Relationship among Online learning, Multimedia Instruction and Individualized Learning

Relación entre aprendizaje en línea, instrucción multimedia y aprendizaje individualizado

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ABSTRACT

The quest for effective teaching-learning strategies and instructional approach in engineering communication skills has been a challenge to educators throughout the world. Students must be in the centre of learning in any effective approach to cater for each individual to achieve the predetermined objectives. This study aimed at designing, developing and implementing a new online individualized multimedia instruction framework for engineering communication skills. The questionnaire has three sections to assess individualized instruction, multimedia instruction and online learning. Overall reliability using the Alpha Cronbach test and the Rasch Model analysis together with expert reviews for the content validation of the questionnaire, suggested that the questionnaire is reliable and valid to measure the OIMI model. Data collected from 166 engineering learners were tested with confirmatory factor analysis using AMOS to obtain three best-fit measurement models from the three latent variables. Subsequently, the structural equation modeling was applied to test the hypotheses. The results showed a strong relationship between Online Learning and Multimedia Instruction, and a negative relationship between Individualized Instruction and Multimedia Instruction.

Keywords: OIMI, Individual Instruction, Online Learning, Multimedia Instruction.

RESUMEN

La búsqueda de estrategias de aprendizaje de enseñanza efectivas y un enfoque de instrucción en habilidades de comunicación de ingeniería ha sido un desafío para los educadores de todo el mundo. Los estudiantes deben estar en el centro de aprendizaje en cualquier enfoque efectivo para atender a cada individuo para lograr los objetivos predeterminados. Este estudio tuvo como objetivo diseñar, desarrollar e implementar un nuevo marco de instrucción multimedia individualizado en línea para las habilidades de comunicación de ingeniería. El cuestionario tiene tres secciones para evaluar la instrucción individualizada, la instrucción multimedia y el aprendizaje en línea. La confiabilidad general usando la prueba de Alpha Cronbach y el análisis del Modelo Rasch junto con revisiones de expertos para la validación del contenido del cuestionario, sugirió que el cuestionario es confiable y válido para medir el modelo OIMI. Los datos recopilados de 166 estudiantes de ingeniería se probaron con análisis factorial confirmatorio utilizando AMOS para obtener tres modelos de medición de mejor ajuste de las tres variables latentes. Posteriormente, se aplicó el modelo de ecuaciones estructurales para probar las hipótesis. Los resultados mostraron una fuerte relación entre el aprendizaje en línea y la instrucción multimedia, y una relación negativa entre la instrucción individualizada y la instrucción multimedia.

Palabras clave: OIMI, Instrucción individual, Aprendizaje en línea, Instrucción multimedia.

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1. INTRODUCTION

The location of study is Al al-Bayt University in Jordan. It offers a bachelor degree in architecture, civil, and surveying engineering. The current practice of engineering communication skills can be classified as instructors led instructions. Classes proceed with application tasks, case studies, or discussion of communication practices. Students and staff alike often complete these classes wondering if they are just pretending to communicate. In reality, engineering education traditionally rely on technical skills, more than communication skills (Corrello 2012). Engineering instructors teach engineering communication skills with deficient or inappropriate teaching and lack of opportunity for engineering students to practice communication skills. Methods of teaching engineering communication skills are considered as insufficient (Mehra & Virgandham, 2013; Veerasamy 2010).

Engineering students are learning the technical skills they need in the classroom, but they need more communication skills training (Nasir et al., 2018; Nicometo et al., 2012). Thus, insufficient and unsuccessful online engagement reflect defectively on the individual and the profession (Baharudin et al., 2018). The insufficient level of engineer communication skills are due to engineering communication skills instruction (Riemer 2007). Rayan and Shetty (2008) emphasized that the training should focuses on particular area, and training should be individualized. Nordan (2013) in his study drawled attention to the need for technical communication skills in order to allow engineering graduates to adjust to their employer's demand and achieve their future career goals. A gap between learning and practicing engineering communication skills demand in engineering education do exist. Understanding the main reasons for this gap, universities should adopt an integrated approach to enhance engineering communication skills. The quest for effective teaching and learning strategies, and instructional approach in engineering education in general has been one of the challenges that continue to be of interest to educators around the world (Al Mashakbh et. al. 2013; Ahmad et al. 2016; Zainal et al. 2018).

