



UNDERSTANDING AND UTILIZING STUDENTS' ATTITUDES TOWARD PARTICIPATION IN DISCUSSIONS BY USING EMOTION ANALYSIS

Mikiko Sode Tanaka

International College of Technology
Kanazawa, Japan

Takao Ito

Kanazawa Institute of Technology
Nonoichi, Japan

Miyazaki Keisuke

Kanazawa Institute of Technology
Nonoichi, Japan

Conference Key Areas: *Methods, Formats and Essential Elements for Online /blended learning, Engineering in Schools*

Keywords: *AI, Group work, PBL education*

ABSTRACT

We propose a method that uses an emotion analysis for PBL education. The emotion analysis is a method of analyzing a person's emotions from the person's remarks or facial expressions. In this method, teachers understand the situation of students from the results of the emotion analysis and give accurate advice.

PBL education often involves group activities. The students conducted groups discuss, propose ideas, select ideas, and make the products. However, not all students are able to participate in discussions and express their opinions. It is the teacher's duty to provide guidance to such students. Therefore, we propose the use of the emotion analysis techniques to identify and guide students who have problems, such as those who cannot participate in discussions. The method is possible for one teacher to grasp multiple groups at the same time and to help developing the students' ability to learn.

Under COVID-19, face-to-face classes were restricted. Online classes using Zoom etc. have also been introduced in PBL education. In online classes, it is difficult to grasp the situation of students. This was a big difference from face-to-face classes. So we looked at ways to keep track of the situation for all students. This is because the gap between students who are willing to take classes and those who are reluctant to take classes has widened due to the shift to online classes. As a result of the adaption to the classes, the number of students who actively participate in the classes has increased. The effectiveness of the proposed method was confirmed.

1 PBL EDUCATION UNDER COVID-19

The educational environment has changed a lot under the influence of COVID-19. The Japanese government issued the first state of emergency and expanded it all over the country in April, 2020. Figure 1 shows the poster that explains the items that should be followed to prevent the spread of COVID-19. The important instruction is “Avoid the three Cs”! Which means to avoid Closed spaces, Crowded places and Close-contact settings. In response to the state of emergency, Kanazawa Institute of Technology (KIT) forbade the student from coming into all the campuses. Classes were started as online classes on April 20. Group discussion in the classroom indispensable for PBL became impossible.

In the Covid-19 vortex, PBL education changed its teaching format from face-to-face to online classes. The problem there was so the difficulty of group activities in online classes. The problem with group activities was that when students were divided into several groups and worked in groups in breakout rooms, the teacher could not fully grasp the students' situation. The teacher can check each group in turn in the breakout room, but the teacher cannot see the whole group at once. To solve this problem, we built a system to support PBL education called "automatic meeting minutes creation system," which is part of AI teacher [1, 2]. AI teacher has a function to keep audio recordings of group activities as text. By utilizing this function, the teacher can give appropriate advice to each group [1, 2, 3]. However, it is time-consuming to understand students' situations from texts. Therefore, we added emotion analysis [4] to this function to improve the teacher's ability to grasp the situation visually.



Fig. 1. Items that should be followed to prevent the spread of COVID-19

1.1 “AI teacher” system configuration

We are developing “AI teacher” for Project/Problem Based Learning (PBL) education using coaching technology. Figure 2 shows the overall structure. The goal of AI teacher is to provide all students with the best possible support and help them reach their full potential. Since it is difficult to increase the number of teachers in charge of classes, we decided to use AI technology.

Students can use chatbots of AI teacher as virtual teachers. They can ask questions that they wonder about in class. Students can also request advice when students are not sure what to do next. The chatbot will provide suggestions based on accumulated past examples. The faculty member checks if the answer is given correctly and registers the answer if there is a problem. This process will help to ensure that good answers are given.

