Problem Based Learning in Metaverse As a Digitized Synchronous Type Learning

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Abstract

There are four important learning types, which include distance learning and the conventional style. The first one is a non-digitized synchronous type that corresponds to the traditional face-to-face learning. The second one is the non-digitized, non synchronous type. Correspondence education is a good example of it. The third one is a digitized, non synchronous type. It includes general e-learning classes. In addition, a fourth type may be described as digitized, synchronous learning. It is difficult to provide concrete examples for this category. However, some experimental classes in Metaverse fit this description well. Quite a few researchers have already shown some interesting and informative achievements for this type of experimental education. Therefore, we decided to focus on Problem Based Learning (PBL) in Metaverse. In an e-learning system, students can learn at any time and at any place. However, such a learning style also has some demerits. One of them is the lack of socialization in the class. Since PBL promotes a team effort approach for problem solving, it may be one of the answers for overcoming the demerits of e-learning. In this study we synchronously carried out a PBL project with college students in Metaverse.

Introduction

E-learning has been a powerful educational tool for many years. It has a special advantage, in that learning can take place at any time and at any location. This is great for adults with full time jobs. However, e-learning for traditional students still has some problems. In particular, the lack of social skills in e-learning educational programs is a serious flaw from the pedagogical viewpoint. The application of e-learning to engineering education should fit the current needs of manufacturing industries, which require skills for communication, teamwork, etc. for the young engineers of the future. Since e-learning was originally a “classroom for one”(1), it seems to be ill-suited for current and future educational purposes. If e-learning does not overcome its demerits, then it will have limited use in the engineering education field. In addition, each student has a favorite learning style. According to Fukumura et al(2), the students’ learning styles can be classified into four types from the viewpoints of digitization and synchronicity. The first one is a non-digitized synchronous type that corresponds to the traditional face-to-face learning. The second one is a non-digitized, non synchronous type. Correspondence education is an example of it. The third one is a digitized, non synchronous type that includes general e-learning classes. The fourth type is digitized, synchronous learning. E-learning should properly correspond to these various learning styles, so that it can benefit traditional students. Particularly the fourth type of learning could be used to compensate for the lack of social skills in the conventional e-learning method by distance learning. Probably, a TV class through the Internet and Metaverse would be the concrete examples for the fourth learning style. In this paper, we describe a PBL (Problem-Based Learning) model that we established in SL (Second Life), a special type of Metaverse. PBL is an educational tool for creative education and for developing critical thinking and problem solving skills in a team setting. Therefore it was important for us to establish a model that incorporated social skills.

GENELRA SKETCH FOR PBL IN METAVERSE

Fig.1 PBL discussion scene in Metaverse.

Fig.2 Building practice by using prim in metaverse.

PBL makes students struggle with ill-structured problems that relate to their daily lives. For this project the students (as a group in Metaverse) discussed the problem, collected materials to solve the problem, debated about it, and finally agreed in class on a solution to the problem. PBL in real life could be transferred into Metaverse, since the class in it would be synchronous and more realistic than the virtual world through emails, chatting etc.

The PBL class in Metaverse was arranged as follows. First, the participants were classified into two groups. Since the total number of participants was10, each group had 5 members. Some faculty belonged to each group and helped moderate the discussions. Then an ill-structured problem was clearly presented . It was "What will conventional houses in the global warming era look like?" This problem requires the students to devise the structure and function of the typical house of the future through virtual discussions. After practicing fundamental skills used in SL such as basic movements, chatting, building prim, teleporting, etc, the discussion began. Students sat around tables in the classroom and held discussions that were moderated by the teachers (Fig.1). After the discussion, they made the buildings according to the discussion results. They used the technique for prim building that was available to all participants in SL (Fig.2). Finally the groups had a serious discussion about the function and shape of the typical house for the future. After agreeing on a final solution to this problem, each group built a prototype house.

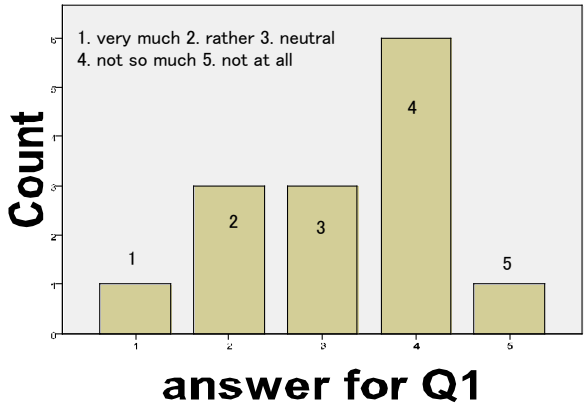

Fig.3 Answers for question 1: Do you feel the class in Second Life worked for you, when compared with the conventional face-to-face learning class?

