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Experiential Learning: The Effective Application of Virtual Reality in Teaching and Learning

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Abstract

Virtual reality education is a computer interface with specific characteristics transforming an immersive and interactive experience in to an education evolution. The purpose of this paper is to look into different approaches to study on emergence of the application of virtual reality in teaching and learning in classroom. Academic literatures indicate artificial intelligence is an evolution of the technology that taking the education to new ways. The pilot questionnaire was administered to a group of 45 subjects. A group was primed to complete the questionnaire before engagement of virtual reality and completed the questionnaire for post-test after experienced the virtual reality. Analysis from empirical evidence proves that virtual reality presents an opportunity of learning with a real situation, but artificially created enabling the visualization and the interaction sense with the study. This paper contributes to the theory on the implications of emerging technologies on the way students learn and how institutions teach and evolve. The paper draws intention to the implication of better appropriation of the concepts and a bigger facility in the activities performance specifically in modern education.

Keywords: Experiential learning; Virtual reality; Learning style; Education; Technology.

1. Introduction

Education system is changing rapidly aligned with the revolution of global education paradigm. Utmost attention is deliberate on the field of sciences, technologies, religious, engineering, mathematics and social sciences. Nowadays students are more likely to experience the futuristic ambience during the learning processes. Smart classroom has been introduced worldwide to replace traditional classroom where the teaching and learning practice were using chalk and talk techniques.

Advancement in technology and application of artificial intelligence in education create new pathway of educational governance. Almost every school and higher learning institution establish the use of Internet in an effort to improve student learning and early future workforce preparation (Inan and Lowther, 2010). Artificial intelligence (AI) is define as computing systems that are able to engage in human-like processes such as learning, adapting, synthesizing, self-correction and use of data for complex processing tasks (Popenici and Kerr, 2017).

Computer graphics, synonym with computer games are equipped with better and faster graphics boards allow user to experience the surrounding world in virtual dimension encounter the world of three-dimensional graphics. Virtual reality (VR) is booming new technology artificially stimulate our sense manipulated into another version of reality. In early 90s, the development of virtual reality became vigorous in the era of technology allow user navigate real-time interactive graphics with three-dimensional computer generated environments with clone of physical reality. Rapidly changing technology captures the most essential aspects on what people perceived and envision for the forthcoming world virtual environment.

VR is considering a clone of physical reality with the simulation of the design environment. Most VR experiences involve interaction, present (immersion) and autonomous. Telepresence refers to VR that simulates systems that enable users to sense world of three-dimensions in real time the same way user act in the real world. Teleoperation is where user interact with the simulation and able to control visual stimuli.

Twenty-first century education thru the revolutionize of world educational system transform diverse needs of new generation of students. The new challenge faced by educators today is to teach students the skills needed with the bombards of information communication and technology (ICT). Rotherham and Willingham (2010), state that

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the skills students need in the 21st century are not new and the urge of shifting the content and curriculum. Present day, new knowledges has been introduced, yet how people perceive the information must put into account.

2. Student Learning Behavior

New generation of students specifically the Gen-Y and the Gen-Z are more likely a person- driven to find creative modus to problem-solving. The status quo of present higher learning institution scenario are, the educators are those among the Baby Boomers and Gen-Xers are the one who teach Gen-Y and Gen-Z students. In comparison, Gen-Z is the most Internet savvy generation and feasible to multi-tasking activities to a new level, whereas Gen-Y uses technologies as requirement with direction to utilize the technological tools. Moreover, Gen-Z spends more time in virtual world rather than social interaction, such as outdoor activity, outing to recreational places and outdoor sports.

Educators delivering a lecture form using a traditional technique by simulation and demonstration are still essential in the classroom of today. The technique, such as questioning probe and learning probe where educators ask student to answers related to course contents in determining their understanding of the lessons. In assuring the technique is effective, educators should first, determine the difficulty of the questions, second, open class comments to students' answers, and third, make summarization to overall students' responses. Some academic literature suggest teaching and learning technique, involving students triggered student's readiness to learn especially new knowledge.

