Encouraging Student Motivation in a 3D Self-directed Learning Environment

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Abstract. Today, the key challenge in traditional classrooms is to enhance the students' motivation. Currently, there is high demand for 3D visualization technology in urban designs. Complex analysis, simulation and visualization can be created using 3D technology for better visualization. The study aims to use a 3D learning environment to promote students' motivation in their learning. A self-directed learning approach was used to provide learners with the opportunity to take control of their learning process as well as to increase their motivation to learn. A 5-point Likert scale survey was given to a cohort of students to gauge their learning experience in this 3D environment. The results showed that the students were able to be responsible for their learning and become motivated learners in this 3D learning environment. The findings can provide educators with a better understanding of the use of 3D learning environments to boost their students' learning experience.

Keywords: Self-directed learning · 3D Visualization · Urban Design · 3D Learning Environment

1 Introduction

Cities all throughout the world are confronted with enormous challenges. Emerging cities in Asia and Africa, for example, frequently face unforeseen side effects from mass transportation, inadequate urban infrastructure, or other environmental side effects as a result of rapid urbanisation, necessitating flexible and adaptive urban design solutions. Over the previous few decades, the strategy has been to use innovative technologies and gather knowledge through data mining tactics [1]. The 3D technology in urban design could be integrated with traditional 2D paper-based design, as well. Using 3D based, GIS solution can be accurate for modern urban design approach [2].

It has been proven by previous researchers that 3D technology has a lot of advantages in terms of visualization. Immersive virtual reality environments (VEs), which are realistic 3D representations of real or imaginary locations, nevertheless show promise in reproducing real or fictional environments and providing immersive experiences in which one can safely perform research under controlled conditions, (i.e., explore the

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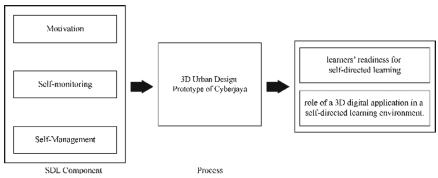

Fig. 1. Research flow diagram

future or the past, go beneath the seas, or go to Mars) [3]. Today, urban design can adopt this 3D technology to analyze the current site development for better understanding of the situation [4]. There is high demand for 3D visualization technology in urban design in recent years. Complex analysis, simulation and visualization can be carried out with this technology [5]. Malaysia is focusing on introducing more advance 3D capability and interactive visualization of its urban design [6].

Instead of solely focusing on cognitive instruction, it is important in urban design education to increase students' motivation to learn. The teaching approach employed is important in increasing student interest and participation [7]. The current educational system mainly follows the traditional lecture class, ignoring the fact that this generation is capable of fast adapting and utilising all types of emerging technology and applications (3D modelling, Virtual Reality, Game-based learning) for their own goals [7]. Traditional educational approaches (e.g., transmitting information through lecture-style presentations) have been demonstrated to be less successful than interactive methods in studies. The main unsolved challenge with this instructional style is how to increase student motivation rather than spoon-feeding education [8].

Self-directed learning is a model that is widely known in the field of adult education. The concept is strongly focus on the control and management of the learning tasks. Self-directed learning is basically reflecting three dimensions, such as, self-management or control, self-monitoring or responsibility and motivational or task [9]. The theory has shifted the method of education from teacher directed learning to learner or self-controlled learning approach. In addition, learners will take full responsibility of their own learning activities and outcome, either favorable or unfavorable.

Therefore, this study aims to study the learners' readiness for self-directed learning and the role of a 3D digital application in a self-directed learning environment. The primary aim of this research project is to bridge the gap with this new technology concept for users to use 3D interactive application of an urban simulation in the city of Cyberjaya, Malaysia (Fig. 1).

