Student's Perception to Learning of Innovative Skills through Multi-Dimensional Visualization System: Reliability and Validity Tests of some Measurements

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ABSTRACT

Learning has been described as the process of obtaining new knowledge, skills and habits, and can be subjective to the individual preparedness to learn, especially in the context of gaining the innovative skills. Knowing the perception of student's towards learning of innovative skills would assist the management and teachers on the appropriate approach for teaching. However, there has been less or no research that focuses on bringing the perception of students towards the learning of innovative skills into reality prior to the commencement of teaching. Therefore, a Multi Dimensional Visualization system is proposed in this research to reveal the level of perception of students towards learning of innovative skills in university set up by adapted Expectation Confirmation Model. An experiment was conducted by engaging 200 undergraduate students within the university campus so as to measure their level of perception towards learning of innovative skills using the proposed system. A measurement model analytical technique from the perspective of Partial Least Square of Structural Equation Model was used to confirm the reliability and validity of the proposed system, while the result shows high accuracy. This research gives useful hints for the university's management by obtaining the perception of student prior to learning of innovative skills.

Keywords: Multi Dimensional Visualization, Learning Perception, Innovative Skills, Expectation Confirmation Model.

I INTRODUCTION

Innovation in teaching and learning has been viewed as an approach of changing past orientation of knowledge sharing and moving towards acquisition of skills in a centralized way, thus increasing the self practicing of student's acquired knowledge (Smith, 2012 & Gosling, 2009). Teaching of innovation as part of the curriculum in the institution of higher learning does not only broad the student's reasoning but also allowing them being creative in the field of their endeavour (Molenaar et al., 2011; Cachia et al., 2010). This implies that students require acquisition of innovative skills which should be part of their curriculum in order to be independent in practicing and be employability in life.

Learning of innovative skills by the students of institution of higher learning should be encouraged in order to instill mind of being creative, self-learning, learning to learn, build competence and confidence among students (Molenaar et al., 2011). Thus, innovative skill could be liken to approach of forming a creative learning and process of effecting new techniques, tools and contents that add to the value of learners and their creative potential (Cachia et al., 2010; Zavertnik et al., 2010). In the aspect of teaching, many institutions of higher learning have introduced different innovations in their teaching towards complimentary of achieving innovative skills among the students, such as online learning, forum and virtual classroom (Smith, 2012; Pundak & Rozner, 2008). On the other hands, the perception of students towards learning or acquiring knowledge about innovative skills is the issue of concerned which can lead to its success or failure.

Previous studies have portrays variation in the attitude of students towards acquiring innovative skills while learning (Parai et al., 2015; Jwayyed et al., 2011). This may due to the influence of different learning style on the students' assimilations (Parai et al., 2015). In other words, perceptions of students towards learning of innovative skills may become difficult to study since it is intrinsic in nature, thus require its expression in reality form so as to identify the appropriate learning style for individual students. Studies have shown that student's perceptions have been conducted on the pedagogical content knowledge on self-efficacy in self regulating learning (Criu & Marian, 2014); e-learning in blended environment (Bauk, 2015); dimensional comparisons of the learning environment (Arens & Moller, 2016). However, there has not been study to the knowledge of researcher that focuses on bringing the perception of students towards learning of innovative skills into reality prior to the teaching. Knowing the perceptions of students on the learning of innovative skills would assist in using the appropriate teaching style to enhance their academic achievement (Wei et al., 2011).

Visualization of one's cognitive mood portrays the implementation of processed data to arrive at a

specified level of understanding (Yusoff & Salim, 2015). On the other hands, visualization of individual's perception on a subject matter may be referred to as the interpretation of different dimensions of modeled factors (Lukeneder, 2012). Therefore, visualization of one's intention can be achieved through a computerized system that is capable of interpreting modeled dimensions. Hence, this research proposes a Multi Dimensional Visualization (MDV) system towards bringing the student's perception to learning of innovative skills into reality. This will assist the teacher in choosing the appropriate teaching approach while teaching.

