Comparing The Effectiveness of Blended Learning and Traditional Learning in An Orthopedics Course.

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Research Article

Keywords: blend, effectiveness, learning, orthopedics, traditional

Posted Date: September 20th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-852260/v1>

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Version of Record: A version of this preprint was published at Annals of Medicine and Surgery on November 1st, 2021. See the published version at <https://doi.org/10.1016/j.amsu.2021.103037>.

Abstract

Background

The ongoing Covid-19 pandemic is driving medical schools to replace substantial parts of the traditional lecture method with online formats to maintain social distancing guidelines, and reduce face-to-face contact in the classroom. To our knowledge, there were a few studies comparing the effectiveness of traditional teaching and blended teaching based on the students' final grades which the efficacy of online learning is still controversy. This study aims to compare the efficacy of blended teaching and conventional teaching in an orthopedics course.

Methods

This study was a retrospective cohort study which collected from fifth-year medical students between April 2019 and March 2021. The students were divided into two groups which based on years of education. The summative assessment was based on summing the MCQs plus KFs, the MEQ plus oral exam, OSCE, simulated-chart of patients, and OPD. All students were subjected to the same end of course quizzes with no difference between the groups regarding the kinds of knowledge tested. The results of these quizzes were used to compare the effectiveness of the conventional teaching in 2019 and the blended teaching in 2020. The paired t-test was used to analyze the data.

Results

A total of 252 students were enrolled in this study, of whom 128 and 124 patients were in traditional teaching group or blended teaching, respectively. The grade point averages of the students were 3.2 ± 0.4 and 3.3 ± 0.4 in 2019–2020 and 2020–2021, respectively, without significant difference ($p = 0.06$). The scores in blended learning group were higher than in the traditional learning group in all assessment tools (MCQ, KF, Oral, and OSCE scores) except the MEQ.

Conclusions

Blended learning was as effective as traditional learning for teaching medical students. However, well-designed, randomized controlled trials are needed to further analyze the educational structure and investigate the factors related to the effectiveness of this type of learning.

Introduction

The ongoing Covid-19 pandemic is driving medical schools to replace substantial parts of the traditional lecture method with online formats to maintain social distancing guidelines, and reduce face-to-face contact in the classroom. The most common teaching method in medical education is the lecture. The

advantage of a lecture is that it is able to transfer information from medical educators to a large number of students at the same time, and it is a simple and effective way of conveying factual information [1]. It is an effective way of conveying core knowledge and explaining difficult concepts, generates increased learning, increases student engagement, and activates self-directed learning [2]. However, in recent years computers and other electronic tools have been increasingly used in medical education, and electronic learning has been found to meet the needs of medical students [3].

Online learning has increased in recent decades. The advantage of online learning is that students can learn anywhere and anytime. There are also several disadvantages of online learning, however, which can be seen in many ways, such as the lack of social support, especially peer support, and the lack of physical visibility of the instructor [4, 5]. While online learning has been increasing, traditional classroom instruction in the form of didactic lectures has declined in recent years, facing criticisms such as failing to promote engagement and less effective due to its one-way communication basis.

Blended learning has various definition in the previous literature. The absolute definition for blended learning is not clear [6]. The combination of traditional and online learning was defined by Graham [7], whereas Lotrecchiano et al. [8] gave the definition as blend of structured and unstructured learning. For medication students, the clinical skills are needed. Therefore, the blended learning is crucial for medical students. The ongoing Covid-19 pandemic is driving medical schools to replace the traditional lecture method with online formats to maintain social distancing guidelines, and reduce face-to-face contact in the classroom. The effectiveness of online teaching is still controversial, with some studies [9, 10] examining the effectiveness of online teaching compared with offline teaching and finding that the conclusions did not yield consistent results. The most recent systematic and meta-analysis study concluded that there is no evidence that offline learning works better and that the advantage of online learning is to improve students' knowledge and skills depending on the teaching [11]. Therefore, the aim of this study is to compare the effectiveness of traditional teaching and blended teaching based on the students' final grades. Our hypothesis was that there would be no differences between the methods.