Online multimedia instruction has the ability to increase learner motivation by providing both greater learner autonomy and increasing options for support (Azizul & Din 2016; Gabarre et al. 2016). Its benefits may vary from simple e-mail lists, through multifunctional virtual learning environment, to totally adaptive learning environment (Khalid et al., 2016; Moore et al. 2011). Despite the large volume of research published at this time on online learning, neither had tried to develop a model to individualize learning connecting OL, II, and MI models together specifically in engineering communication skills. Therefore, this study investigates the relationships among the variables within a multivariate model of individualized instruction, online learning, and multimedia instruction for engineering communication skills. The following hypotheses was developed to test:

H1: Multimedia instruction influences towards individualized instruction

H2: Multimedia instruction Influences online learning

2. METHODOLOGY

This study adopts mainly a quantitative research approach. The target population was from Al-Bayt University undergraduate engineering learners' participation in three engineering communication skills courses (engineering communication skills course, the provisions of the building and skills practice of the profession course, and technical skills course). The sample was 166 engineering learners in the first semester of an academic year and were selected purposively with the acceptable of the sample size (Loehlin, 1992; Hoyle, 1995).

The need analysis study was conducted as an early sub study involving a small-scale quantitative research using the open-ended questionnaire. A task analysis for blackboard interfaces and media was conducted to ensure whether the modules used fit learner needs and to make sure, the suitability of individual learner pace. The respondents rated the subtopics in terms of the consequences of incompetence in certain areas. Four scales were provided starting with "not significant" (0 marks), "significant" (1 mark), "serious" (2 marks) and "disastrous" (3 marks). The average rating for twenty-seven of the subtopics were "significant" while three subtopic, Intercultural interdependence communication, Minimizing bad listening habits and Building positive workplace relations received an average rating of "serious". Additionally, the respondents were asked to rate the importance of each subtopic. Four scales were provided starting with "not relevant" (0 marks), "not important" (1 mark), "important" (2 marks) and "critical" (3 marks). Twenty-two subtopics received an average rating of "important" while the other five subtopics received an average rating of "critical". As a result, all significant subtopics that received a rating of "significant" and "important" were delivered online while all "critical" subtopics were delivered online with additional activities. This was done despite the fact of whether the subtopics received a rating of significant, disastrous or serious because of incompetence.

Thirty modules were listed. The respondents were asked to rate the subtopics in terms of the Satisfaction level. Four scales were provided starting with "not satisfied" (0 marks), "natural" (1 mark), "satisfied" (2 marks) and "very satisfied" (3 marks). The average rating for twenty-three modules were "very satisfied" while seven modules received an average rating of "satisfied". Additionally, the respondents were asked to rate the importance of each module. Four scales were provided starting with "not relevant" (0 marks), "not important" (1 mark), "important" (2 marks) and "critical" (3 marks). Twenty-six modules received an average rating of "important" while the other four modules received an average rating of "critical".

The course structure and contents, especially the learning matrix, were developed and redeveloped based on experts' agreement on overall comments and suggestions. (ii) Authoring and developing the courses activities, this was done using Blackboard Course Management System corresponding to learners' paces (e.g., lectures, assignments, examples, exercises, self-assessment tests, feedback, discussion forms, course outline, calendar, useful link, and questionnaires); In addition, during this stage numbers of media file were selected and develop based on learners pace. (iii) Designing and developing the individualized engineering communication skills course portal on backboard course management system. This research used two approaches for evaluation; formative and summative evaluation. The formative evaluation throughout the instructional development process was used to ensure that the model achieves its stated goals and objectives. One evaluation method for online educator to consider, as suggested by Willis (1992), is to give students number of assignments, self-assessment test, exercises, and a feedback. Summative evaluation was addressed using a survey study to collect necessary information about confirmation factors, which are assumed to influence the formation of II, MI and OL.

