

Effect of using online active learning platforms on students' engagement and the teaching outcomes

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Summary

Increasing evidence has shown that engagement of the students in the process of teaching and their interaction with the teacher and the teaching material; collectively known as active learning, improves student learning and performance. Oral communication and discussion of the teaching material is a crucial element that ensures interaction of the disseminated material with students' pre-established knowledge. However, majority of the students remain silent during the class and do not participate in the discussions or answer teachers' questions. This study investigates whether use of online active learning platforms can improve student participation in the discussions or answering of teachers' questions, as well as other outcomes such as student learning and course/teaching satisfaction. Online platforms (Mentimeter and/or Kahoot) were used during 8 classroom teaching (SAU: student activating teaching) sessions (medical cell and tissue biology course, bachelor level) and one lecture (Molecular pathology course, master level). The results show that use of online active learning platforms increased participation of the students in oral communication and discussions by 160% in the SAU sessions. In addition, students' opinion about the impact of using online active learning platforms was determined using a questionnaire in which majority of the students indicated that online platforms helped to increase their learning in the class and improved students' satisfaction of the teaching and their interest in attending the class. This study indicates that use of online active learning platforms can increase student engage-

ment in oral communications and class discussions and provides preliminary evidence for beneficial effects of using these online platforms on student learning and satisfaction of the courses investigated in this study.

Background

Active learning is a student-centered teaching approach in which students are actively involved in the teaching process through engagement in activities that require working with the new material and relating them to their pre-established knowledge (Bonwell et al., 1991; Michael, 2006). There has been diverse opinions about whether or not active learning has any beneficial effects on student performance and learning outcomes (Andrews et al. 2011; Haak et al., 2011). However, the largest analysis done to date on the effects on active learning had meta-analyzed 225 studies comparing learning from traditional lecturing to active learning and provides compelling evidence that active learning improves course and performance student learning in science, engineering and mathematics education programs (Freeman et al., 2014). Participation in the discussions in the class has a key role in attaining knowledge through active learning (Bonwell et al., 1991; Leitão, 2000; Michael, 2006; Osborne, 2010; Larrain et al., 2014). However, often majority of the students are silent during the class and it is only a small group of students (19% of the students) who contribute to oral communications in the class by participating in the discussions or answering teachers' questions (non-published, pre-project by Jafari, Villa, and Thomsen, UP2018, University of Copenhagen). Such low level of student participation in the discussions may not only compromise the beneficial effects of active learning on student performance and learning, but also would create a concern for the teacher about whether the subject matter is at all understandable for the passive students (who comprise the majority of the students in the class)? Such concern and uncertainty can have adverse effects on the teachers' performance.

In a previous study on class room teaching, we indicated that majority of the passive students (52%) do not contribute to the discussions or answer teachers' questions due to uncertainty about the validity of their answer/opinion, highlighting fear of failure as a major hurdle to students' contribution to the discussions in the class (non-published, pre-project by Jafari, Villa, and Thomsen, UP2018, University of Copenhagen). Online active learning platforms offer the opportunity for anonymous contribution

to the discussions during the teaching and therefore have the potential to address the challenge of fear of failure. Therefore, in this study, 2 online active learning platforms were used during different teaching sessions and their impact on the students' participation in the discussions, as well as student learning and satisfaction was determined.

Methods

The study was performed during two different types of teaching: class room teaching (SAU: student activating teaching) and lecture. Class room teaching sessions were related to the course medical cell and tissue biology organized by the Department of Cellular and Molecular Medicine, University of Copenhagen. Two classes of medical students (2nd semester) were involved in the study, and each class had 4 individual 2-hours SAU teaching sessions (i.e. total of 8 individual SAU teaching sessions). The number of registered students in the classes was 25 and 21; however the number of students participating in the classes was variable throughout different sessions. The lecture that was included in the study was related to the course Molecular Pathology organized by BRIC (Biotech Research & Innovation Centre), University of Copenhagen. 35 master (MSc) students from Molecular Biomedicine and Human Biology programs were present at this 1 hour lecture.

