

Conversation Analysis of PBL in Metaverse for students from the USA, Korea and Japan

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Abstract — A multinational PBL type discussion among US, Korean and Japanese students took place in the type of Metaverse known as Second Life. The students (who were divided into three groups) had two discussion sessions. One took place without any translation system, and the other with it. A language grid was introduced and used as the translation system. For each session, the groups were assigned a particular topic to discuss. The three topics (which relate to our daily lives) include Songs, Sports and Movies. Each group was composed of a US, Korean and Japanese student, respectively. The students carried out discussions by chatting, which was recorded. Their conversations were later analyzed. The effectiveness of the language grid system was discussed for the PBL in Metaverse in regards to its use in the future.

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Index Terms — Problem Based Learning, Metaverse, Second Life, Language Grid, Multilanguage discussion, e-learning

INTRODUCTION

The importance of Problem Based Learning is increasing for engineering education^{[1]-[4]}. It can enhance problem solving skills for teams of students as well as promote positive learning attitudes. Originally engineers worked together with colleagues to achieve common goals. Now, particularly for engineers in the 21st century, this is essential because of the very rapid and open innovation activities taking place. This type of collaboration will be required on a global scale in the future. The engineering teachers, who have to educate the engineers of the future, need to prepare many educational tools for the youngsters so they can become productive, competitive, and successful engineers. Therefore, the authors focused on PBL using e-learning^{[5]-[10]}, since the educational tool could overcome the geographical disadvantage. This method allows students to learn at anytime and anywhere. Researchers in Japan and the US have already successfully carried out a PBL project for e-learning in Metaverse. In this new educational experiment (carried out in Metaverse) the PBL among students from different countries was planned to enhance international collaboration skills. The greatest barrier for this project was the language variable, since the PBL activity required mutual communication between students from different countries. Therefore, a language grid system was used for the Metaverse learning environment. In this study, the multilingual discussion with the language grid system^[11] was planned and carried out, so that the results would be the effective preparation materials for full-scale multinational PBL in the future.

EXPERIMENTAL

Participants and discussion topic

Students as subjects were chosen from a high school (Edwards-Knox Central 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. To start, three groups were formed. Each one included a student from Japan, the US, and Korea. The groups met twice at fixed dates and times in a virtual island of Metaverse owned by Nagaoka University of Technology. Each group met in a separate building and discussed a special topic assigned to them in advance by the teachers. One group talked about sports. Another communicated about music and the third group discussed movies. Usually, problems leading to the core of classes would be proposed for students. However, this project was just a preliminary one for PBL classes in the future. In this investigation, a special language grid system was introduced into Second Life so that the participants could have fluent discussions (in their own language) with each other about some topics. The researchers investigated the effect of the language grid on the discussions and its usefulness for PBL in the future. The students discussed general topics, so that advanced knowledge in various disciplines was not necessary. The discussions in the first session were carried out in English, while the students spoke in their own languages (English, Japanese, and Korean) for the second one. Tables 1 and 2 show how the students were placed in groups and what they talked about. The topics were changed (for each group) for the two sessions, so that the students would have a fresh impression about their topics.

Table1 Discussion groups and the constitutions for the first session

Discussion group	Group1 (songs)	Group2 (movies)	Group3 (sports)
Japan team	J1	J2	J3
US team	U1	U2	U3
Korea team	K1	K2	K3

Table 2 Discussion groups and the constitutions for the second session

Discussion group	Group1 (sports)	Group2(song)	Group3(movies)
Japan team	J1	J2	J3
US team	U1	U2	U3
Korea team	K1	K2	K3

For the first meeting, the students had discussions in English. Their conversations were not translated into other languages. However, for the second meeting the students communicated in their own languages. This time every conversation was translated into the other two languages simultaneously. For example, a student speaking Japanese would have his /her words simultaneously translated into English and Korean. After the two sessions, all students' conversations were analyzed. They were investigated from various viewpoints to determine the effectiveness of this educational system for global engineering education.

