Virtual Classroom Environment for Multi-Lingual Problem Based Learning with US, Korean and Japanese Students

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Abstract
For this study, the authors investigated multi-lingual discussions in Metaverse. The research project was planned to serve as an example of virtual, Problem Based Learning (PBL) using e-learning. To start, virtual classrooms were built on an island (owned by Nagaoka University of Technology) in Second Life. Gradually some functions such as chatting, a recording system, web-coupled functions and language grid systems, etc. were introduced. By using these functions and systems, US, Korean and Japanese students were able to carry out multi-lingual discussions in Second Life. The main goal of this project is to establish new educational e-learning tools for international collaboration. The hardest obstacles for international communication are generally the geographical distances and the difference of languages. The former could be solved by using e-learning. The latter could be overcome by some appropriate translation systems. For the latter, a language grid system was introduced into the virtual PBL environment so that students could communicate with each other by using a translation system. This allowed the participants to chat with each other by using their own languages. The project and its results are discussed in detail.

Keywords: PBL, Problem Based Learning, E-learning, Metaverse, Second Life, language grid

1. Introduction
The importance of E-learning for engineering education is increasing because of the current trends in globalization. International collaboration for engineering education, support for foreign students, and other similar activities relate closely to the globalization of higher education. Therefore, it is expected that E-learning may be very useful for these situations. E-learning can be classified into four categories from the viewpoints of synchronous-asynchronous and digital-analogue learning styles. Each style can be effectively applied for different educational purposes. For example, engineers of the future may need to solve engineering problems as part of a multi-national team. Another example is foreign students who may need mental support, counseling, tutoring, etc. in a form that is different from the typical face-to-face format. For these cases, a digitized e-learning system could play an important role. However, the system in such a case should be synchronous. Metaverse (as one of the social media) seems to have the potential as an educational tool to serve this purpose. Some of the authors have already investigated the possibility of carrying out Problem Based Learning (PBL) in Metaverse. They were successful and already established a PBL model in a virtual three dimensional space. In this new study, they applied their model to international PBL among US, Korean and Japanese students. The main goal of the project is to establish new educational e-learning tools for international collaboration. The hardest obstacle for international communication is generally the difference of languages. For this investigation, a language grid system was introduced into the virtual PBL environment so that students could communicate with each other by using a translation system. This allowed the participants to chat with each other by using their own languages. The outline of this project and the virtual classroom environments used for this project are discussed in detail.

2. Virtual Classroom Environments
2.1 Classrooms
Metaverse is a 3D virtual space where Avatars are active on behalf of the human users. Second Life is well-known as the Metaverse, which Linden Research Inc. in San Francisco provides. In the virtual space, one can buy an "island" and establish buildings to virtually operate games, business, education, promotions, etc. Fukumura, one of the authors, bought an island several years ago on behalf of Nagoka University of Technology (NUT). He planned to carry out PBL classes in this virtual space. In order for this to take place, virtual classrooms needed to be established. One of the merits for learning in Metaverse (a form of E-learning) is that it gives one a strong sense of reality (similar to...
learning in real life). Therefore, virtual classrooms were built.

Fig. 1 shows the appearance of virtual classrooms made by using a programming language called Linden Script. For this new research project, involving multi-lingual communication, the students had three discussion topics. The discussions were carried out in separate buildings. Each building was used for a specific discussion. A group of students was assigned to each building, all of which had the same structure. A sign indicating the particular discussion topic (songs, movies, or sports) was placed in front of each building, so that the students knew the locations for the discussions.

Fig. 2(1) shows the inside of the classroom. As shown in the figure, the tables and chairs were prepared just as those in a real classroom. Avatars, who do everything on behalf of the users in Metaverse, sit on those chairs around the table for the discussion. Discussions were carried out by chatting based on character media. From this viewpoint, the tables and chairs might not be needed for the discussion. However, those classroom facilities could provide students with the strong sense of reality, which was essential for the learning in Metaverse.

2.2 Chat Recording and Web-coupled Functions

The blue item (floating in the classroom shown in Fig. 2) was the object made of Linden Script. It could collect chatting (composed of exchanged instant messages) and recorded the conversations. The recorded chatting documents were sent to a Web server by HTTP protocol. Then the documents were saved as readable and writable CSV files, which could be viewed by browsers. The system is shown in Fig. 3(2) schematically.