2 Literature Review

Previous studies have established a direct positive relationship between the use of technology as connection with students' engagement and self-directed learning approach [10]. Self-directed learning or SDL is one of the prominent learning approaches for the most adult learners. Comprehensive theoretical model has been proposed for SDL,

the SDL model construct with three variables self-management (task control), self-monitoring (cognitive responsibility) and motivation (entering or task) the variables or dimensions are interconnected with each other [9].

2.1 Motivation

Motivation itself can be divided into two parts, which are Entering motivation and Task motivation. Entering motivation is related to the process of deciding to participate in a specific task or learning process and task motivation is related to the effort required to stay on task and persistence. In task motivation, persistent can be directed in achieving learning activities and goals [9]. Research shows that, readiness for self-directed and independent learning are most important characteristics for learning environments. Self-organization and self-discipline are important characteristics for any learners to enter the educational environment. It also provides evidence such that, students' self-directed learning readiness has strong relationship between academic self-efficacy and academic motivation [9] Independence in learning, study skills and problem solving has correlation with self-efficacy and academic motivation as well [11].

2.2 Self-monitoring

Self-monitoring or responsibility is a process where the learners have to take full responsibility for the construction of personal meaning (i.e., integrating new ideas and concepts with previous knowledge). Self-monitoring integrates new knowledge with the existing knowledge structure in a meaningful way to meet their learning goals [9]. All students need to be responsible for his or her own learning, must have a willingness and ability to self-monitoring of the learning process. Observing, judging, and reacting to their tasks and activities are the steps for students self-monitoring, during the learning process [9]. Self-monitoring (cognitive responsibility) is actually monitoring the collection of learning strategies, as well as, an awareness [12].

2.3 Self-management

Self-management or control is mainly related with task control issues or facts. It actually focuses on the social and behavioral implementation of learning intentions or desire. In Self-management, learners should be provided with choices like, how they wish to proactively carry out the learning process in a smooth way with materials and resources be arranged and available. Self-management cannot be separated from other dimensions like self-monitoring or responsibility, and motivation or task control strategies [9]. Self-management or contextual control focuses on setting learning objectives and managing learning resources [9]. In order to apply self-management effectively to a learning process, the learning environment must be included with people, resources, assessment and time, and all of them need to be identified and managed properly [13].

Therefore, the aim of this study was to find and ascertain the level of student readiness for a self-directed learning environment using digital 3D application.

Fig. 2. 3D Urban Prototype of Cyberjaya

3 Research Methodology

The study is a descriptive and quantitative study. It basically investigates among students of Multimedia University (MMU) in Cyberjaya campus. The sample used in this study were the students (undergraduates and post-graduates) of the Faculty of Creative Multimedia in Multimedia University.

A similar research was conducted on self-directed digital 3D design class. It identified that, the self-directed 3D design class supports students learning independently. During the design process, students can view the learning resources provided by the course and search for extra-course resources on the Internet [14] (Fig. 2).

The study identified the samples among the student groups of undergraduate and post-graduate programs of the Faculty. A convenient sampling design was used to choose the respondents. For data collection purposes, the self-directed learning (SDL) Evaluation scale survey was used which was adapted from the previously published research studies [15–17] The survey used was a 5-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5) with Neural (3).

As per the information provided by the faculty, the total number of undergraduate and post-graduate students in Faculty of Creative Multimedia (FCM) is 1075 and 75 respectively, adding up to a total of 1150. For selecting the sample size, the researcher depended on the table for determining sample size from a given population, using the method developed by Krejcie and Morgan (1970), the researcher selected a student sample size of 285 which is appropriate for a total number greater than 1100 and less than 1200.

3.1 Procedure

The survey was design and administered to the participants through Google form. The participants only had to click and answer the questionnaire provided via the link through what's app and email. The given answers were stored digitally through google form technology. Once completed, the researcher retrieved the data from the sample after they have completion of the survey within a 10-day time frame.

A prototype model of a 3D urban plan was constructed for the study. The site location of the prototype is almost in the middle of Cyberjaya city. The researcher constructed a hypothetical design for the location with road layouts, buildings, and other utility facilities.