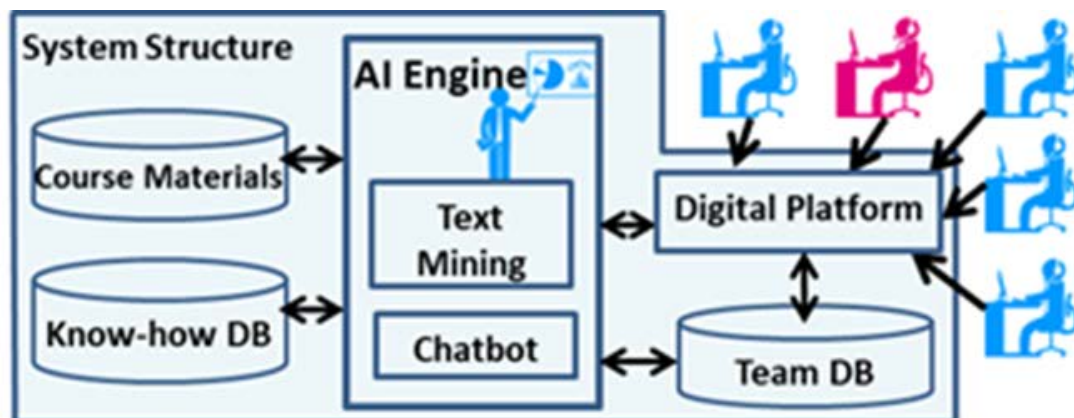


Fig. 2. “AI teacher” configuration

We used AI teacher's minutes function to solve the difficulty of understanding students' attitudes toward the class, which was a problem in online PBL classes [2]. The minutes function allows teachers to keep all of students conversations in text form. It also records who said what. This makes it possible to keep track of the situation even if the teacher is not present. The ability to create a summary from the minutes also makes it easier to understand the content. In addition to these functions, we have added the ability to understand the students' situation through the emotional analysis. Figure 3 shows an image of the emotion analysis results displayed on the screen. Teachers can monitor student status at a glance.

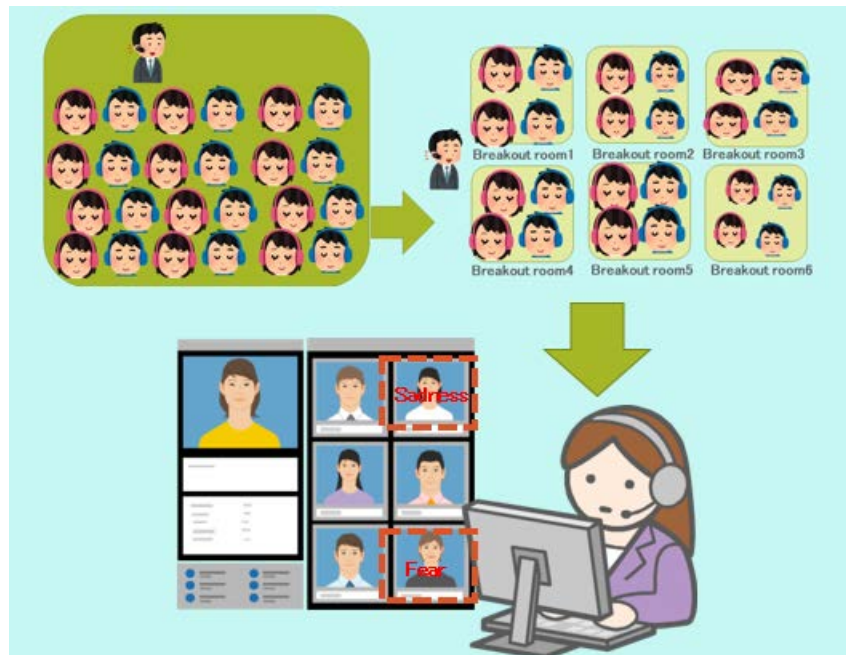


Fig. 3. Using emotion analysis to solve the difficulty of understanding students' learning attitudes in online-based classes

1.2 Emotion analysis

There are four main types of emotion recognition AI today as follow.

- "Voice emotion recognition AI" is a mechanism that recognizes emotions by analyzing physical features such as "voice intonation" and "voice loudness" without depending on a specific language such as Japanese or English.
- "Sentence emotion recognition AI" is a mechanism in which AI reads and analyzes sentences (text) input by humans by natural language processing to judge emotions.
- "Facial expression emotion recognition AI" can read the emotions of the other person from the facial expressions, just like humans do in normal communication. The mechanism is to use a camera that can capture small changes in movement to read the size of the line of sight and pupils and infer human emotions.
- "Biological data emotion recognition AI" is an AI that recognizes human emotions based on data such as biometric information, brain waves, heart rate, and vitals.