Their results are presented in another paper[3]. Our current paper now displays and discusses the results of the final questionnaires (which were completed at the conclusion of this PBL project by the students and faculty members taking part in the activity). Usually, the discussion and the final product should have been evaluated educationally. However, this was not done because the current project was just experimental and did not lead to any credits.

After the project was completed, the final questionnaires were sent to the students and the faculty who joined the project. The results were analyzed to clarify the problems and also to discuss the possibility of pedagogical applications. The final questionnaire is provided.

Final Questionnaire
#1: Do you feel the class in Second Life worked for you, when compared with the conventional face-to-face learning class?
1. very much, 2. rather, 3. neutral, 4. not so much, 5. not at all
#2: Do you feel the class in Second Life worked for you, when compared with conventional correspondence education?
1. very much, 2. rather, 3. neutral, 4. not so much, 5. not at all
#3: Do you feel the class in Second Life worked for you, when compared with a conventional e-learning class?
1. very much, 2. rather, 3. neutral, 4. not so much, 5. not at all
#4: What do you feel is the most technically difficult task in SL? Look at the four choices below. If you have an additional task to add, then write it next to the word "other." Rank all the listed tasks (four or five of them) in order of difficulty by putting numbers within the parentheses. For example, if you feel chat is the most difficult task, then write the number one (1) in the parenthesis after the word "chat."
Chat ( )
Prim Making ( )
Basic Movements such as walking, flying, etc. ( )
Teleport ( )
Other: task name, _____ ( )
#5: Would you like to have another SL class activity in the future?
1. very much, 2. rather, 3. neutral, 4. not so much, 5. not at all
The results were recorded and analyzed statistically by using SPSS (ver.17). The Kendall's rank correlation coefficients were calculated among all of the questions, subjects' sex and profession and a model was established.

RESULTS AND DISCUSSION

Figs.3, 4, and 5 show the tendency of learning styles for subjects from the viewpoints of classification such as analogue-digital and synchronous - asynchronous. The face-to-face learning corresponds to a analogue and synchronous learning.

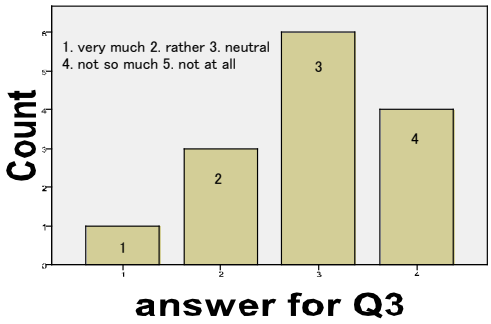

Fig.5 Answers for question 3: Do you feel the class in Second Life worked for you, when compared with a conventional e-learning class?

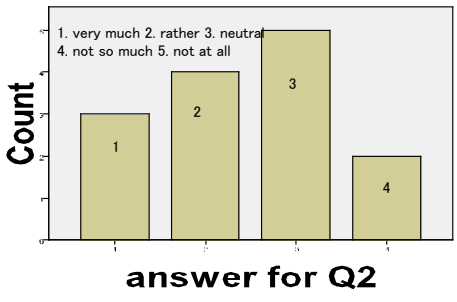

Fig.4 Answers for question 2: Do you feel the class in Second Life worked for you, when compared with conventional correspondence education?

The correspondent education was mentioned as an analogue and asynchronous learning style. The conventional e-learning corresponds to a digital and asynchronous learning style. The final combination of two concepts, digital and synchronous learning style has not been so established well. However, we assume the current PBL class in Metaverse will belong to this final category. Therefore, the results in Figs.3, 4, and 5 indicate what kind of favorite learning styles the subjects had in this case.

On the other hand, the answers for question 4 are shown in Fig.6. They indicate what tasks the subjects felt were the hardest technically. Chat, prim building, basic movement and teleport were mentioned as technical objects. The subjects rated each technique by five steps (using five numbers). These figures suggest that subjects felt chat and prim building were relatively difficult, while they did not feel that basic movement and teleport were so difficult.

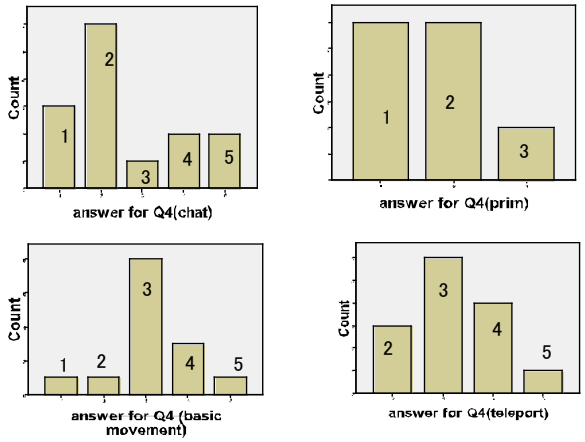

Fig.6 Answers for question 4: What do you feel is the most technically difficult task in SL?