Methods

Design and study participants

This was a retrospective-cohort study performed at the Department of Orthopedics of medical center in South-East Asia based on data collected from the department's fifth-year medical students between April 2019 and March 2021 to compare the efficacy of blended teaching and conventional teaching. Normally, our department teaches a one-month course in Health, Disease, and Rehabilitations in Orthopedics which is broken down into two parts. The codes of this course were 388-571, and 388-572. In 2019-2020, the course consisted of sixteen conventional lectures delivered by face-to-face instruction in the classroom, as well as other activities such as outpatient clinics, in-patient clinics, attending/assisting in the operating room, interactive meetings with case-based discussions, and practice of basic orthopedics skills.

However, the covid-19 pandemic began in 2020, peaking in March and April, and although the medical students began their new semester on May 1st as normal, new teaching practices were developed to ensure the safety of the students. Our faculty education team divided the 5th year medical students into 12 rotations: pediatrics, surgery, internal medicine, obstetrics-gynecology and family medicine for two weeks each, and orthopedics and emergency for one week each, and instructed every department to do online learning whenever possible. Each department was in charge of its own online course. Our orthopedics department decided on a blended learning approach, beginning with a one-week online course, followed by three weeks of traditional training in the outpatient clinic, in-patient clinic, and operating room.

The orthopedic online course included a variety of activities over the one-week period, including 16 online lectures, live meetings with medical educators through the zoom application, and shorter segments such as traumatic film interpretation, upper limb disease case-based discussion, lower limb disease case-based discussion, and an assignment about spine disease. The live meetings activities developed in order to engage our student to online course and also created the social support from medical instructors and their peer. These activities comprised of one and half hour per session from Monday to Thursday. The onsite learning included the necessary face-to-face practices such as out and inpatient clinics, operating room attending/assisting, and basic orthopedics skills as taught during a normal semester.

E-learning program

During the online course, the medical students were graded on the online content using Moodle, an online learning management system created by our institution. Using the program available at online website, both students and medical instructors evaluated the students' work. Course information, lecture notes, and other teaching materials were included in the teaching materials.

Assessment instrument

There are many common assessment tools available for assessing students grouped by Miller's levels of competence [12]. The assessment of this course comprised formative assessment and summative assessment. For the summative assessment, multiple choice questions (MCQs), key features (KF), modified essay question (MEQ), oral exam, and objective structured clinical examination (OSCE) were used. For the formative assessment, the medical instructors evaluated professionalism and communication.

The formative assessment was divided into three gradings, good, pass, and fail, based on the interactive activities including case-based discussion, assignment learning, and attending/assisting in OPD, IPD, and OR. The summative assessment in the first part of the course was evaluated via summing MCQs plus KF (55%), MEQ plus oral exam (45%) while the second section used OSCE (60%), simulated-chart of patients (30%), and OPD (10%). All students were subjected to the same end of course quizzes with no difference between the groups regarding the kinds of knowledge tested. The results of these quizzes were used to compare the effectiveness of the conventional teaching in 2019, and blended teaching in 2020.

Data collection and analysis

The marks of the quizzes were taken from the secretary's office in the form of an Excel sheet that did not contain any names only the results of the whole class. The data were analyzed using R program Version 3.4.5 (R Foundation for Statistical Computing, Austria). Descriptive statistics are given in percentages and mean $\pm$ SD. To evaluate the effectiveness of the two methods the paired-samples *t* test was used. A *P* value of < 0.05 was considered significant.

Results

A total of 252 students were enrolled in the Orthopedics online course during 2019-2021, 128 in 2019-2020 and 124 in 2020-2021. The participants' ages ranged between 22 and 31 years, 81.8% aged 22–23 and a mean age of 23.2 ± 1.1 years. Two-thirds of the students (60.2%) were female in 2019-2020 and there was equal gender distribution in 2020-2021. Overall student baseline demographics were not different between the two groups. The grade point averages of the students were 3.2 and 3.3 in 2019-2020 and 2020-2021, respectively, without significant difference ($p = 0.06$) (Table 1).