II RELATED WORKS

Possession of innovative skills subjects individual into presentation of work and its content differently and effectively (Brzycki & Dudt, 2005; Cheung & Huang, 2005). The study of Brzycki and Dudt (2005) argued that learning of innovative skills provides avenue and mechanism for developing new method and technology for problem solving. Thus, innovative skills provide opportunity for the learners to gain more information on the holistic cycle of the new techniques. On the other hands, innovative skills ensure self development and encourage creativity on the learners (Wolff, 2008). Hence, learners should be active in seeking for the innovative skills so as to become authentic and experienced learners.

Researchers have stressed that success of introducing the innovative skills as part of the curriculum in higher institutions could be on its relevant to the concept of the respective institutions (Smith, 2012; Heilesen & Josephsen, 2008; Ozdemir & Abrevaya, 2007). This may have direct effects on the perception of some students towards learning of innovative skills. Previous study has stressed that perceptions of students in the institutions of higher learning have been captured through the use of questionnaires, focus groups and interviews (Parai et al., 2015). However, each of the known approach has one or the other pros and cons depend on the ground of usage and the researchers. Moreover, a technological based mode of teaching has been described as the new method of imparting knowledge (Sanz et al., 2000; Zahorian et al., 2000). Thus, using a technological approach in visualizing the perception of students towards learning of innovative skills cannot be overestimated (Parai et al., 2015). Hence, this study proposes a system to assist in bringing the perception of students towards learning of innovative skills into reality.

III THEORETICAL FRAMEWORK

This study bases its theoretical foundation on the Expectation Confirmation Theory (ECT) due to its ability to ascertain the continuity or discontinuity of individual on the use of technology (Muraina et al., 2016; Muraina et al., 2015; Ham et al., 2012; Hwang et al., 2011; Chiu & Wang, 2008; Bhattacherjee, 2001). The ECT portrays that users of technology possess initial expectation prior to assessment of a service. Thus, users bound to compare the perceived performance vis-a-vis original expectation which leads to continue or discontinue. In the context of this study, visualization of student's perception on the innovative skills could be obtained by capturing their belief on the expected benefit of acquiring innovative skills. Besides, it requires focusing on the agreement between their expectation and the main performance of the innovative skills, thus inducing their feelings about acquiring the skills. Hence, the ECT would assist in obtaining the perceptions of individual students towards learning of innovative skills. The adapted model of the ECT together with the conceptual definitions of their constructs is shown in Figure 1, research model and Table 1 respectively.

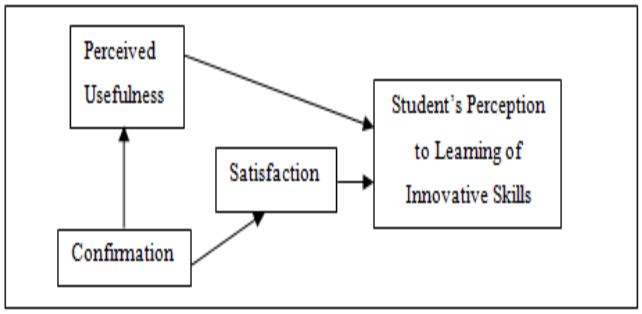

Figure 1. Research Model

Table 1. Conceptual Definition

Constructs	Definitions
Perceived usefulness	Student's perception of the expected benefits of learning of innovative skills.
Confirmation	Student's perception of agreement between their expectation and the learning of innovative skills.
Satisfaction	Student's feelings prior to learning of innovative skills
Learning perception of innovative skills	Student's change or reaction in knowledge or behavior as a result of experience gained in learning innovative skills.

IV RESEARCH METHODOLOGY

A. Designing of Multi Dimensional Visualization System

Visualization of the student's perception towards learning of innovative skills is achieved in this research through the MDV system. The MDV system was designed using C# programming language. Besides, computation of the system is based on the research model in Figure 1 by taking its constructs; perceived usefulness, confirmation, satisfaction and learning perception into consideration. The system is designed to estimate the level of perception of students towards learning of innovative skills and visualize their status as shown in Figure 2 and 3. Thus, the MDV system categorizes the perception level as low perception (< = 60%), moderately perception (61% – 70%) and highly perception

(> 70%).