To assess the impact of online active learning platforms, Mentimeter and/or Kahoot were employed during the teaching sessions. Kahoot platform was used only in the SAU sessions and at the beginning of the class and used for asking questions related to the subject matters covered in the previous sessions (i.e. using of Kahoot started from session 2). Mentimeter was implemented in both teaching types (i.e. SAU & lecture) and was used during the class for asking questions related to the new knowledge and material discussed in that teaching session.

Based on the experience of teaching the same SAU sessions in the previous semesters (since 2016) without using online platforms, the percentage of students who participated in the discussions has been variable, but in majority of the cases was found to be around 20%. Interestingly, our pre-project study performed on the students enrolled in the programming course at the Department of Computer Sciences, Faculty of Science, University of Copenhagen, indicated an almost similar level (19%) of student participation in class room discussions in the absence of using online active learn-

ing platforms (non-published, pre-project by Jafari, Villa, and Thomsen, UP2018, University of Copenhagen). To assess the impact of using the online platforms on the student participation in the discussions, the following numbers were recorded during the class: total number of students present in the class, number of students who used the online platforms to answer the questions or contributed to the discussions, and number of students who volunteered to answer questions or contributed to the discussions. Using these numbers, the percentage of the students who participated in the discussions or answered the questions online or orally was determined in each class at each teaching session. Finally, the average percentage of student online and oral participation throughout all sessions was calculated using the recorded data from the 4 different SAU teaching sessions of both classes (i.e. average of 8 SAU teaching sessions).

To determine students' opinion about the impacts of using online active learning platforms on different outcomes, a questionnaire was used at the end of the last SAU teaching session and after the lecture and students were asked to rank the different statements on a scale 1-5, 1 meaning totally disagree and 5 meaning totally agree. The following statements were used in the questionnaire:

1. Using active learning online platforms made the class more attractive and increased my interest to attend the class.
2. Using active learning online platforms made the learning experience more satisfactory.
3. Using active learning online platforms inspired me to participate in the discussions and to volunteer to answer the teacher's questions.
4. Using active learning online platforms helped to increase learning in the class.

For the questionnaire used after the lecture, the statement number 1 (please see above) was replaced with the following statement: Using active learning online platforms helped to increase duration that I remained engaged & focused on the lecture.

Results

We have previously shown that in the absence of using online active learning platforms, around 20% of the students present in the class participate in the discussions or answer teachers' questions during class room (SAU)

teaching. Interestingly, using online active learning platforms significantly increased student participation in oral discussions, as the average oral participation in the discussions or answering the questions during SAU sessions was increased to 51% (Figure 8.1A). On the other hand, average online (anonymous) participation of the students in the discussions or answering questions during SAU teaching sessions was found to be 80% (Figure 8.1A). The detailed results indicating the percentages of online and oral contributions of the students in every SAU teaching session of individual classes is indicated in Figures 8.1B-C.

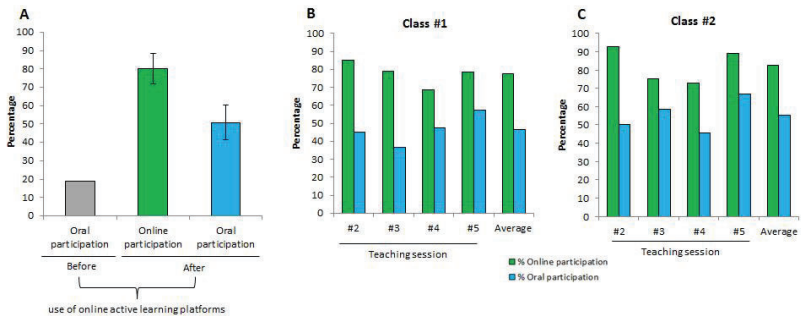


Fig. 8.1. Impact of using online active learning platforms on students' participation in discussions/answering questions. (A) Percentage of online and oral participation of students in discussion/answering questions, before using online active learning platforms and after using these platforms in 4 SAU teaching sessions of 2 independent classes of second semester medicine students. Error bars indicate standard deviation. (B, C) Detailed results indicating the percentage online and oral contributions of the students in each of the 2 classes at each SAU teaching session.