PBL Environments and Its Procedure



Fig.1 Virtual class room on Second Life

Problem Based Learning (PBL) is a class where students try to solve the ill-structured problems proposed by teachers. These are problems (relating to daily life), for which both students and even their teachers don't know the answers. The PBL class generally nurtures students' self-motivated learning attitudes and team solving skills. Particularly, it can enhance critical thinking skills which are indispensable for creativity. In this investigation, the virtual classroom had to be built in Second Life, a type of Metaverse. Nagaoka University of Technology (NUT), to which some of the authors belong, owns a virtual island in Second Life and has built different kinds

of classrooms there where some e-learning classes are already available. For this project, three new classrooms were built. The virtual building in Second Life is generally made by a programming language called Linden Script. Fig.1 shows the appearance of the virtual classroom. Those classrooms have quite the same inside structures as shown in Fig.2. All of the discussions were carried out by chatting based on characters. The discussion was recorded by the object written by Linden Script which was located in an upper part of the classroom. The collected chatting documents were transferred to a Web server by HTTP protocol to be saved as CSV files, which could be read by browsers later.

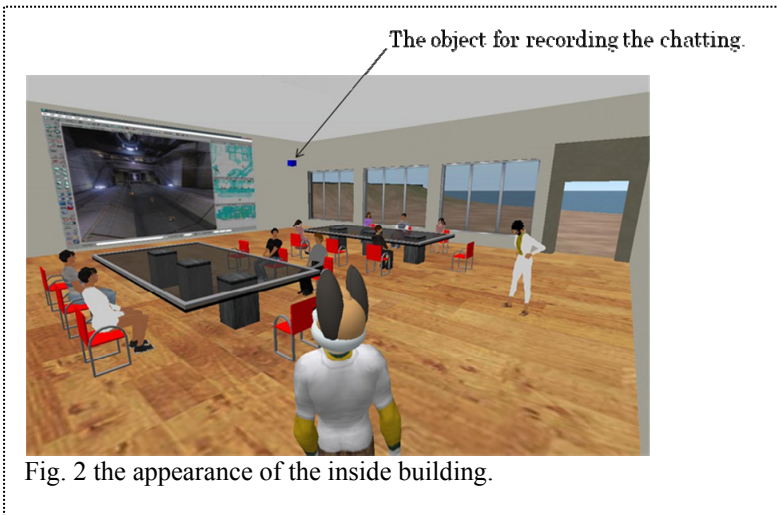


Fig. 2 the appearance of the inside building.

All of the participants (composed of three teachers, 9 students and others) got together in the yard of NUT virtual island at 9:30AM, January 28 (Thursday), Asian time (7:30PM, January 27, Wednesday, US Eastern Time) for their first session. The same members gathered together in the yard of the NUT virtual island again at 9:30AM, February 11 (Thursday), Asian time (7:30PM, February 10, Wednesday, US Eastern Time). After the confirmation for participants and the opening message by teachers, they entered their classrooms to carry out their topic discussions as shown in Tables 1 and 2, respectively. Once entering the building, the students sat in chairs around a table. Then they sat down around the virtual tables and began the discussions about the specific topic that was assigned to them (each team had a specific topic). The discussion topics were assigned as follows.

Songs classroom: What is the most popular song in your country?
Movies classroom: What is the most popular movie in your country?
Sports classroom: What is the most popular sport in your country?

After the one hour discussion, both sessions were closed and later the recorded chatting documents were analyzed and discussed.

RESULTS AND DISCUSSION

The discussion began with greeting each other in every classroom for the first session. An example of the conversation is provided below:

----- An example of the chatting for the first session -----

A: a US student, B: a Korean student, C: a Japanese student

Classroom: Songs

A: My name is XXX and I am from the United States of America.

C: I am XXX from Japan.

B: oh I see

B: what do we discuss?

A: Currently in the United States the most popular song is Bad Romance by Lady GAGA.

B: oh, I know that song.

A: What is the most popular song in your countries?

B: I enjoy that song these days.

C: O

----- end -----

Fig.3 shows the conversation flows for the group 1 at the first session. The number in the figure corresponds to the conversation one. Since the discussion was carried out in English competely, the Japanese student (J1) seldom made his speeches during the discussion. Most of those conversations were exchanged between the Korean student (K1) and the US (U1).

On the other hand, the discussion in Fig.4 belonged to the group2 for the first session. The topic was “movie”. Also for this topic, the center of the conversation was centered around the US student, as shown in the figure. And it shows the discussion was not so active in the case.