This study proposes a system development framework to develop learning and teaching environments within the online individualized multimedia model for engineering communication skills course. The new developed delivery system consists of multi stages corresponding to student, instructor and administration. This research used two main instruments to develop the I-OIMI model for engineering communication skills and to answer the research questions. The OIMI model for engineering communication skills using participative design and validation method includes the six phases of the research design such as design, development and validation (Din, 2010). The Index of Learning styles (ILS) questionnaire, which was developed by (Felder & Silverman 1991, 2002) consists of 44 questions that specialize in four dimensions of learning styles was adopted to check empirically all two hypothesized relationships where II-22items, MI-31 and OL-26). The measurements scale is a Likert-type scale, which has 1 to 5 scales; 1 equals "strongly disagree" and 5 equals "strongly agree."

The content validity of each section of (I-OIMI) was established by conducting the systematically reviews related literature, interaction analysis, document analysis, and Experts' judgments. The content validity index (CVI) in this study was determined to be 0.78 (i.e. 78%) or above which is in the acceptable value as suggested by Beck and Owen (2007). Therefore, the reliability of the II, MI, and OL measure were established by employing the internal consistency (Cronbach Alpha) approach where their values was more than .80. The overall analyses suggested that the instrument was reliable to measure these three constructs. To evaluate the adequacy of the II, MI and OL measures for engineering communication skills, the data were analyzed using WINSTEPS (Linacre 2003), a computer program for Rasch Model. Subsequently data were collected using the validated instrument with a acceptable reliability index. Structural Equation Modeling was used to analyze the data to answer the research hypotheses.

3. RESULT AND DISCUSSION

On one hand, the results showed that the SEM procedures supported the theoretical framework. The results as shown in Figure 1 suggest that II was related to the MI where multimedia instructions influences individualized instructions. However, the relationship of .22 indicates a moderate influence of MI towards II. No single method can be said to be globally effective because learners differ in preferences and interest. Combining the II method with other methods such as MI will increase the possibility for instructors to approach the needs of more students and to help them develop and reach their learning goals (Okeakwa, 2011).

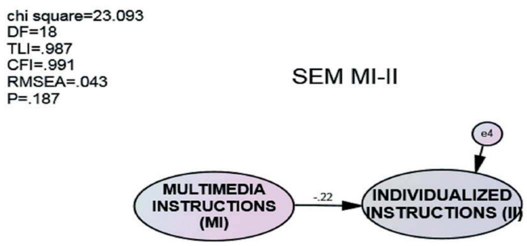

Figure 1. Revised Structural Model Showing MI and II Relationship

Specifically, the test calculated that the CFI (.991) fit indicator exceeded the threshold of .90, while the TLI index of .987 fall between the typical range of 0 and 1, hence meeting the threshold of .90 to indicate a good fit (Hair et al. 2006; Arbuckle 1997; James et al. 2006). The root-mean square error of approximation (RMSEA=.043), chi-square (χ^2) 23.09 with DF 18 (normed chi-square (χ^2/df) =1.16) and p value of .187 (normally acceptable $p > .05$) indicate a good fit (Arbuckle 1997; James et al. 2006; Hair et al. 2006). The beta value of .22 indicates which is larger than the required 0.2 value shows a direct influence between MI and II exists. The test failed to reject the hypothesized model. Thus, the procedures established a model showing MI influences II as in Figure 1. In other words, as MI goes up by 1 standard deviation, II goes down by .22 standard deviations. The result did not establish any basis, which can be used to claim that (MI influences the achievement of II) is incorrect. Thus, the result of this study was consistent with the literature of MI and II that the MI help create a student's centered learning environment which provides students with an opportunity for more individualization in the learning process.

