Comparison of online group discussion and class discussion learning for a soil mechanics class

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Abstract. Soil Mechanics had been a fundamental science material that needs a great understanding of the concept. Many attempts had been done in varying the study method for this course. An attempt to utilize online discussion learning will be discussed in this paper. To analyze the online learning experience, the Community of Inquiry (CoI) model was utilized. The CoI model divides the dynamic online learning process as social presence, teaching presence, and cognitive presence. This study aims to compare the application of CoI in the Soil Mechanics course between two different types of discussion under the Civil Engineering Department at a large public university in Indonesia. The students of the Soil Mechanics course were given two types of problem-based online discussions for two learning topics. The first one was a case study of Consolidation Settlement in a Group Discussion, while the second one was a case study of Seepage in a Class Discussion, which was done in one single discussion forum. Through quantitative analysis of the students’ discussion transcripts, it was found that cognitive presence was dominantly higher than teaching presence and social presence in both types of discussion. Finally, through an interview with students, it was found that students with active participation gain several benefits, among others, the better ability of systematic and critical thinking of interpreting a problem and growing sense of engineering compare to passive students.

1. Introduction

Soil mechanics is a science used to study the mechanical properties of soil that are required for the design of structures. It involves the study of soil composition, soil strength, and soil consolidation to solve the problem related to geology and construction works. It has a vital role since it is used widely to support civil engineering projects in foundations, retaining walls, earthwork, dams, and other projects [1].

The complexity of concepts and the difficulty of empirical formulas used in soil mechanics has been a concern for many civil engineering students [2]. The module of soil classification, seepage, and the
proprietary software introduced for the design modules in the subject of soil mechanics remains academically challenging for the students [3,4].

The typical teaching method, such as lecture and homework, has been criticized due to promoting passive learning and may not prepare students for a better understanding [5]. To respond to the inadequate teaching method and to enhance the students' learning experience, the improvement of teaching strategies is needed to improve students' satisfaction.

The online discussion learning method is one of the well-known alternative methods implemented in a new educational trend. Due to the advancement of technology, the development of online discussion forums has received much positive attention throughout the world. Experts agree that online discussion forums enhanced student's understanding of the class [6]. There are various advantages associated with online discussion forums. Yam et al [7] note four benefits of online discussion forum: students learned to collaborate to solve problems, increased their responsibility and promote self-regulated learning, learned how to conduct deep learning as they apply basic principles for specific context, and were able to conduct initiative and proactive thinking while being able to formulate plans carefully. Also, an online discussion forum allows students to shift from passive learning to active learning, as all the activities in the online forum are recorded [6].

A Model of Online Learning: The Community of Inquiry (CoI) model was first introduced by Garrison et al [8]. The model identifies the essential elements that are crucial for a successful learning experience in teaching in the higher education process. The model underpinning the theory that active learning occurs between the interactions of three elements: social presence, cognitive presence, and teaching presence [9].

From the previous statements, it can be seen that implementing the online discussion to the Soil Mechanics class would eventually add another teaching method for the students. This attempt leads to several analyses. First, this study aims to compare the application of online discussion learning by using the Community of Inquiry (CoI) model for the Soil Mechanics course between two different types of discussion. This study will also analyze the level of understanding for the class through the trend of the three essential elements of the CoI such as social presence, teaching presence, and cognitive presence. Lastly, the students' obstacles in conducting the problem-based online discussions will be observed through an in-depth interview.

2. Method

2.1. Teaching methods and class situation

The class taken into account for this case is a compulsory Soil Mechanics class for Civil Engineering students in their 5th Semester. Students of the class were already quite well-versed with the online discussion method and had access to an online platform of the class where the lecturer shared discussions and the lesson presentations.

The case study was taken in the first half of the semester. The problem-based online discussion was divided into two different types of discussion for two different topics; Consolidation Settlement and Seepage. The first topic was conducted in a Group Discussion where the students discuss the topic in a small discussion forum, and the latter topic was conducted in a Class Discussion where the students discuss the topic freely in a single discussion forum.

For both discussions, the lecturer posted brief explanations for the problem one day before the class was conducted. Students then had around 12 hours to give their responses and were encouraged to discuss it within the group and gave opinions for the topics. No intervention was done throughout the discussion by the lecturer except for a conclusive comment. Moreover, the comment was given after the physical class was conducted.