Fig. 4 shows some of the web-coupled functions schematically. The web display could be shown at any walls of the classroom. The function included almost complete Web Browser functions. Flash and JavaScript could operate with them.

2.2 Language Grid System

Language grid is a multi-lingual service infrastructure. Here, people can share language resources (dictionaries, example-based parallel translation or machine translation, etc.) all over the world, or collaborate with each other. ID and passwords need to be provided by the operational entity.

In Second Life, one can communicate to the outside world by HTTP protocol, using the special scripts. Language grid systems use the function in Second Life. However, Second Life does not have any functions to use the language grid system. Therefore, a relay server is needed.

Fig. 5 shows how the language grid system was introduced into Second Life. Users had an access to the Second Life server at first (process (A)). Then the Second Life server had an access to the relay server in NUT once to utilize the language grid system (B)). Then the relay server had an access to the language grid server by SOAP
protocol (the process (C)). The language grid server had an access to different translation servers that existed discretely, where there were different language services and language resources ((D)).

Fig. 5 Language Grid System and the operation in Second Life

3. Project Outline and Results

Students as subjects were chosen from a high school close to Clarkson University in the US, Yonsei University in Korea and Nagaoka University of Technology in Japan. Participants (nine students) included three members from each educational organization. Also three teachers (one from each country) served as moderators for this PBL project. Students were divided into three groups each of which was composed of three members (one from each country). Three general topics were chosen for the discussion – Songs, Movies and Sports. Since this project was the preliminary stage for future PBL projects and since the students’ grade levels and disciplines were different from each other, the topics for the discussion were selected, so that anyone could easily join the activity. Concretely speaking, the problems were proposed in the following way: Songs classroom: What is the most popular song in your country? Sports classroom: What is the most popular sport in your country? The sessions were held twice at a certain time interval. The participants first got together in a yard of NUT (Nagaoka University of Technology, Fig. 6) for the opening session and announcements. Then they entered their classrooms according to their assigned discussion topics. For the first session, they discussed the topics (on their own) completely in English. However, the discussion for the second session was carried out in their own language with the use of translation software. Every chat in the second session was translated into the other two languages with the use of the language grid system, shown above. The group members remained the same for both sessions. However, the discussion topics were changed for each
session, so that the students would not got used to the topics and the other members. Each discussion continued for one hour. For the second session, students sat down (around a table) on specially prepared language chairs. The US students sat on green chairs, Korean students sat on red chairs and the Japanese students sat on yellow chairs. The language chairs are shown in Fig. 7. When they were sitting on their language chairs, every chat was translated into the other languages simultaneously, as shown in Fig. 8(3).

After each session, questionnaires were given to the participants. The contents of those questionnaires are shown below:

#1: Were you able to communicate with the other members?

#2: Were you able to express your ideas?

#3: Did you understand the other members’ ideas?

#4: Do you have experience in Second Life?

#5: Do you have experience chatting by computer?

#6: Did you feel more comfortable in Second Life than in other communication systems?

#7: If you found any problems in NUT island (the Japanese island), then please feel free to write them in the space provided.

#8: Please feel free to write down your impression of this session in SL.

The results of the questionnaires and the conversation analyses for the two discussion sessions were analyzed. According to the results of this investigation, the following points can be made. The US students were very positive both for the first session and the second session. The Japanese students showed higher satisfaction in the second session than in the first session. The US students could always speak their languages. Therefore, they showed high satisfaction during the sessions. As for Japanese students, the translation made them more relaxed and comfortable, so that their communication became smoother. However, the tendency was not so remarkable for the Korean students, even though they were not English speakers either. The reason could be attributed to the insufficient dictionary used for the Korean language and English. It may be attributed partly to the high English capability of Korean students. However, such a negative factor would be solved by the improvement of the dictionary’s quality. At any rate, the introduction of web-coupled functions, automatic chat recording and the language grid system, made the multilingual discussion more effective among the US, Korean and Japanese students.

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References