Students' engagement in school, university or higher learning institution involves both behaviors and attitudes, and the more they engaged, the more they retain learning activities. Even the trend in the workforce has intensely changed towards understanding how to do better hiring, how to working with and how to be best lead as they start to enter job environment. Students today are taught with a structured curriculum in majority of the institutions. The 21st century educators are ought to use problem-based learning, critical thinking skills learning, and discovery learning approaches to cater the younger generations' students into the essence of learning sphere. There is a need for advance development of students' learning style to blend in the rapid changes of the world education in this decade. Students learning materials with efficacy by using 10 learning techniques (Dunlosky *et al.*, 2013). such as::

- Elaborative interrogation;
- Self-explanation;
- Summarization;
- Highlighting / underlining;
- Keyword mnemonic;
- Imagery for text;
- Rereading;
- Practice testing;
- Distributed practice;
- Interleaved practice

According to Kahu (2013), students' engagement depicts a growing paradigm that captures learning institutional system and students' behaviors, associated with students' satisfaction and accomplishment that include, time given on project, academic and social interactions, and delivery of knowledge. Pössel *et al.* (2013), noted that students feel safe and relax in classroom when they are supported by educators in academic as well as personal matter. In addition, higher classroom engagement positively triggered students' intrinsic behavior toward learning institutional. Performance of students are enhanced when they use self-explanation techniques that involve transferring what was learned in classroom and able to solve new problems (Dunlosky, 2013).

3. Technology Classroom

The practice application of technologies has substantially changed due to the fast development of technology day by day. The technology used today might not be the same technology of tomorrow. Many new technologies have emerged throughout a period from writing assignments or projects using typewriters, saving documents in floppy disks or compact disk, using computer as teaching machines and productivity tools replacing blackboard, and technology instruments engaged in various activities, in which enhancing knowledge expansion.

Academic literature agrees that students' metacognition and self-regulation play significant role in improving effective learning in indoor classroom as well as outside classroom. Students are excellent at test takers, yet show a poor outcome at higher-order thinking skills, specifically in cognitive learning and they are not able to transform efforts to move teaching instruction from routine learning to problem-solving, concept development, and critical thinking (Muir-Herzig, 2004).

The ways people are communicating, interacting, collaborating and making social constructs display a new paradigm through the development of social networking technologies and the evolution of digital medium of communication. The availability in market, perceived ease of use, and the use of variety applications that are accessible in digital technologies and portable devices have increased the possibility that young learners and adult learners will engage in off-task behaviours in instructional contexts (Wood *et al.*, 2012).

Transformation in education had intensely moved forward with the advancement of technological education in science, engineering, mathematics, business, medicine, information management, technical and vocational, and digital networking platforms. Inan and Lowther (2010), study signified that contextual factors play crucial roles in

technology integration decisions and practices, such as teachers' beliefs and attitudes, demographic characteristics, technology availability and institutional support structure.

The application of digital technology in the classroom embolden active learning, knowledge sharing, questions and answer (Q&A), and fostering beyond topic discussion via virtual communication or in different physical classroom locations. According to Muir-Herzig (2004), technology gives guidance in facilitating the knowledge-constructed classroom. These technologies improve learning atmosphere by leveraging networking technologies to increase collaboration, knowledge sharing, and connecting learning activities. Technological advances make ease to educators in delivering lesson by utilizing instructional tools for students practice outside the classroom, including computer simulation and online learning (Davies *et al.*, 2013).

VR has grown into a simulation tool to enable human to interact with vibrant experiences of virtual worlds and into a methodology in human-machine system design and evaluation. Application of VR in education is suitable in practical and technical and vocational training that skills developed in virtual environment are paralleled to the real environment. Furthermore, in real environment, transferring knowledge and skills may incur high costs. The best education training has been widely used are medical procedures and flight simulation and different industry, such as manufacturing, servicing, transportation, engineering and others.

