EXEMPLAR: QUASI-EXPERIMENTAL STUDY

Project: Effects of a quasi-experimental study of using flipped classroom approach to teach evidence-based medicine to medical technology students

Background
Flipped classroom methodology is recognised for enhancing learning efficiency and fostering the application of advanced knowledge. To assess the impact of this approach on teaching evidence-based medicine (EBM) to medical technology students, the study conducted a non-randomised controlled trial involving six customised EBM courses using the flipped classroom model specifically designed for this student group.

The Intervention
In this study, aiming to emphasize on medical technology educations, we designed a Flipped Classroom EBM (FC-EBM) course tailor-made for medical technology students. The design and the procedure of the course were explained before class. Course preparation consisted of the following tasks: (1) Establishing a learning platform, (2) Course description, (3) Counselling mechanism and (4) Gather information. Activities during class incorporated various components: (1) Student grouping and (2) Curriculum planning.

The teaching materials of the flipped classroom course were stored on the digital learning platform, while the teaching materials of the traditional course were supplied in paper format.

The trial developed a customised Flipped Classroom EBM (FC-EBM) course tailored specifically for medical technology students. Before the course began, the researchers provided a detailed explanation of the course design and procedures. Course preparation encompassed several key tasks, including (1) establishing a digital learning platform, (2) creating a comprehensive course description, (3) implementing a counselling mechanism, and (4) gathering necessary information. Within the classroom setting, various activities were integrated, such as (1) organising students into groups and (2) planning the curriculum.

The teaching materials of the FC-EBM were accessible on the digital learning platform, whereas the traditional course relied on paper-based teaching materials.

Methods
Trial Design
This trial adopted a quasi-experimental design with medical technology interns to understand whether the implementation of the flipped classroom approaches affects the learning efficiency of EBM for this group.

Students in the intervention group attended the flipped classroom course, while students in the control group attended the traditional course. The learning outcomes were evaluated by Fresno test in both groups once a week for 6 weeks and performed the Fresno test 1 week after the end of the course.

The Fresno test is a standardised and objective tool to measure one's competence on the application of EBM [24]. It consists of four domains that include the following: asking clinical question (PICO question), searching strategy, developing critical appraisal skill and applying to clinic. The duration of the test was 30 min. To provide a detail description of the opinions and attitude of implementing flipped classroom to EBM trainings, self-made 14 questions satisfaction survey (Likert 5-point scale) and open-ended questions were used in intervention group.

In addition, to understand student's perceptions on the flipped classroom approach, students in the experimental group were required to fill in a satisfaction survey and answer some open-ended questions.

Intervention and Control Groups

A total of 62 medical technology students from Kaohsiung Chang Gung Memorial Hospital were enrolled for this study. The control group consisted of 24 students who attended the Traditional course EBM (TC-EBM). The experimental group consisted of 38 students who attended the FC-EBM. All participants had no previous in attending EBM and flipped classroom course.

The age, gender and education level were similar in both the intervention and control group. Most of the participants are college students and most of them are female. Fig 1 shows the course timing and curriculum information of the different teaching models. Both groups used the Line app as the information technology. The teacher, the assessors, the number of lecture and the study cases were identical in both groups. Only the number of students in each discussion group was different in each group.

Fig 1. Class format for control and intervention group (source: Huang et al. 2020)

	Control group (TC-EBM)	Experimental group (FC-EBM)
Prior to class		Read eBook and video material
In class	Standard lectures Q&A session	Problem set Q&A session
After class	Problem set	
Curriculum information		
Teacher	The same	
Course session (total duration)	6 sessions (6 h)	6 sessions (3 h)
No. of student in a group	4~5	2~3
Assessors	Two teachers who did not teach the course (the same teachers in both groups)	
Study cases	4 study cases (1) Does an apple a day really keep the doctor away? (2) Does apple really have an anti-tumor effect? (3) Can wearing compression socks prevent deep vein thrombosis? (4) How to reduce the hemolysis rate?	

Analysis

The demographic data for the control group and the experimental group were examined via chi-square and two-tailed t-tests. Continuous variables were presented as mean ± standard deviation and were analysed with Mann-Whitney U test.

Results

- The Fresno test scores of the intervention group were significantly higher than that of the control group.
- A FC-EBM course improved diagnostic skills compared to traditional teaching.
- FC-EBM aligns with medical technologist training and encourages active learning.
- Flipped classrooms engage students in advanced learning, critical thinking, and metacognitive strategies.

- From the results of the satisfaction survey, we know that students were satisfied with this course format. Students claimed that the flipped classroom approach could improve their learning efficiency and the interactions with teacher could help them to think more deeply.

Limitations

- Inability to randomly assign participants in an educational setting.
- Small number of participants in this quasi-experiment, requiring further research with larger groups for general consistency.
- Student performance may be influenced by teacher expectations, could have affected the results.
- The course had only 6 classes with a total of 3 hours of training time, which may not be sufficient for predicting long-term training performance.

Conclusion

To conclude, most students showed positive attitudes and views on flipped classroom strategy. Moreover, students' questions were solved more effectively during class resulting in an improvement of effectiveness of evidence-based medicine trainings.

Note

This example is based on the article below. Please refer to the article for a comprehensive understanding of the trial and its protocols.

Huang, H-L, Chou, C-P., Leu, S., You, H-L., Tiao, M-M. and Chen, C-H. (2020). Effects of a quasi-experimental study of using flipped classroom approach to teach evidence-based medicine to medical technology students. *BMC Medical Education* 20 (31) https://doi.org/10.1186/s12909-020-1946-7