Fig.5 shows the discussion flow for the group 3 when they discussed the topic about “sports”. The same tendency could be seen also in this case and the center of the discussion was with the US students.

All of these results show a certain tendency. Even though they might depend on the contents of the topic and the participants’ concern to some extent, the discussion only in English was a barrier for a smooth discussion in general. The

reason should be attributed partly to the language problem and partly to the culture differences. In any case, the problem is essential and critical for effective discussions in multinational projects such as PBL.

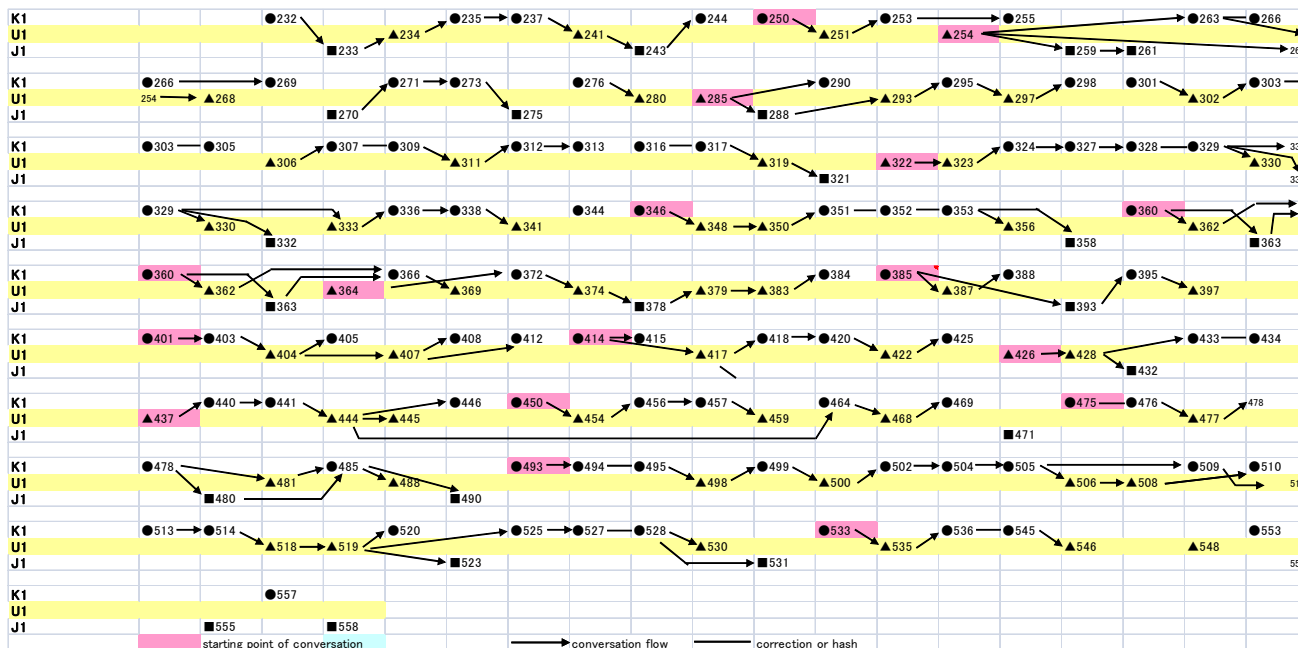


Fig.3 Conversation flows for group 1 at the first session. (Discussion on songs without translation).

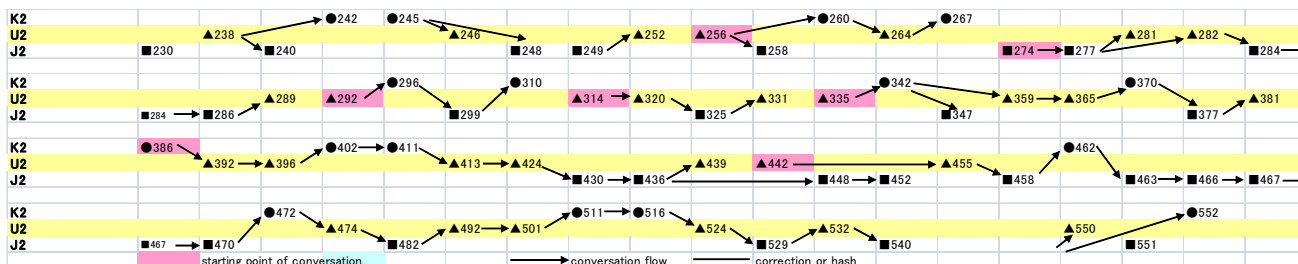


Fig.4 Conversation flows for the group 2 at the first session. (Discussion on movies without translation).