2.2. Data analysis of online discussion transcripts

In order to understand the trend of different presence in the forums, quantitative data analysis of online discussion transcripts was analyzed from the messages in the discussion forum. Due to the manageable
amount of data and the convenience of identifying it, messages were used as a unit for the discussion transcript analysis. Below are the examples of each the online Group Discussion and Class Discussion method:

“Hello Virda, regarding the soil settlement, maybe it was caused due to the failure of soil consolidation planning. Thus, when the building is constructed, the weight will be hefty and cause the settlement. Mistakes in planning and constructing can be a very contributing factor.” (Group Discussion message)

“I agree with what Vania said. The seepage that happened can lead to great destruction that will harm humans. That is why it should be carefully calculated when a dam is designed so that seepage would not happen and destroy the dam. Periodic checking should also be done to know whether there is a part of the dam that starts to fail so that it can be immediately fixed and preventing it as a threat in the future.” (Class Discussion message)

The messages were extracted into a file for each respective discussion type and coded by three raters using a coding scheme based on the CoI model developed by Garrison et al [8]. From the three raters, two were both researchers and an expert in the subject, and the other was an online educator but not an expert in the subject. Three categories were used in transcribing the message: cognitive presence, social presence, and teaching presence. The coding results from three raters were then tested using the Fleiss Kappa for its reliability of agreement between the raters. A decision could be accepted when two out of three raters agree on the coding. Finally, the agreed codes were summarized into a presence trend for both discussion types.

2.3. In-depth survey
Following the previous section, the satisfaction level of online discussion was analyzed through an in-depth interview with the students. An interview with six randomly picked students was done two weeks after the first half of the semester was finished. It was conducted orally in an open group discussion with two interviewers. The asked five questions were:

- Could you tell us in details about your experience from the online learning discussion conducted in your class for the first half of your semester;
- What kind of skills did you acquire through the online learning discussion (e.g., discussion skills, able to give opinions, understand opinion from others, etc.);
- What kind of skills that you can implement in real life from the skills that you mention you have acquired through the online learning discussion before;
- Could you tell us any obstacles that you had from the online learning discussion;
- How do you rate your satisfaction from the online learning discussion conducted in the Soil Mechanics class from 1 to 6?

The answers to each question were analyzed and checked with the exam scores for the specific topics. The result would lead to an analysis of the effect of the online learning discussion with the students’ understanding.

3. Results and discussion

3.1. Data analysis of online discussion transcript results
From the messages in both the Group Discussion and Class Discussion, the raters' agreement reached the Kappa value of 0.83 for the Group Discussion and 0.91 for Class Discussion. These values showed that there were almost perfect agreements between the raters, indicating that the results are reliable.

In total, there were 70 messages in Group Discussion, and 27 messages in Class Discussion detected, but some exhibited more than one presence. Thus, raters coded the message for each presence unit, not the message itself. The frequency of each presence unit and its total value can be seen in Table 2. Note
should be taken that from 39 students registered in the class, three students were passive in Group Discussion, and thirteen were passive in Class Discussion.

Table 1. Frequency of presences in group and class discussion.

|                | Cognitive Presence | Social Presence | Teaching Presence | Total Presences |
|----------------|--------------------|-----------------|------------------|-----------------|
| Group Discussion | 66                 | 29              | 32               | 127             |
| Class Discussion | 27                 | 7               | 3                | 37              |

The percentage for each type of presence in the two different types of discussion could be seen in Figure 1. It can be seen that cognitive presence is dominant at both discussion type, whereas there was no significant difference between social presence and teaching presence. This result might be due to the unclear discussion guideline, absence of interruption throughout the discussion, and minimum lecturer participation in the discussion. Although the lecturer had already verified the answers in the conducted class and give comments to conclude the online discussion, it was believed as inadequate.

In terms of message content, most of the messages were questions about detailed information for the given case, clarification of the case, added information from trusted sources by the students, and correct opinions from each other. Some disagreement was seen, but students were able to reach their conclusion at the end.

3.2. In-depth interview and exam results correlation with the discussion

From the previous section, it was known that more students were active in the Group Discussion instead of the Class Discussion forum. Through the interview, it was known that the behavior was due to social pressure from students outside of their focus group is active. They were then felt encouraged to be active and to give more opinions in the forum. Whereas at the Class Discussion, students felt that when their opinion was already represented by others who posted earlier, they lost the will to post a message.

Analysis from the exam score showed that the average scores between the active and passive students did not differ significantly. The result might be due to the type of questions which only evaluate the theoretical skill rather than the analytical. However, through the interviews, it was known that active students in the discussion gained several unmeasurable benefits. Some of the benefits were gaining systematic and critical way of thinking through correctly writing their opinion from trusted references, better ability to express and defend their opinions in the forum, growing the sense of engineering as the
topics were relevant to a real-life context, tendency on making a win-win type of discussion with the other participants, and better ability to listen to other’s opinion without being biased.

