-level is 21-25 which is almost 70% of the total group.

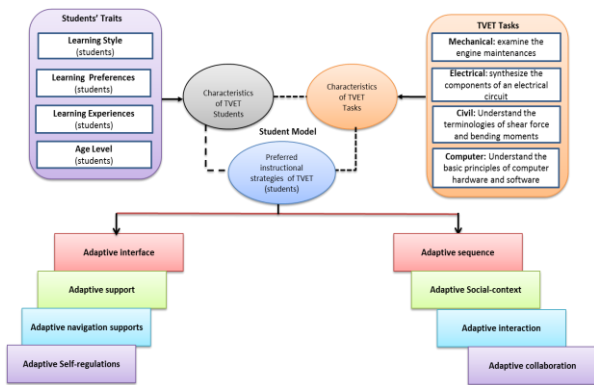


Figure 7. Architecture of adaptive Web-based e-Learning Environment for TVET

The Architecture of adaptive Web-based e-Learning environment has been constructed where task-traits-treatment interaction (TTTTI) focused on as it is one of the best 'instruction-develop approach'. The adaptation i.e., the adjustment of TVET learners have taken place with well-combinations of (i) the task characteristics of TVET, (ii) traits of TVET students, and (iii) learning strategies of TVET. The adaptive methodologies have taken by considering adaptation variables of TVET, Bangladesh. This architecture merely for TVET arena: the context of Bangladesh. In general, TVET in Bangladesh has three goals in teaching-learning: (i) to provide the technical skill rather than knowledge, (ii) to train up students' with competency-based technical know-how by hand-on practice, and (iii) to develop capability with new information on science, engineering and technology. The architecture in figure 7 has made to attain the above mentioned goals of TVET in Bangladesh.

V. CONCLUSIONS AND RECOMMENDATIONS

A comprehensive analysis of the research findings indicates several trends and perceptions of technology use that provide important implications for future Web-based technology development. First, this research found that students had positive attitudes toward technology use in this program. Some interview findings suggested that there was a heightened level of technology acceptance among online learners. It is the positive indications for adpative Web-based technology adoption in future in TVET. It seemed that the increasingly proactive attitude toward technology was

associated with the perceived ease of use of the course in TVET system.

Web-based e-Learning is basically a mode for delivering the needed knowledge and skills to trainees, which belongs to the overall training attempts of institutions. As TVET programs are the combination of training and theories as training, it must be based extensively on a thorough training needs analysis, comprehensive design and development, effective implementation, and narrow evaluation. Usually, institutions tend to invest heavily in e-Learning technology, ignoring the importance of the learning aspect. This research suggests those aspects like students learning needs, learning preferences, prior experiences, preferred instructional strategies etc. to integrate in Web-based e-Learning environment to enhance learning.

The ubiquitous nature of the Internet and computing and communications technologies allow training and learning to be delivered in new formats. Technology and the changing workplace provide opportunities to both individuals and their employers to approach learning and skill based development in different way. Adaptive Web-based e-Learning technologies often mean that it is no longer necessary for individual employees to gather together at the same time and in the same space for training and professional development programs. Training and learning can now be provided online on an "as needed" basis to individual staff members at times that best suit them (and their work commitments). Adaptive Web-based e-Learning can also be timed to suit the workplace skill requirements.

There are many reasons for not becoming involved with Adaptive Web-based e-Learning education, and those may come up in the course of this perspective; however, this research would first like to show the positive effects that have noticed from Web-based e-Learning. The researchers believe most important, is that students must take the responsibility for their own learning. In all the initial materials, syllabus, exams, welcome message to the class, and first weekly message, the research stress that individual initiative is the most important quality or asset that a student may bring through Web-based e-Learning environment.

The previous literatures showed that students with a Converging-type learning style can solve problems and will use their learning to find solutions to practical issues. They prefer technical tasks, and are less concerned with people and interpersonal aspects. The converging learners are best at finding practical uses for ideas and theories and solve problems and make decisions by finding solutions to questions and problems. Also, Converging-type learners are more attracted to technical tasks and problems than social or interpersonal issues to experiment with new ideas, to simulate, and to work with practical applications. To accomplish all those activities successfully required big thinking, dialogic communications and conversations all around. In accordance to Vygotsky's (1997) dialogic communication, thinking is formulated in the process of two interconnected communications. The first process is inner communication with oneself, i.e. self-debate. When ideas involved in this internal communication are externalized, represented, and exchanged in a group of individuals with public discussion. Adaptive Web-based e-Learning environment provides the atmosphere of learning conversation for dialogic thinking.



In Dewey's (1933) terms, this can be considered to be reflective thought learned from the experience in joint actions. In Resnick (1993) and Rogoff (1998) state that most knowledge derives from an interpretation of experience that is based on schemas, which is actively shaped; changed or transformed; and influenced by the learning conversations among members in a community.

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