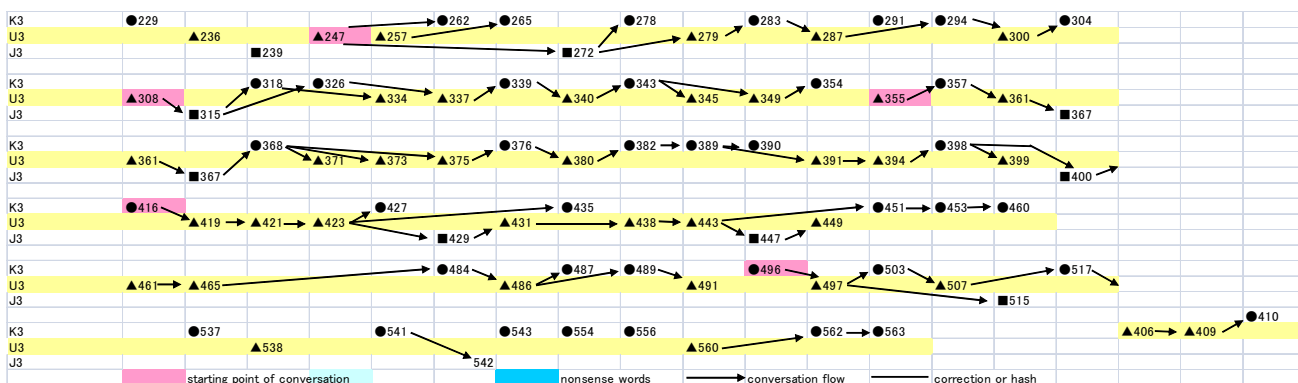


Fig. 5 Conversation flows for the group 3 at the first session (Discussion on sports without translation).

The second session was carried out by the same groups. However, the topics were changed, so that the participants would not have been accustomed to each topic in advance for the second session. This time, each chatting statement was translated into the other two languages at the same time. Fig.6 shows how the translation for chatting looked on the computer screen. For the second session, the language grid system was introduced, as already discribed. Visually, it was realized as a language chair. Students sat down (around a table) on specially prepared language chairs. Concretely

speaking, the US students sat on green chairs, Korean students sat on red chairs and the Japanese students sat on yellow chairs. In Fig. 6^[12], the avatar (the animated figure who does everything in second life.) sat on the green chair and said something to himself in English. Then this statement was promptly translated into the other two languages.



Fig. 6 Language grid system in the second life

speaking, the US students sat on green chairs, Korean students sat on red chairs and the Japanese students sat on yellow chairs. In Fig. 6^[12], the avatar (the animated figure who does everything in second life.) sat on the green chair and said something to himself in English. Then this statement was promptly translated into the other two languages.

The discussion for the second session started in the following way for example.

----- An example of chatting for the second session -----

A: a US student, B: a Korean student, C: a Japanese student

Classroom: Sports

C: こんにちは (Hello. 안녕하세요)

A: Hello, How are you? (こんにちは, どうであるか? 안녕하세요, 어떤가?)

C:元気です (건강합니다)

A: That's great (それはすばらしい. 그것은 훌륭하다.)

B: 안녕하세요. (こんにちは. Hello.)

A: What sports are popular in your country? (どんなスポーツが国でポピュラーであるか? 어떤 스포츠가 나라에서 일반적인가?)

C: 野球だと思います。(야구라고 생각합니다.)

B: 야구가 가장 일반적입니다。(野球が最も一般的です。Baseball is general most.)

----- end -----

The discussion was analyzed in the same way after the session was closed.