To determine students' opinion about the impact of using online active learning platforms on their learning and their experience of the teaching session, a questionnaire was used. Analysis of the questionnaire results indicated that 86% of the students agreed/totally agreed that using active learning online platforms made the class more attractive and increased their interest to attend the class (Figure 8.2A). In addition, 86% of the students agree/totally agree that using active learning online platforms made the learning experience more satisfactory (Figure 8.2B). Furthermore, 62%

of the students agreed/totally agreed that using active learning online platforms inspired them to participate in the discussions and to volunteer to answer the teacher’s questions (Figure 8.2C). Finally, and most importantly, 81% of the students agreed/totally agreed that using active learning online platforms helped them to increase learning in the class (Figure 8.2D).

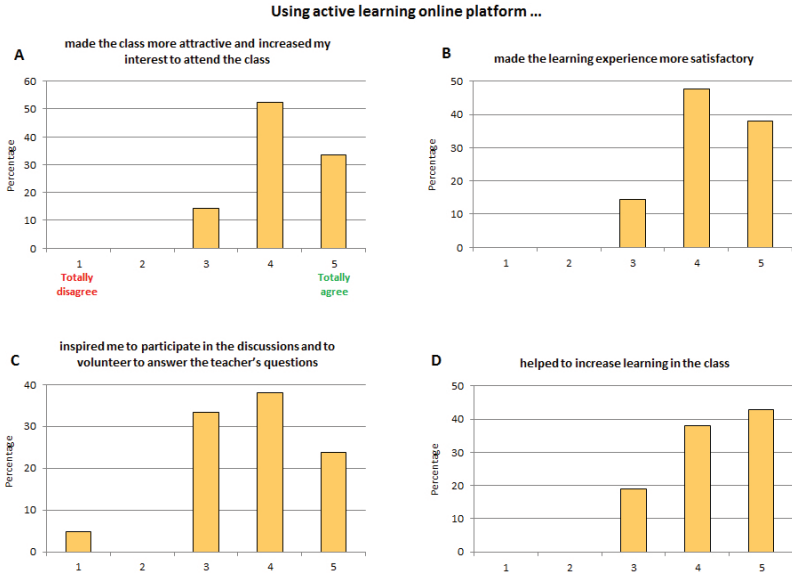


Fig. 8.2. Results of questionnaire about the impacts of using online active learning platforms in SAU teaching sessions on student performance and satisfaction. Students’ opinion about impact of using online active learning platforms on (A) attraction of the class and student interest to attend the class, (B) satisfaction of the teaching experience, (C) inducing interest in participating in oral discussions or answering teachers’ questions, (D) learning in the class.

Analysis of the questionnaire after the lecture indicated that 97% of the students agreed/totally agreed that using active learning online platform helped to increase duration that they remained engaged & focused on the lecture (Figure 8.3A), and 100% of the students agreed/totally agreed that

using active learning online platforms made the learning experience more satisfactory (Figure 8.3B). In addition, 77% of the students agreed/totally agreed that using active learning online platforms inspired them to participate in the discussions and to volunteer to answer the teacher's questions (Figure 8.3C) and finally, 94% of the students agreed/totally agreed that using active learning online platforms helped them to increase learning in the class (Figure 8.3D).