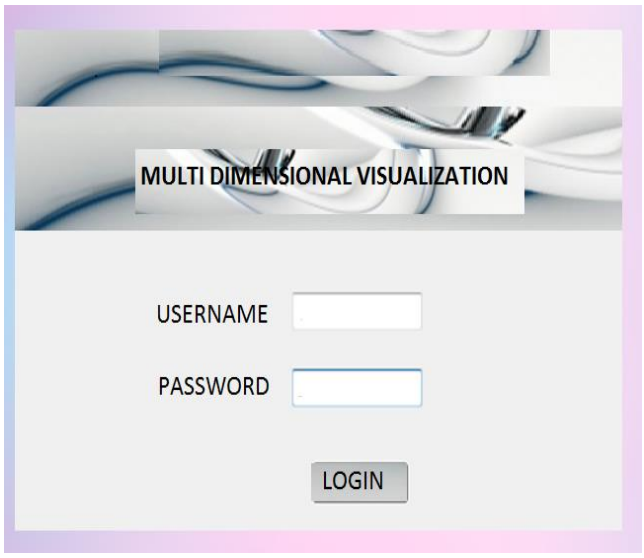

Figure 2. Login Page

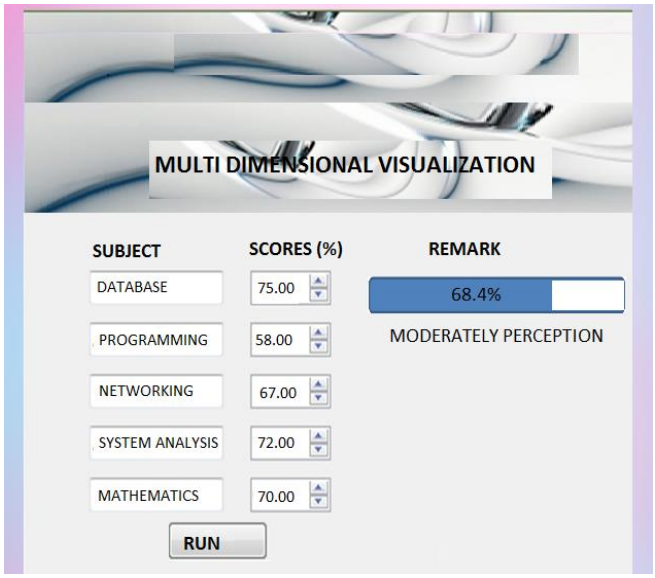

Figure 3. Perception's Measuring Page

B. Experimental Procedure and Data Collection

The experimental procedure in this research was achieved by asking the students to install the MDV application on their respective Personal Computer (PC), running on Windows 10 operating system. Therefore, we ensure that all the students' PCs have only one Google chrome browser and Java Script to achieve homogenous of the systems and avoid bias in the participants' results. The instructions were given to the selected undergraduate students to register with the proposed MDV system and answer the required questions which based on their previous performance in the selected courses. The MDV system runs the participant's responses and visualizes their perceptions level as shown in Figure 3.

Meanwhile, selection of participants for the experiment was done through simple random sampling from the undergraduate students in Universiti Utara Malaysia. The total number of 200 undergraduate's students was selected through fishbowl technique of simple random sampling towards testing of functionality of the MDV system. Moreover, 200 survey questionnaires were distributed to all the students that took part in the experiment to measure their perception on the functionality of the proposed system. The designed questionnaire comprises of the measurement items for the research model's constructs as shown in Table 2.

Table 2. Constructs and their Measurement Items

Constructs	Measurement items
Perceived usefulness	i. Using MDV system helps determining my performance towards learning of innovative skills. ii. Using MDV system helps determine my level of effectiveness in the classroom towards learning of innovative skills. iii. Using MDV system assist in determining my capacity in solving the class's tasks towards learning of innovative skills. iv. Using MDV system is useful in revealing my academic performance with respect to learning of innovative skills.
Confirmation	i. I have better experience while using MDV system towards my perception in learning innovative skills. ii. The service level provided by MDV system was better than my expectation towards my perception in learning of innovative skill.
Satisfaction	i. I was satisfied with overall experience gained while using MDV system towards determining my perception to learn innovative skills.