All data used for making the prototype were collected from secondary sources. CAD map of Cyberjaya city and other 2D maps were collected from Sepang Municipal Council. The buildings and city layout were procedurally generated. The researcher tried to incorporate fine details into the 3D model and to mimic the city's original constructional style and layout. The interface design is modern. The interactive design and functionality of the prototype are very user-friendly and self-explanatory as well. The interface is well organized and similar to any modern computer game today. In the 3D prototype, users will see the main menu. A stand-alone application of the prototype was distributed among the students through the google form. Participants downloaded the application from the link provided in google form. They installed it in their computer to have full SDL experience by running it.

Participants' ware instructed to, explore and experiment the prototype by interacting with it first prior answering the survey. The prototype itself was user friendly. The inbuilt vocal guide system and interaction process of the prototype helped participants gain their expected SDL knowledge.

After collecting the feedback data from the participant, the researcher used Statistical Packages of the Social Science (SPSS) software version 23.0 analyze and calculate the retrieved feedbacks. Descriptive statistics were employed to summarize the characteristics of the sample. Statistical significance was set at 0.05 levels for all tests ($\rho = 0.05$).

4 Results Analysis

There were no missing data, as all questions were mandatory. The valid questionnaires coming from 194 male and 91 female with age range of 20–25 years old. The majority of the respondents were Malay students. Scores were obtained by allocating numerical values to participant responses: "Strongly Agree" scored 5, "Agree" scored 4; "Neutral" scored 3; "Disagree" scored 2 and "Strongly Disagree" scored 1.

Table 1 shows the results of the items of the survey. The results show that the means range from 4.14 to 4.34. This indicates that the participants were very positive to the self-directed learning approach used in the 3D learning environment. The survey also showed that a vast majority of students had chosen both "Strongly Agree" and "Agree" resulting in a very high agreeable frequency, ranging of over 90%. These strongly indicate that the students showed positive attitudes towards this learning environment.

The items were then categorised into the three constructs, mainly, Self-Monitoring (SM), Motivation (MV) and Self-Management (SMGT) and were shown in Table 2. The results showed that the means of these constructs ranged from 4.23 to 4.28 indicating very high positive attitudes towards this learning environment. According to [18], Cronbach's alpha from 0.5 to 0.75 is generally accepted as indicating a moderately reliable scale. The result shows in this study that the Cronbach's Alpha for each constructs ranged from 0.7 to 0.746 which indicates the constructs are reliable. The findings demonstrate that most of the students exhibited readiness for SDL.

The results indicated that the participants in this study were able to learn in a self-directed manner. They were ae to have control over their learning process and managed their resources well (m = 4.23 in Table 2) They also were able to take responsibility over

Table 1. Student's perception of self-directed learning with 3D city visualization (Descriptive statistic survey)

