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Effectiveness of Flipped Classroom in Pharmacy Education – A Meta-Analysis

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Cui, H[1]; Xie, XY[2]; Wang, BY[3]; Zhao, Y[4].

Corresponding author:
He Cui

c-he@outlook.com

Author Affiliation:
Hebei GEO Univerisity.

ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 31 August 2023 and was last updated on 31 August 2023.

INTRODUCTION

Review question / Objective Flipped classroom, blended with online and offline learning, was regarded as an effective learning approach in pharmacy education. This meta-analysis was to comprehensively compare the effectiveness of flipped classroom and traditional lecture-based approaches, attempting to generate a unified and firm conclusion of the effectiveness of flipped classroom in pharmacy education.

Condition being studied Flipped classroom, a form of blended learning, took advantage of asynchronous lectures and in-class interactive activities. Flipped classroom is defined as a method that instructors expose pre-work to students outside of class, and then use class time to arrange the harder work of helping assimilate that knowledge, through problem-solving, discussion, or debates.

One of the most important advantages of flipped classroom is student-centered learning, through which students can actively engage in classroom and interact more with instructors. Before class, students have already familiarized the learning contents through posted materials. Then, lecturers undertake a series of activities to inspire the interests of students, including presentations, patient case discussions, classroom games. These interactive learning activities transform passive acceptance into active learning, thus enhancing critical thinking and innovation ability. Additionally, through group discussions and problem-solving processes, students are able to learn more effectively from their fellow students rather than instructors.

METHODS

Participant or population Pharmacy students, who attended courses in pharmacy curriculum

from higher education programs, were included in this meta-analysis.

Intervention Flipped classroom was conducted in experimental groups, which included pre-work prepared by teachers, self-directed learning before class, and in-class interactive activities between students and lecturers, while control groups were equipped with a traditional lecturer-centered teaching method as a comparison. The course should ensure the same credit hours, class time, and same course topics prepared for students between the experimental and control groups.

Comparator The control groups were equipped with a traditional lecturer-centered teaching method as a comparison.

Study designs to be included We included studies designed to explore the effectiveness of flipped classroom in pharmacy education in comparison with traditional classroom or lecture-based pedagogy. The studies should include objective evaluation of students' performance, like course grades or GPA.

Eligibility criteria Articles were excluded if: published studies lacked the required control group; published studies lacked sufficient extractable data or calculable effect size; students included in the meta-analysis were from K-12 education; written language was not English or Chinese; studies were published before 2000.

Information sources Data were collected up to October 10th, 2022 from the following databases: Cochrane Library, PubMed, Embase, ScienceDirect, Web of Science, China National Knowledge Infrastructure (CNKI), and Chinese Biomedical Literature Service System (SinoMed). The following keywords were selected: ((flipped classroom) OR (flipped education) OR (flipped learning) OR (reverse classroom) OR (backward classroom) OR (inverted classroom) OR (inverse classroom)) AND (pharmac*). The search strategy was imported as a string and searched independently in these 7 databases.

Main outcome(s) Course grades or examination scores served as main indicators to evaluate the effects of the flipped classroom and traditional lectures. The contents and forms of these assessment instruments must be similar or identical between the experimental and control groups.

Data management Two authors independently reviewed each article, and extracted data involving the first author, published year, countries, sample size, pharmacy course type, student level, intervention measures, contrast pedagogy, and outcome indicators. When there were different opinions, the authors resolved them through discussion or adjudication by the third reviewer.

Quality assessment / Risk of bias analysis The Effective Public Health Practice Project (EPHPP) Quality Assessment Tool was employed to assess the methodological quality of studies, due to its suitability for both interventional and observational studies. According to the EPHPP tool, the following items were taken into consideration: selection bias; study design; confounding factors; study blinding; data collection; withdrawals and dropouts. The quality of studies was rated as Strong, Moderate, and Weak. Based on the number of weak ratings they received, the overall rating was also rated as three levels: Strong (no weak ratings), Moderate (one weak rating), and Weak (two or more weak ratings).

Strategy of data synthesis Qualitative analysis was undertaken by the Stata/SE version 16 (StataCorp LLC, College Station, TX). The standard mean difference (SMD) with the random-effects model was adopted for data pooling, which extracts average mean and standard deviations (SDs) from studies. Considering that educational research usually included multiple effect measures, we extracted the data separately according to the types of effect measures. When a study incorporated several similar effect measures, we chose the most suitable one to present the outcome required for the meta-analysis. If one study included different students' performance data used to evaluate different parts or modules of one course, we incorporated these independent group comparisons separately. For instance, subsets of examination were usually used to evaluate different modules of a course, for precisely evaluating student performance. For studies that lacks of required data, such as average means and SDs, we contacted the authors by email. Studies would be excluded if we could not obtain the required data.

Subgroup analysis Subgroup analysis was undertaken to evaluate the effects of different contexts on the outcome measures, including countries, degree programs, etc.

Sensitivity analysis I-squared statistics were conducted to evaluate the heterogeneity of effect sizes. The standard mean difference (SMD) with the random-effects model was adopted for data pooling.

Country(ies) involved China.

Keywords flipped classroom, pharmcy education, learning effects.

Contributions of each author

Author 1 - He Cui performed the statistical analysis and wrote the first draft.
Email: c-he@outlook.com
Author 2 - Xinyu Xie contributed to the first draft.
Author 3 - Boyang Wang carried out data collection and data coding.
Author 4 - Yuan Zhao contributed to the revision of the manuscript.