We used the sentence emotion recognition AI because it was easier to use online[4, 5, 6, 7, 8].

For the emotion analysis, 8 emotion scores of "anger, fear, disgust, joy, sadness, anticipation, trust and surprise" are extracted and normalized based on the positive and negative evaluations that evaluate the positiveness of students and the basic 8 emotional ideas. We use two popular theories of motivation: the "hierarchy of needs" of Maslow (1943)[6] and the "basic motives" of Reiss (2004) [7] to compile 5 coarse-

grained and 19 fine-grained motivation categories, shown in Figure 4. Our system allows them to check the state of the discussion using colors.



Fig. 4. Theories of motivation (Maslow and Reiss) and emotional reaction (Plutchik)[5].

2 EMOTION ANALYSIS FUNCTION OF AI TEACHER

In this paper, we will introduce the mechanism and effect of group activities supported by AI teacher. And we explain the automatic meeting minutes creation system which is a part of AI teacher. In particular, we introduce the function of notifying the teacher of a student's emotional changes. And we explain the results of its use.

When actually using the automatic meeting minutes creation system, it was difficult to grasp multiple groups at the same time by reading the texts of meeting minutes, and we came to the conclusion that a mechanism that can grasp the situation visually and intuitively is necessary. Therefore, we examined the application of emotion analysis technology.

Automatic meeting minutes creation system performed emotion analysis on the text data, and visualize the results by color. The teacher looks at the screen, If there are many negative colors, teacher read and understand what the students are saying and gives advice. Figure 5 shows the Image of the results of positive and negative evaluations. Figure 6 shows the flow of the automatic meeting minutes creation system for evaluating the student's attitude to participate in the meeting. Students had a meeting by Zoom.

Speaker	Utterance	Emotion
A	Today I would like to consider an idea.	Neutral
B	OK, Where do you start?	Positive
C	How about listening to ideas in turn?	Neutral
D	Eh. I don't like it.	Neutral
E	It's not good.	Positive
A	It's my turn at first.	Neutral

	Positive
	Neutral
	Negative

Fig. 5. Image of the results of positive and negative evaluations

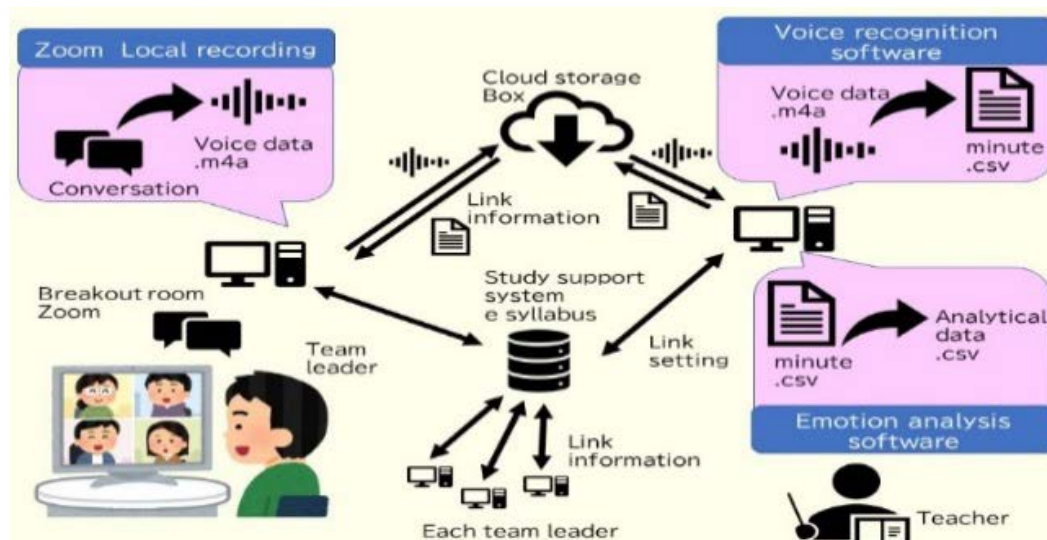


Fig. 6. Flow of Emotion Analysis in a class using Zoom

3 EVALUATION RESULTS

We used an AI teacher automatic meeting minutes creation system in an actual online class. We took a questionnaire at the end of the class. The results are shown in the figure 7. It is a comparison of the class that taught with the AI teacher and the class that did not use the AI teacher. The red bar indicates the degree of satisfaction with the class. We can see that the class using the AI teacher is more satisfying. The

teacher commented, "I understood the content of the discussions in each group and it became easier to proceed with the classes." He also says, "Students seem to feel that the teacher supports all the students in detail, and the students are very satisfied." Another teacher noted, "The minutes made it easier for teachers to keep track of what was going on with each team. The assumption that minutes would be taken encouraged reluctant learners to speak up. It increased the involvement of reluctant learners in team activities."