On the other hand, the results as shown in Figure 2 suggest that OL was related to the MI. Online multimedia instruction can contribute to provide students with options regarding their learning. Moreover, online multimedia instruction provides students as well as instructors a systematic framework to implement, use, repeat, and redevelop the pace of instruction, methods, and contents to individualize the instruction (Genden 2005). According to Junaidu (2008), students systematically perform far better in queries related to the demonstration of understanding and the application of algorithms that have been carefully animated. Students' comments have typically been that they found the course a lot easier when the first major examination happen and as they study the rather more heavily animated parts of the course subsequently. In other words, MI can improve the online experience and improve the ability to learn and retain information. The quality of the online multimedia instruction depends upon the use of good design principles; students can improve test performance and improve the transfer of learning if they are exposed to well design MI (Genden 2005) in an online environment.

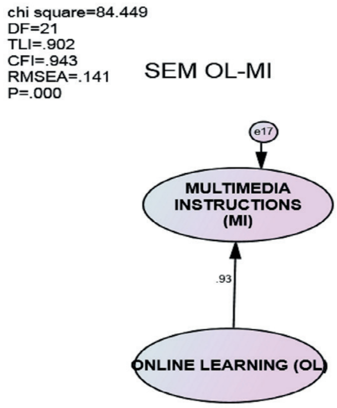

Figure 2. Revised Structural Model Showing OL Influence on MI

The result did not establish any basis, which can be used to claim that (OL influences the achievement of MI) is incorrect. The results indicated that the CFI (.943) fit indicator exceeded the threshold of .90, while the TLI index of .902 fall between the typical range of 0 and 1, hence meeting the threshold of .90 to indicate a good fit (Hair et al. 2006; Arbuckle 1997; James et al. 2006). Root-mean square error of approximation (RMSEA=.141), chi-square (χ^2) 84.449 with DF 21(normed chi-square (χ^2 /df) =4.1) and p value of .00 (normally acceptable p > .05) indicate a good fit (Hair et al. 2006, Arbuckle 1997, James et al. 2006). The factor loading of OL towards ML is .93. Overall result indicates that the test failed to reject the hypothesized model Thus, the procedures established that the OL was related to the MI model in Figure2. Hence, the result of this study was consistent with the literature of MI and OL that using OL environment suits MI and vice versa. OL can help to create a student centered learning environment providing students an opportunity to be more active in the learning process.

4. CONCLUSION

The purpose of this study is to establish a theoretical framework that validly and reliably represent the OIMI model for engineering communication skills. These findings are associated with an integrated learning and teaching environment that allow for more socialized interaction. This study assisted engineering learners with differentiated learning style preferences to learn and practice engineering communication skills knowledge by integrating; OL, II and MI theories into the learning environment via Blackboard Course Management System. This conception represents a major adjustment in the way engineering faculties have usually developed engineering communication skills. Overall, the OIMI model will not replace, eliminate, or displace formal learning. Teaching institutions will still need to create, deliver, provide, set learning outcomes, prepare course outlines and reports on official recognition and conformity initiatives.

In conventional engineering communication skills settings, teachers spend much more time teaching in content presentation. This activity usually takes the form of lectures. Moreover, students consume much more effort in their studies in taking down lecture notes. Irrespective of whether this is a good or bad educational practice for engineering communication skills learning; it is certainly an inefficient and ineffective use of teachers' and students' time. There are surely, several more efficient and effective ways of teaching and learning engineering communication skills. Engineering communication skills needs more active and individualized instructional environment, based on learners pace. Students in OIMI model settings are doing more than they did in conventional systems. Experience is the best teacher, and a student's activity is the experience by which he learns. II is attained through the socialized learning environment. Establishments of interactive communications to over come the distance between learners themselves and with instructors, often is so accurate. Neglecting the improvements of learning opportunities in engineering communication skills at the university level can lead to a low level of understanding in the engineering education. Thus, embedding more technology in learning and teaching engineering communication skills can lead engineers to be part of the contemporary globalized world.

The present study expands the existing body of knowledge in several ways. Firstly, the positive of OIMI model for engineering communications skills learning to reach predetermines learners' objectives. Secondly, the learners appear to be enhanced to use new technology. To sum up the model is projected to be able to fit the data from other similar courses with the same characteristics offered by any other university in the world.

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