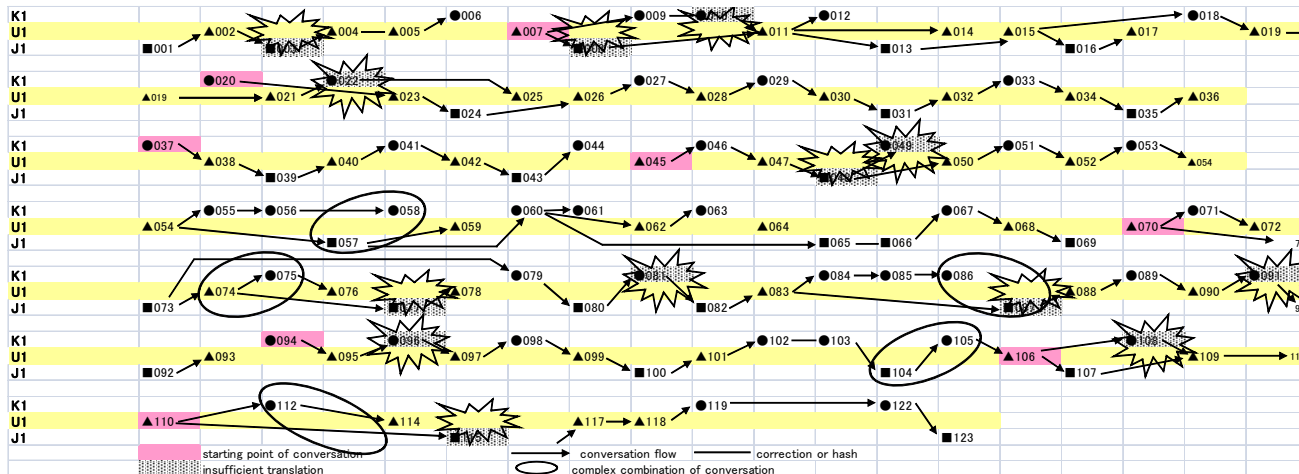


Fig.7 Conversation flows for the group 1 at the second session (Discussion on sports with translation).

Fig.7 shows the results for the group 1 at the second session. When the results were compared to Fig.3, the active involvements into the discussion by all group members was obvious. Particularly, the Japanese member of the group1 was active during the discussion much more than in the Fig.3. In the figure, insufficient translation sometimes occurred. It could be attributed to the quality and accuracy of the dictionary used for the language grid system. As shown in Fig.7, it occurred particularly between Korean and the US students. The results of the questionnaire (completed by the students after the project ended) show that Korean students preferred the first session to the second one. It could be attributed to the insufficient quality of Korean-English translation.

Fig.8 and Fig.9 show the results for the groups 2 and 3 at the second session, respectively. In the former case, students discussed songs and in the second, they discussed movies. They show that the continuities of discussion were obvious and that all participants were involved with the discussion much more than Fig.4 and 5. And it indicates how effectively the language grid system made the participants join the discussion. Also in those figures, insufficient

translation occurred particularly between Korean and the US students. However those negative effects might be found to some extent. The discussion became active with the introduction of the language grid system, as shown in Fig.7 to Fig.9.