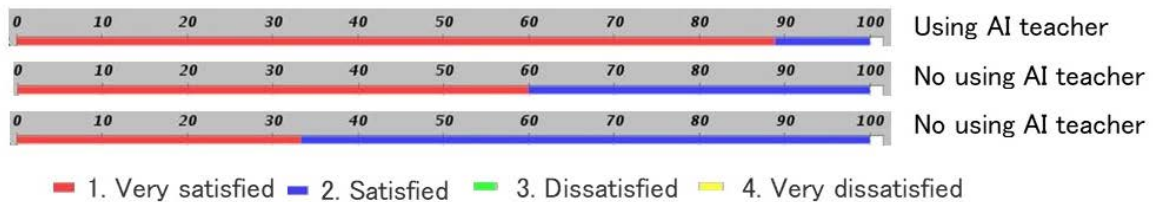


Fig. 7. Questionnaire results regarding classes satisfaction

We asked the teacher to use the emotion analysis function of the AI teacher after the end of semester. The teacher commented, "It is necessary to consider how to use the results of emotion analysis, but I think it is effective for grasping the situation of students."

4 CONCLUSION

We have built a system to support PBL education called AI teacher and are currently testing its effectiveness in actual classes. We have also introduced the emotion analysis technology into PBL education and examined methods for evaluating students' attitudes toward participating in meetings.

From 2020, due to COVID-19, we have been going to use online communication tools such as Zoom to provide online PBL education. The problem at this time was that when students were divided into multiple groups and working in groups in breakout rooms, teachers could not keep track of what was going on with the students. The teacher could check in with each group in turn in the breakout rooms, but could not see the whole group at once. This was a major difference from face-to-face education.

Therefore, we used the AI teacher automatic meeting minutes creation system to record all conversations in the breakout rooms. This enabled teachers to check the progress of each group to see who was taking the initiative and who was not participating well. In addition, by utilizing emotion analysis, it is now possible to understand students' emotions. From the evaluation results, it was confirmed that the system is effective in grasping students' attitudes.



REFERENCES

- [1] Takao Ito, Mikiko Sode Tanaka, Masako Shin, Keisuke Miyazaki, "The online PBL (Project-Based Learning) education system using AI (Artificial Intelligence)," The 23rd International Conference on Engineering and Product Design Education. Denmark on 09 - 10 September 2021.
- [2] Mikiko Sode Tanaka, Takao Ito, Masako Shin, Keisuke Miyazaki, "Group activities with AI teacher support in PBL education," Sefi annual conference 2021, 2021/9/13-16.
- [3] Keisuke Miyazaki, Takao Ito, Mikiko Sode Tanaka, Masako Shin, etl., "Introduction of meeting minutes to PBL team activities and their educational effects —Visualization of contribution to teams using voice recognition AI in online classes—," The 69th Japanese Society for Engineering Education Annual Conference / JSEE Annual Conference Domestic Session Proceedings, 2021/9/8~10.
- [4] Hannah Rashkin, Antoine Bosselut, Maarten Sap, Kevin Knight and Yejin Choi, "Modeling Naive Psychology of Characters in Simple Commonsense Stories," Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics (Long Papers), pages 2289–2299 Melbourne, Australia, July 15 - 20, 2018.
- [5] Paul Ekman, "An Argument for Basic Emotions. Cognition and Emotion," Vol. 6, pp. 169-200, 1992.
- [6] Abraham H Maslow. 1943. A theory of human motivation. Psychol. Rev. 50(4):370.
- [7] Steven Reiss. 2004. Multifaceted nature of intrinsic motivation: The theory of 16 basic desires. Rev. Gen. Psychol. 8(3):179.
- [8] Robert Plutchik. 1980. A general psychoevolutionary theory of emotion. Theories of emotion 1(3-31):4.