Lastly, from the student’s interview, it was known that their satisfaction level of the online learning discussion was 4.2 out of 6, which means that they were quite satisfied with the learning method in the class. Some of the obstacles that they faced were the forum not being quite attractive for the students, late notification of response given by the other students’ to their opinion, and the lack of confidence in their opinion due to the lack of understanding in the field.

3.3. Discussion

The results shown were in line with previous research conducting CoI on a well-versed online discussion method students [6,10]. The dominant presence for the cognitive presence in both the group and class discussion affected the critical thinking of the students. Although not quantitatively proven by the test score from the exam, active students from the interview claimed that the learning method had enabled them to think critically and made them aware of their surroundings. The awareness was likely due to the problems given in the discussion, which was taken from real cases.

Intervention by the lecturer should not be a big problem for the students at their semester, different than the students given training during their first semester [10]. However, from the results previously mentioned, an intervention was still needed by the students. The intervention would give an assurance that they are on the right track for grasping the concept of the discussion. As mentioned before, a lack of discussion guidelines from the lecturer made the students confused and discouraged from giving an opinion on the topic. The low social presence and teaching presence were also due to the inability of the lecturer to project himself as a ‘real’ person in the messages. As such, the students became confused about how to conduct themselves in a forum. From previous research, an increase in social presence would likely increase the cognitive presence. When the three presences are balanced, the goal of an ideal online learning method would likely be achieved.

4. Conclusion

The study was conducted on a Soil Mechanics Class and resulted in several conclusions. First of all, it was known that the Group Discussion gained more messages from the students than the Class Discussion. The main reason was known to be social pressure and recognition of new opinions stated by the students. Second, the cognitive presence was dominant in both the discussion type. This presence is in line with the benefits stated by the students, such as systematic and critical thinking. The benefit is further known to be at many real-life contexts judging by the type of problems given in the discussion. Due to the lack of participation and understanding based on the results, the lecturer should give a guideline of discussion before starting, occasionally interrupt by giving comments to encourage students to participate, and also project himself as a ‘real’ person in the messages. These attempts would likely increase the social presence and teaching presence, which would balance the three presences in the discussion. Lastly, some obstacles were apparent in conducting the online learning discussion in the Soil Mechanics class, such as the forum not being quite attractive for the students, late notification of response given by the other students’ to their opinion, and the lack of confidence in their opinion due to the lack of understanding in the field.

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References

[1] Zhang S-M, Wei G, Zhang S-X and Wei X-J 2003 The Thought and Practice in Teaching Reform of Soil Mechanics *IJEME* 1 pp 55-59

[2] Pinho-Lopes M 2012 Some reflections on the use of cooperative learning model in Soil
Mechanics Course *Shaking the Foundations of Geo-Engineering Education* ed B McCabe et al. (London: CRC Press) pp 301-308

[3] Pinho-Lopes M and Macedo J 2011 Cooperative learning in a Soil Mechanics course at undergraduate level *Eur. J. Eng. Educ.* **36** pp 119-135

[4] Orr T L L and Pantazidou M 2012 Use of case studies in geotechnical courses: Learning outcomes and suitable cases *Shaking the Foundations of Geo-Engineering Education* ed B McCabe et al. (London: CRC Press) pp 105-112

[5] Stump, Glenda S, Jonathan C H, Jenefer H, Wen-ting C and Wonsik K 2011 Collaborative learning in engineering students: Gender and Achievement *Journal of Engineering Education* **100** pp 475-497

[6] Junus K, Suhartanto H, R-Suradjijono S H, Santoso H B and Sadita L 2019 The Community of Inquiry Model Training Using the Cognitive Apprenticeship Approach to Improve Student’s Learning Strategy in the Asynchronous Discussion Forum *J. Educ. Online* **16** 1

[7] Yam L H S and Rossini P 2010 16th *Pacific Rim Real Estate Society Conference* (Pacific Rim Property Research Journal)

[8] Garrison D R, Anderson T and Archer W 1999 Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education *Internet High Educ.* **2** 2-3 pp 87-105

[9] Kanuka H and Garrison D R 2004 Cognitive Presence in online learning *J Comput High Educ* **15** 2 pp 21-39

[10] Junus K, Sadita L and Suhartanto H 2014 *IEEE Frontiers in Education Conference* (IEEE) pp 1587-1592