No.	Item	Mean (M)	Std Dev	SA f (%)	A f (%)	U f (%)	D f (%)
Motivation (MV)							
MV 1 (Q1)	I take the challenge to learn.	4.14	.413	46 (16.1%)	234 (82.1%)	4 (1.4%)	1 (.4%)
MV 2 (Q2)	I am a 'why' person.	4.15	.467	53 (18.6%)	223 (78.2%)	7 (2.5%)	2 (.7%)
MV 3 (Q3)	I critically evaluate new ideas and knowledge.	4.21	.487	69 (24.2%)	208 (73.0%)	7 (2.5%)	1 (.4%)
MV 4 (Q4)	I would like to evaluate the level of my learning progress.	4.32	.544	102 (35.8%)	172 (60.4%)	11 (3.9%)	0
MV 5 (Q5)	I would like to learn from my mistakes.	4.29	.525	91 (31.9%)	186 (65.3%)	7 (2.5%)	1 (.4%)
MV 6 (Q6)	I believe in effort to improve my performance.	4.31	.494	93 (32.6%)	188 (66.0%)	4 (1.4%)	0
MV 7 (Q7)	I enjoy learning new things.	4.34	.510	102 (35.8%)	178 (62.5%)	5 (1.8%)	0
MV 8 (Q8)	I trust my abilities to learn new things.	4.32	.511	97 (34.0%)	184 (64.6%)	3 (1.1%)	1 (.4%)
MV 9 (Q9)	I have positive expectations about what I am learning.	4.33	.492	96 (33.7%)	186 (65.3%)	3 (1.1%)	0
Self-monitoring (SM)							
SM 1 (Q10)	I am aware of my own weaknesses.	4.17	.533	63 (22.1%)	212 (74.4%)	8 (2.8%)	2 (.7%)
SM 2 (Q11)	I can link pieces of information when I am learning	4.32	.509	96 (33.7%)	183 (64.2%)	6 (2.1%)	0
SM 3 (Q12)	I pay attention to all details before taking a decision.	4.33	.533	101 (35.4%)	177 (62.1%)	6 (2.1%)	1 (.4%)
SM 4 (Q13)	I would like to set up my goals.	4.33	.501	99 (34.7%)	182 (63.9%)	4 (1.4%)	0
SM 5 (Q14)	I correct myself when I make mistakes.	4.31	.484	90 (31.6%)	192 (67.4%)	3 (1.1%)	0
SM 6 (Q15)	I am a responsible person.	4.27	.462	80 (28.1%)	203 (71.2%)	2 (.7%)	0
SM 7 (Q16)	I judge my abilities fairly.	4.23	.475	71 (24.9%)	209 (73.3%)	4 (1.4%)	1 (.4%)
SM 8 (Q17)	I think deeply when solving a problem.	4.31	.494	93 (32.6%)	188 (66.0%)	4 (1.4%)	0
SM 9 (Q18)	I prefer to set up my criteria to evaluate my performance.	4.28	.479	83 (29.1%)	198 (69.5%)	4 (1.4%)	0
Self-Management (SMGT)							
SMGT 1 (Q19)	I evaluate my own performance.	4.22	.446	66 (23.2%)	215 (75.4%)	4 (1.4%)	0
SMGT 2 (Q20)	I prefer to set my own goals.	4.23	.477	72 (25.3%)	208 (73.0%)	4 (1.4%)	1 (.4%)

Note: Disagree includes "Strongly disagree"

Table 2. Descriptive Statistics (N = 285)

Factor	Overall Mean	Overall Std Dev	α
Motivation (MV)	4.27	0.284	.746
Self-Monitoring (SM)	4.28	0.271	.703
Self-Management (SMGT)	4.23	0.345	.700

their learning (m = 4.28 in Table 2) and to integrate new knowledge with their current schema. Overall the students were very motivated with a mean of 4.27 as shown in Table 2. These highly motivated students maintained their interests in the topic throughout their learning process and completed the tasks at hand.

Overall the study showed that the students were ready for self-directed learning and could learn independently.

5 Conclusion

To conclude, most of the students in this study were found to be ready for SDL. The study findings provide a better understanding about self-directed learning readiness among the students. Also provides evidence on how participants can react with 3D learning environment. It showed that, 3D learning environment can be a reliable extension with self-directed learning environment. Knowledge about the SDL readiness have the potential of working as a motivational tool for students to improve on their independent learning, utilizing SDL hours and preparing themselves for lifelong learning habits. The study also provides evidence that combining SDL with modern 3D urban design can impact positively and strongly among learners'.

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Tse-Kian Neo contributed to the introduction, literature review, discussion and supervision.
Kaniz Farhana contributed to the data analysis.
Angela Amphawan contributed to the data analysis.
Soon-Hin Hew contributed to the data collection and co-supervised.
Mai Neo contributed to the pedagogy and conclusion.

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