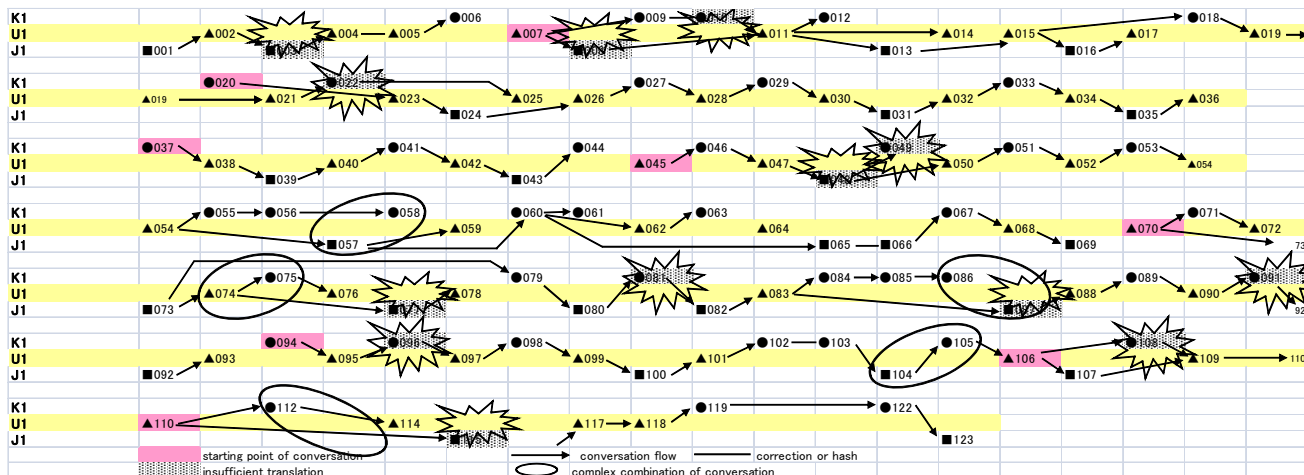


Fig.8 Conversation flows for the group 2 at the second session (Discussion about songs with translation).

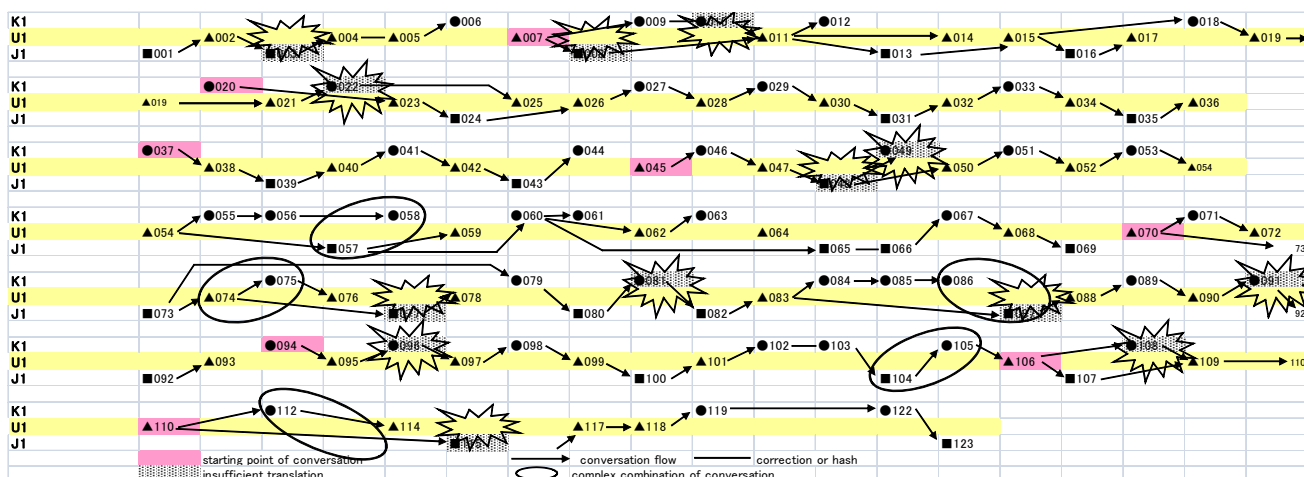


Fig.9 Conversation flows for the group 3 at the second session (Discussion about movies with translation).

The questionnaires were given to the participants and their impressions were analyzed. Those results were written in detail for another paper^[12]. To summarize them, the US students felt very positive for both sessions. They could enjoy the project and felt them to be very informative. Korean students tended to prefer the first session to the second session, even though there was an exception. Japanese students became very active with the introduction of the language grid system. They felt satisfied with the discussion at the second session.

Those results partly depend on the quality of the dictionary used. As shown in Fig.7 to 9, the qualities differed from language to language. However, it was clearly obvious that the translation function by the language grid system made the conversation much more smooth and meaningful.

CONCLUSIONS

The multinational PBL type discussion among students from three countries (the USA, Korea and Japan) was planned and took place in a type of Metaverse, known as Second Life. Its effectiveness was investigated, analyzed and discussed, in regards to the language grid system that was introduced for the translation. As a result, the student discussions with the language grid system enhanced the activity for participants and the continuity for conversation appeared successfully. Particularly, the tendency was found remarkably among Japanese students, while it was not so obvious among Korean students. The results might depend partly on the quality of the dictionary used for the language grid system. Unfortunately, the translation between Korean and English words did not work well. However, the overall impression

among participants was positive and the effectiveness with the language grid system was confirmed successfully in this study.

