A Mobile Technology-Based Cooperative Learning Platform for Undergraduate Biology Courses in Common College Classrooms

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ABSTRACT

As a high-impact educational practice, cooperative learning uses a structured group study to promote students' active learning. Currently, it lacks economical yet effective tools to facilitate the interactive nature of structured cooperative learning in regular classrooms. Here, we have established a mobile technology-based cooperative learning (MBCL) platform that comprises the 2018 iPad, Apple Pencil, LiveBoard, Google Forms, and Google Drive. We tested the MBCL platform in multipe undergraduate biology courses. During semester-long MBCL studies, the students engaged in cooperative learning to discuss a real-life issue or chapter-based contents. With the MBCL platform, the students' group study processes were shown on shared, visible electronic whiteboards that were updated in real-time, generating visible thinking and instant, interactive communication. The instructor was able to guide the students promptly to conduct knowledge integration and knowledge synthesis using tables and diagrams. The deep learning outcome was evident in the examples and quantitative analyses of students' whiteboard study results and team presentations. Thus, integrating innovative mobile technologies into high-impact teaching practices, exemplified by the MBCL platform, promotes deep learning in higher education.

INTRODUCTION

- Cooperative learning:
  - A high-impact practice in which students form small study groups or teams to complete structured assignments toward a common learning goal through cooperation[1]
- Research questions:
  - What innovative teaching tools can help instructors conduct and guide cooperative learning in common classrooms toward deep learning?
  - How can the iPad mobile technology be utilized to promote deep learning in structured group studies? [2]
- Our hypothesis:
  - By integrating the iPad and Apple Pencil into high-impact practices, such as cooperative learning, we can promote students' deep learning via real-time, dynamic interactions and visible thinking.

The Mobile Technology-Based Cooperative Learning (MBCL) Platform

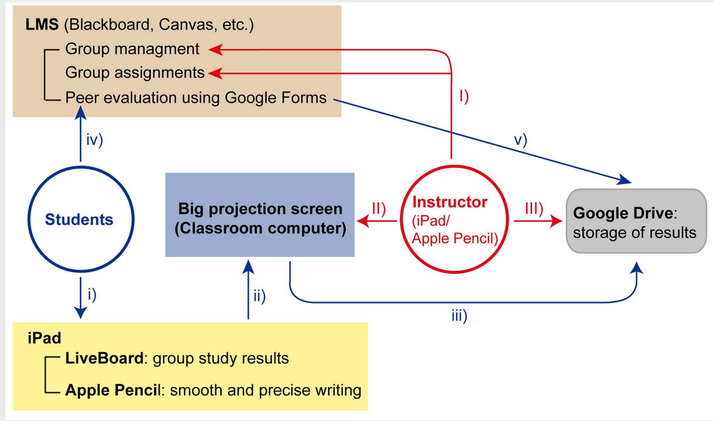

Fig. 1. The major components and workflow of the MBCL platform. In MBCL studies, the student-generated information flows in blue. The instructor carries out the tasks indicated in red.

Classes	Student majors
Microbiology Lecture (BIOL 265), Fall 2018	Biology (2 students), Health Science (12), CLS (2), Veterinary Technology (3), and Undeclared (1)
Genetics (BIOL 360), Fall 2018	Biology (13), Health Science (2), and CLS (3)
Immunology (BIOL 310), Spring 2019	Biology (1), Health Science (3), CLS (3), Veterinary Technology (1), and Undeclared (2)
Genetics (BIOL 360), Fall 2019	Biology (8), Health Science (4), CLS (1), and Undeclared (2)
General Biology I Lecture (BIOL 160), Fall 2019	Biology (9), Health Science (7), Veterinary Technology (12), Exercise Science (1), and Undeclared (1)

Table 1. Participating classes. The numbers in parentheses are the student numbers of the majors. CLS: Clinical Laboratory Science.

RESULTS

- MBCL promotes deep learning in knowledge identification, integration, and synthesis.

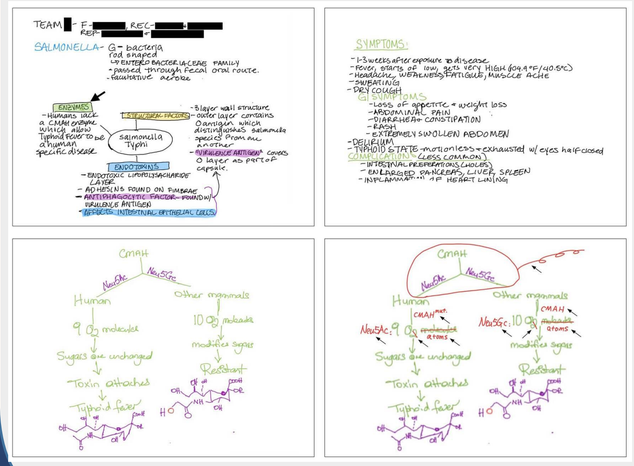

Fig. 2. A representative result of the MBCL study in Fall 2018.

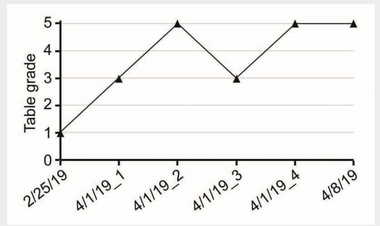

Fig. 3. Grades of student-generated tables in the MBCL studies in Spring 2019.

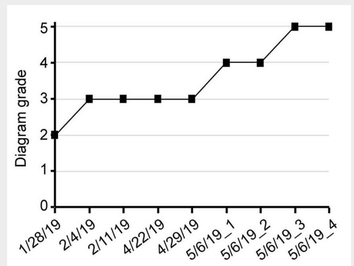

Fig. 4. Grades of student-generated diagrams in the MBCL studies in Spring 2019.

- MBCL improves students' learning outcomes when compared to the traditional method during cooperative learning activities.

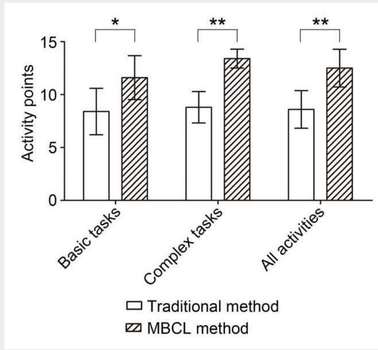

Fig. 5. Comparison of the grades of student-generated diagrams. (Error bar: SD; *: P<0.05; **: P<0.01)

- Students approved the major benefits of the MBCL platform.

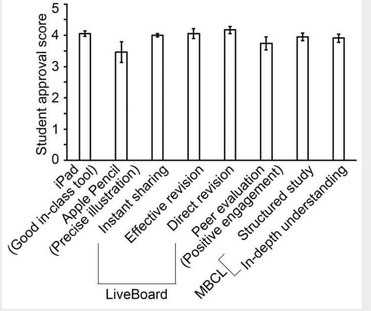

Fig. 6. Students' approval rates on the major aspects of the MBCL platform in the Microbiology Lecture, Genetics (Fall 2018), and Immunology classes. (Error bar: SD)

CONCLUSIONS

- We have established an iPad-based teaching platform.
- MBCL facilitates cooperative learning in common college classrooms without special requirements of fixed equipment.
- Real-time communication and visible thinking generated by MBCL promote students' performance in cooperative learning activities.

REFERENCES

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