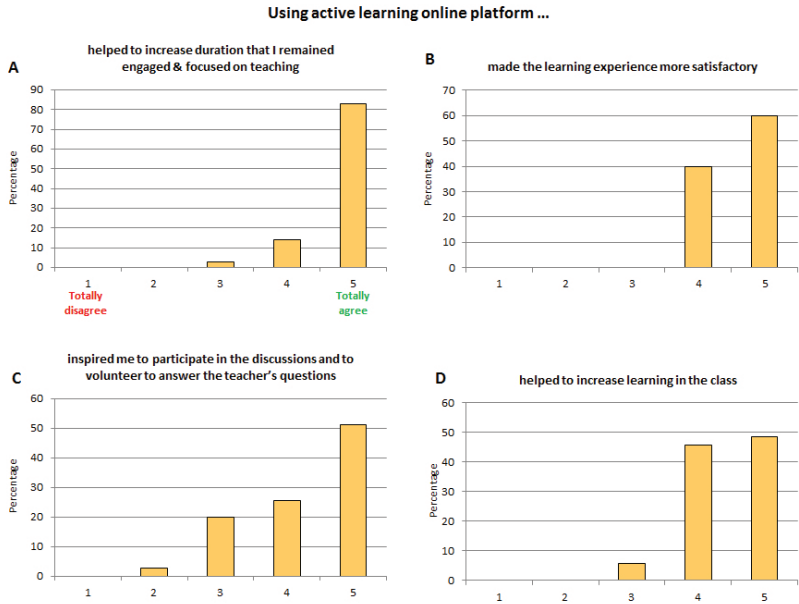


Fig. 8.3. Results of questionnaire about the impacts of using online active learning platforms in lecture on student performance and satisfaction. Students' opinion about impact of using online active learning platforms on (A) Duration of focus on the engagement and focus on the teaching, (B) satisfaction of the teaching experience, (C) inducing interest in participating in oral discussions or answering teachers' questions, (D) learning in the class.

Discussion

This study was aimed to investigate whether using online active learning platforms can increase contribution of the students to whole-class oral communication during the teaching session by participating in the discussions or answering teachers' questions. To this end, two online platforms (Mentimeter and Kahoot) were used during student activating teaching (SAU) sessions and it turned out that this approach had a significant increasing effect on the student participation in oral communications during the class, as number of the volunteers for oral communication in SAU sessions was increased by 168% compared to similar SAU sessions in which online platforms were not used.

In addition, the employed questionnaire in both SAU and lecture teaching determined the opinion of students about the impacts of using online active learning platforms and indicated that majority of the students believed that using these platforms had helped to increase their learning in the class and made the teaching session more attractive and satisfactory. However, one of the interesting observations in this study was that in both SAU and lecture teaching sessions, there were several students who did not agree that using online active learning platforms inspired them to volunteer to participate in oral discussions or answer teachers' questions (Figure 8.2C & 8.3C). This observation is well in line with the findings of our previous study (non-published, pre-project by Jafari, Villa, and Thomsen, UP2018, University of Copenhagen) that indicated some students are not willing to participate in oral discussions under any circumstances possibly due to different personality backgrounds (e.g. being shy), while these students are indeed active during the class and follow the teaching session.

This study provides preliminary evidence that suggest positive impacts of using online active learning platforms on students' oral communication, learning and course satisfaction during lecture and SAU teaching sessions related to the courses; medical cell and tissue biology, and molecular pathology. However, it has to be taken into account that this study had been performed in small groups of students and future studies are required to validate these results using not only larger numbers of classes/students, but also other approaches such as objective testing of the students in terms of their learning outcomes and performance in relation to the use of online active learning platforms. Such studies can include direct comparison of the final examination scores in randomly assigned classes that had been taught by the same teacher, with and without use of online active learning plat-

forms. A limitation of such approach would be possible differences in the performance of the students in these classes, regardless of the use of online platforms. In addition, it has to be taken into account that the results obtained in this study are preliminary and only related to the 2 courses that were investigated and whether the observations of this study would be relevant to other courses in the area of medical biology or other study program is not known and requires further investigation.

Looking at the project retrospectively, it might have been better if the questionnaire was designed to have 3 scale answers (e.g. agree, do not agree, do not know/not sure). The rationale for this statement is that the employed 5 scale answer scheme did not provide extra information in relation to the main question of the questionnaire, which aimed to determine whether students agree or disagree about the different statements and indeed, the level of the students agreement/disagreement (i.e. agree/disagree vs. totally agree/disagree) have not necessarily provided additional information that could be used to help answering the question.

In summary, the results obtained in this study suggest that use of online active learning platforms may be a promising strategy to enhance active participation of the students in the class discussions and oral communications and may exert beneficial effects on student learning and performance.

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