	ii. I was very pleased with overall experience gained while using MDV system towards knowing my perception to learn innovative skills. iii. I was very contented with overall experience had while using MDV system towards knowing my perception to learn innovative skills. iv. I was absolutely delighted with overall experience gained while using MDV system towards knowing my perception to learn innovative skills.
Learning perception of innovative skills	i. I intend to use MDV system to reveal my perception to learning of innovative skills. ii. I intend to use MDV system than use any alternative to reveal my perception to learning of innovative skills. iii. I oppose using MDV system to reveal my perception to learning of innovative skills. iv. I intend to use alternative method than MDV system towards revealing my perception to learning of innovative skills.

IV DATA ANALYSIS AND RESULTS

The reliability and validity of the MDV system were achieved by observing the measurement model of the research model in Figure 1, since it is the basis for development of the MDV system. This was done using the Partial Least Square (PLS) of Structural Equation Model (SEM). The measurement model of the research model in Figure 1 takes care of the convergent validity based on the Fornell Lacker criteria that all the items must be significant at 0.05 with their loading factors greater than 0.7, while the Average Variance Extracted (AVE) should exceed 0.5. The obtained results which confirmed the reliability of the MDV system revealed that loaded factors were above 0.7, while the results of AVE exceeded 0.5 as shown in Table 3 and Table 4 which confirmed discriminant validity.

Table 3. Composite Reliability and AVE for the Factors

Construct	Composite Reliability	Cronbach Alpha	AVE	R^2
Perceived usefulness	0.8341	0.7234	0.5453	-
Confirmation	0.8967	0.7652	0.6342	-
Satisfaction	0.8852	0.8324	0.6236	-
Learning Perception of Innovative Skills	0.7935	0.7634	0.5735	0.621

Although, Cronbach alpha as been described as a conservative way of measuring the internal consistency (reliability) of the indicators of the correlated variable (Hair et al., 2014). Yet, the result of the reliability of the correlated variables used in designing the MDV system were high, ranges from 0.7234 to 0.8324, as shown in Table 3. This implies that any output generated from the MDV system should be reliable as a result of the high Cronbach alpha which is higher than the threshold of 0.7. Moreover, the obtained values in the composite reliability column in Table 3 with high internal consistency values indicate that input into the MDV system do not interfere with each other, thus capable of classifying the perception of students towards learning of innovative skills into different groups (low perception, moderate perception and high perception). Hence, the MDV system is reliable in taking care of visualizing the perception of students to learning of innovative skills.

Table 4. Discriminant Validity (Fornel Lacker Criteria)

Variables	Perceived usefulness	Confirmation	Satisfaction	Learning Perception of Innovative Skills
Perceived usefulness	**0.7435**			
Confirmation	0.6342	**0.8534**		
Satisfaction	0.5873	0.6453	**0.7641**	
Learning Perception of Innovative Skills	0.5673	0.7453	0.6432	**0.7564**

The discriminant validity as shown in Table 4 represents the extent at which a construct is distinct from another constructs by view of empirical explanation. This confirms that the constructs used in the MDV system do not repeat what the other construct stands for. In other words, all the four constructs in the MDV system measure different constituents of perceptions of the students towards learning of innovative skills. Thus it assists the MDV system to avoid interference of one construct on another constructs while categorizing and visualizing (low perception, moderate perception and high perception) the perceptions of the students towards learning of innovative skills. Hence, the empirically analysis through the Fornel Lacker Criteria of discriminant validity as shown in Table 4 represents the validity of MDV system.

V DISCUSSION AND CONCLUSION

The main objective of developing the MDV system is to bring the perception of students towards learning of innovative skills into reality and more interpretable to the audience. The use of the presented MDV system eases determining the level of perceptions of students to learning of innovative skills in the institution of higher learning. Besides, the reliability and validity of the presented MDV system is high as shown in Tables 3 and 4 respectively. This shows that any value and the categorized perception generated by the MDV system would be reliable to interpret the cognitive mood of individual towards the use of the system. On the other hands, this research will be extended in future by increasing the attributes of participants for generalization of the research.

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