4. Learning Style

The concept of learning style describes individual differences in learning, based on the learner's preference for employing different phases of the learning cycle. Each person has different ways of learning. Employing different phases of learning cycle by the learners show different individuals have different learning style (Kolb and Kolb, 2009). Kolb and Kolb (2009), added that people who live in country with high uncertainty avoidance and high in in-group collectivism has significant reflective in learning style.

Cognitive and task conditions are the resources available to the person and the limitations integral to the task, including motivation, beliefs, domain knowledge, disposition and styles, and knowledge of strategized efforts (Azevedo *et al.*, 2012). There is a need for development of students' learning style to blend in rapid changes of world education in this decade. Modern students need to master seven survival skills - critical thinking and problem solving, collaboration and leadership, agility and adaptability, initiative and entrepreneurialism, effective oral and written communication, accessing and analyzing information, and curiosity and imagination (Wagner, 2008).

Experiential learning theory defines learning as the process whereby knowledge is created through the transformation of experience (Kolb and Kolb, 2012). The concept of learning style indicates that student learning process of what they see, listen, understand, remember, and interpret information. Experience learning is a strategy in linking the learning from the real-world situation or scenario with the necessary condition of the application of concepts, ideas, and theories to the interactive setting (Greene, 2011). Evidence from past literature have substantiated the subject of technology and student engagement with utility of computers and ICT on enhancing student engagement which turns student to stimulate higher order thinking (Chen *et al.*, 2010).

5. Methods

5.1. Participants

This study was a quantitative research where data were collected through distribution of questionnaires. The questionnaire consists of eight parts. Part A and B gathers the information about respondents' demographic profile and personality, using nominal scales. Part C, D, E, F, G and H are questions on variables that were measured, using 5 points Likerts Scale that indicates 1 - strongly disagree, 2 - disagree, 3 - not sure, 4 - agree, and 5 - strongly agree. The questions for each construct in questionnaire were taken from various academic literatures. The number of participants in the experimental study was limited due to this study aimed at gaining experience with the VR system design application in education. The data was collected from students participating in bachelor degree program in Semester 2 2017/2018 session. The sample size for the analyses was 45, representing one class in randomly selected group of students. From the results, every student owns a smart phone and almost every student has a laptop with 89.1%. Most of students surf the Internet more than 30 hours a week (32.6%), followed by 6 -10 hours a week (26.1%) (Table 1).

Table-1. Participants by demographic characteristic

	N	***%***
Age		
19 or younger	0	0
20 – 23	15	33.3
24 – 29	30	66.7
30 – 39	0	0
40 – 55	0	0
Over 56	0	0
Devices that you own		
Smart phone	45	100
Tablet	1	2.2
Laptop	41	89.1
PC/iMac	2	4.3
Game console	3	6.5

Wearable technology	1	2.2
Smart TV	1	2.2
Hours a week you surf Internet?		
5 or fewer	1	2.2
6 – 10	12	26.6
11 – 15	8	17.7
16 – 20	3	6.6
21 – 25	5	11.1
26 – 30	2	4.4
More than 30	14	32.6

5.2. Experimental Design

The study was screened, based on the research method, using quasi experiment which includes the pre-test and post-test. The study was scheduled in the smart classroom geared with virtual reality equipment. The session of the test experimental study lasted about 5 minutes for each subject, segmented into sequential sections for learning course content and VR experience. During the experimental section, the subjects performed tasks in VR while wearing headset and sensor detectors for 4D insight. Upon completion of experimental session, subjects were probed with questionnaire on demographic profile and experience learning measures. The researchers used scale measure in pre-test and conducted the post-test in 3 months after the first distribution of questionnaire. Pre-test was conducted to assess students' experiential learning in traditional classroom and post-test was an experiment on classroom with application of technology.