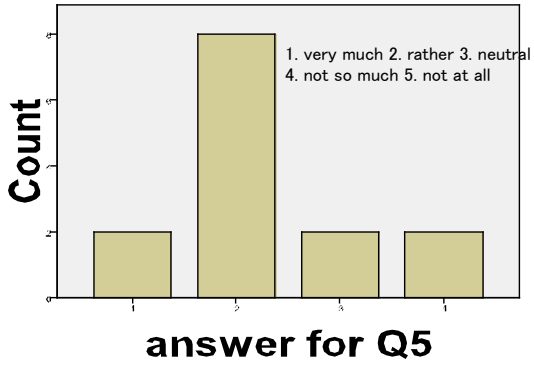

Fig. 7 Answers for question 5:Would you like to have another SL class activity in the future?

Fig.7 shows the answers for question 5. We can consider the answer for the question the satisfaction rating.

The number of subjects who chose the second rating was the maximum and it suggests that most of the participants felt this project was interesting and satisfying.

The Kendall's correlation coefficients were calculated among all of these questions by using SPSS. While most of questions did not correlate significantly, two significant correlation groups were recognized. One was the correlation among questions 1, 2 and 3. These questions correspond to the favorite learning styles for subjects. The results suggest that the positive answers for the Metaverse learning correlate with each other. They are very natural and reasonable, since the strong favorite tendency for Metaverse learning (digital and asynchronous learning) dominated the other types of learning. The more important results were the significant correlation between these three questions relating to favorite learning styles and the question 5 corresponding to the satisfaction rate. Fig. 8 shows the results for the analysis schematically.

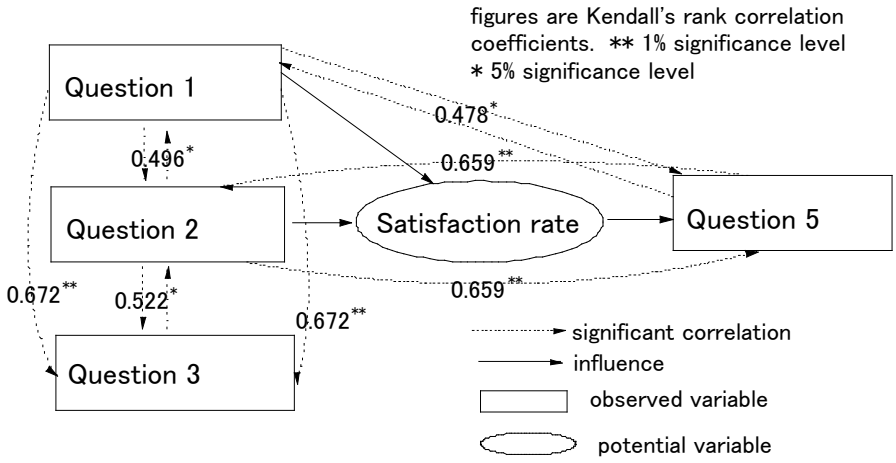

Fig.8 The pass analysis and measurement equation for this model.

The dotted lines among measurement variants (rectangular blocks) show significant correlations. As already mentioned, questions 1, 2, and 3 had significant correlations with each other. On the other hand, question 5 corresponding to the satisfaction rate had the correlation with questions 1 and 2, while it did not have any significant correlation with question 3. Questions 1 and 2 correspond to the tastes digital synchronous learning (Metaverse learning) against the analogue synchronous and asynchronous learning, respectively. The correlation results in Fig.8 indicate that the subjects oriented to Metaverse learning (digital synchronous learning) rather than face-to-face learning (analogue and synchronous learning) and correspondence education (analogue and asynchronous learning) showed the higher satisfaction for Metaverse learning. However, the difference between e-learning devotees and Metaverse ones was not clear, since there were no significant correlations between questions 3 and 5. From all of these results for the calculation of correlation coefficients, a pass analysis was calculated as shown in Fig.8. The solid lines in the figure show the influence among factors. It shows that the subjects oriented to the digital learning (digital synchronous and asynchronous learning) and had the tendency to be satisfied with Metaverse learning (digital synchronous learning).

CONCLUSIONS

In this paper, we introduced PBL in Metaverse and tried to establish a model for digital synchronous learning. Students have many learning styles and the tendency is increasing, since our world is becoming more multifaceted. Education should also correspond to this tendency. The effectiveness of e-learning has been discussed. Some researchers insisted on the no significant difference phenomenon between e-learning and conventional face-to-face learning(4). However, the confused results and discussion could be attributed to the diversified learning styles of students. Metaverse learning can correspond to the diversification of learning styles as one of the new digital synchronous learning methods. This method, when used for PBL in Metaverse, can compensate for the absence of socialization in e-learning. From these viewpoints, the project results described in this paper will broaden the future possibilities for e-learning.

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