REFERENCES

- [1] Hideyuki Kanematsu, Shinji Nakayama, Tatsumasa Kobayashi. *Patent Education by Using PBL. Proceeding of Annual Meeting of Japanese Society for Engineering Education*. 2003: The Japanese Society for Engineering Education (JSEE): p. 239-242.
- [2] Hideyuki Kanematsu, Toshihiro Tanaka, Nobumitsu Hirai, Jonho Lee. *Introduction of Patent Education by PBL into Laboratory's Seminar and It's Educational Effect*. Bulletin of Tokai Kagaku Kougyoukai (The Society of Chemical Industry in Midland of Japan), 2003. **239**: p. 1-8.
- [3] Hideyuki Kanematsu, Dana M. Barry. *World First Marslink Mission As Educational Material for Design Skills - As a PBL Class -*. Proceeding of JSEE Annual Meeting, 2007: p. 250-251.
- [4] Daisuke Kuroda, Hideyuki Kanematsu. *PBL Type Creative Engineering Class Using Bicycle in the Department of Materials Science and Engineering*. Proceeding of Teachers' Workshop 2006 by Institute of National Colleges of Technology, Japan, 2007: p. 317-318.
- [5] Dana Barry, M., Hideyuki Kanematsu, Yoshimi Fukumura, Nobuyuki Ogawa, Atsushi Okuda, Ryosuke Taguchi, Hiroto Nagai. *Problem Based Learning Experiences in Metaverse and the Differences between Students in the US and Japan*. International Session Proceedings, 2009 JSEE Annual Conference - International Cooperation in Engineering Education-, 2009: p. 72-75.
- [6] Dana M. Barry, Hideyuki Kanematsu, Yoshimi Fukumura, Nobuyuki Ogawa, Atsushi Okuda, Ryosuke Taguchi, Hiroto Nagai. *International Comparison for Problem Based Learning in Metaverse*. The ICEE and ICEER 2009 Korea (International Conference on Engineering Education and Research), 2009. **1**: p. 60-66.
- [7] Hideyuki Kanematsu, Yoshimi Fukumura, Nobuyuki Ogawa, Atsushi Okuda, Ryosuke Taguchi, Hiroto Nagai. *Practice and Evaluation of Problem Based Learning in Metaverse*. ED-MEDIA 2009 (World Conference on Educational Multimedia, Hypermedia & Telecommunications), 2009: p. 2862-2870.
- [8] Hideyuki Kanematsu, Yoshimi Fukumura, Nobuyuki Ogawa, Atsushi Okuda, Ryosuke Taguchi, Hiroto Nagai. *The Study on PBL Models for e-Learning – As a Series of eHelp Project -*. Proceedings of JSEE Annual Meeting, 2009: p. 584-585.
- [9] Hideyuki Kanematsu, Yoshimi Fukumura, Nobuyuki Ogawa, Atsushi Okuda, Ryosuke Taguchi, Hiroto Nagai, Dana M. Barry. *Problem Based Learning in Metaverse As a Digitized Synchronous Type Learning*. Proceedings of the ICEE and ICEER (International Conference on Engineering Education and Research) 2009 Korea, 2009. **1**: p. 330-335.
- [10] Ryosuke Taguchi, Yoshimi Fukumura, Hideyuki Kanematsu, Hiroto Nagai. *Construction of Problem Based Learning Environment in Metaverse*. Proceedings of the 34th Annual Conference of Japanese Society for Information and Systems in Education, 2009: p. 476-477.
- [11] Takashi Yoshino, Katsuya Ikenobu. *Availability of Multilingual Chat Communication in 3D Online Virtual Space*. Proceedings of The First International Conference on Culture and Computing - Culture and Computing, 2010: p. 77-89.
- [12] Hideyuki Kanematsu, Yoshimi Fukumura, Dana M. Barry, So Young Sohn, Ryosuke Taguchi. *Multilingual Discussion in Metaverse among Students from the USA, Korea and Japan*, Proceedings of KSE 2010, in print