6. Results and Discussion

The findings are presented, based on the answer from the research questions of the research. Pearson's correlation coefficient (r) test was used in this study to measure the strength of the relationship between the two variables, independents variables and dependent variable. Consistent with the experiential learning in classroom, the pre-test indicated students in second year were significantly satisfied with the course they learned in traditional method in learning ($r = 0.75$, $p < 0.01$). The results show that learning atmosphere ($r = 0.56$, $p < 0.01$), learning objective ($r = 0.49$, $p < 0.01$), and outcomes of the learning ($r = 0.53$, $p < 0.01$) were also significantly associated with students' pleasure in learning in classroom. Meanwhile, based on the use of ICT ($r = 0.38$, $p < 0.01$), there were significant relationship between independent variables (learning atmosphere, learning objective, outcomes of the learning, and use of ICT) and dependent variable (experiential learning).

Table-2. The results of Paired Sample t-test

Observed Test	N	Mean	Sd	t	P
Pre-test	45	3.92	0.471	-6.96	0.00*
Post-test	45	4.40			

*$p < 0.05$

Finding from the post-test shows that the use of ICT was positively correlated ($r = 0.614$, $p < 0.01$) and students' experiential learning has increased after the application of technology in classroom, $t(44) = -6.96$, $p = 0.00$ (Table 2). Students also have high satisfaction level in learning, $t(44) = -6.89$, $p = 0.00$, demonstrated that the 21st century students of today are digital savvy and most likely desired learning with new atmosphere with the integration of ICT in education. The significant, - t (0.026) was lower than α at 0.05 level of significance, then the researchers rejected the null hypotheses. The researchers employed a paired sample t-test to compute the statistical significant difference in pre-test and post-test result for experiment group.

The aim of the experiential learning evaluation was to identify the variance of learning atmosphere on the traditional teaching and learning and the design of VR with educational content facilitating generalization of education into VR applications for real world scenarios to the greatest possible extent. Researchers illustrated the methodology using interaction traced the data from a recent study with 45 students, taught by the same lecturer at the Faculty of Technical and Vocational. Learning atmosphere, learning objective, learning outcome, use of technology and experience learning are independent variable of the model. Experience learning is indicated as dependent variables. The results of this study presented an interesting dichotomy in students' performance at constructing their causal concept maps. Four variables hypothesized to influence experience learning has been explained by 65.5% of the variance of students' experiential learning.

The findings nevertheless support the claim that the results regarding technology use and student learning experience are the best proxy that measures overall students' satisfaction. Researchers' findings suggest that schools or universities using technology-equipped instruments might have high efficacy in teaching and learning processes. Moreover, the findings also understate that the association between students' test results and research outcome, indicates that high experiential learning stimulus student's satisfaction in learning.

The general conclusion drawn from the results provide for an application of VR in education courses are seemly for human-machine system design. The test given in this study indicates that there are gradually increment in test score when the technologies are used in effective manner. Testing can enhance student learning in classroom and there is sufficient evidence examined that testing in the previously studied subject matter can increase its long-term retention (Pastötter and Bäuml, 2014). In this study, the researchers focus on the effectiveness and variation in

students' learning behaviours by refining the action concept step in exploratory methodology. To assess students' overall learning gains, the study calculated as normalized gains in pre-test to post-result scores, researchers categorize the pre-test and post-test questions on the definition questions about experiential learning and learning satisfaction multiple choice format.

7. Conclusion

In this paper, researchers extended an exploratory methodology for identifying student's experiential learning with an iterative approach to action thought, using a variety of action features and presented results analyzing reading insight of students in a learning-by-teaching environment. There are six ways of improving students' achievement and progress in learning by the educators: pedagogical content knowledge, quality instruction, classroom climate, classroom management, educator beliefs, and professional behaviors (Coe *et al.*, 2014). The use of advances in technology and ideas from technology, equipped education has the potential to exponentially increase the effectiveness and impact of students' experiential learning. Learning by practice with high students' involvement is likely to be most effective that enable students to select, organize and integrate information from the lesson learned. Schools, universities or higher learning institutions that implement without recent technologies still can achieve best lessons but deficient in students' experiential learning and learning styles.

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