The scores of each assessment tool comparing between the blended learning group and the traditional learning group are shown in Figure 1. The scores in blended learning group were higher than in the traditional learning group in all assessment tools except the MEQ. The MCQ, KF, Oral, and OSCE scores were 65.7 ± 9.3 , 67.7 ± 7.8 , 80.1 ± 10.6 , and 69.5 ± 6.3 , respectively, for the traditional learning group while the same scores were 66.3 ± 8.3 , 68.8 ± 8.6 , 78.8 ± 10.9 , and 70.8 ± 5.3 for the blended group, with all differences being non-significant (p -value = 0.55, 0.31, 0.36, and 0.07, respectively). However, the MEQ score was significantly higher in the blended group than in the traditional learning group (66.8 ± 6.2 versus 65.1 ± 6.3 , p -value = 0.40).

Discussion

This research has reported on 5th year medical students' scores comparing the effectiveness of blended learning and traditional learning in an orthopedics course. The finding found that the mean score of MEQ and OSCE in blended learning were higher significantly than traditional teaching with consistent result with previously studies [13–18] while the other score tools including MCQ, KF in blended learning group were slightly higher than traditional group, however, without significant. Except the oral examination, the blended learning group had lower score than traditional group without significant.

Our department applied a mixed model to use the recorded lectures and live activities [19, 20]. The other part of course has still the same as traditional learning including ward round, practicing in outpatient and inpatient clinic, assisting in the operative room, and also practice the basic skill in orthopedics because the missing element in the effectiveness of online learning was clinical practice. Therefore, our blend learning defines as a combination of traditional learning and online learning [7]. Overall, the scores from students who learned with blended teaching were higher than the traditional group. There have many

reasons to summarize that the blended learning seems to be more advantages than the traditional group. Our course aim to utilize the technology to enhanced educational outcomes. Therefore, the face-to-face lectures in the classroom was shift to online, and fulfilled the requirements of adult learners by promoting active and student-centered learning [21] with advantage that students can manage their time to achieve goals and also more families and to improve their sleep pattern [22]. Our online learning created a curriculum design framework that focusses on effective pedagogical principles and is further supplemented by an understanding of what makes online learning work for students as studies by Martin and Bolliger [23]. Using interactive meeting aids engage students in an online environment providing them with intuitive interaction, enabling social learning connections with educators and their peers, and promoting active facilitation [24]. From the out result, using these strategies can achieve the effectiveness of learning outcomes using final scores as the traditional learning.

The barrier for educators were the availability of open access resource pose a teaching challenge with maintaining tradition like our department. However, due to specific concerns the pandemic of covid 19, it was unavoidable to push our department to change into blended learning format and found that the resistance to change argument around e-learning technology is too simplistic [25]. Therefore, after controlled the pandemic of Covid19, our department will use the blended teaching to teach our students as we think the more benefit in term of medical instructors and students. The strength of this study was investigated the score from final examination which was directed examined the effectiveness of intervention more than survey based. An evaluation of the effectiveness of blended learning for health professions is timely and very important during a pandemic of covid 19 for both health educators and learners. Another strength of this study was investigated in medical students in the mid to low-income country which was reflect that our students can access the online lecture and using the zoom internet in our country. Therefore, it can be assumed that the technology enhancing learning has been growth. However, this study has several limitations. The effectiveness of blended learning may be dependent on student characteristics, design features, and learning outcomes. Due to this study was a retrospective study, it may loss some factors that influenced the final outcomes which was not collected the data from this study. Therefore, further well-designed randomized controlled trials should be investigated in this point.

Conclusions

Blended learning was effectiveness intervention to teach medical students as traditional learning. However, well designed randomized controlled trials are needed to further analyze the educational structure and investigated the factor related the effectiveness between these interventions.

Abbreviations

MCQs: Multiple choice questions; KF: Key features; MEQ: Modified essay question; OSCE: Objective structured clinical examination; OPD: Outpatient department; IPD: Inpatient department, OR: Operating room

Declarations

Ethics approval and consent to participate

Each author certifies that the ethical committee of Prince of Songkla University has already waived this study protocol (REC 64-251-11-1). All the subjects who participated in the study signed an informed consent and offered to participate.

Consent for publication

All authors participating in the study give their consent for its publication.

Availability of data and material

Not applicable.

Competing interests

Each author certifies that he or she has no commercial associations that might pose a conflict of interest in connection with the submitted article.

Funding

No funding was received.

Author's contributions

Sitthiphong Suwannaphisit: Conceptualization, Methodology, Software, Validation, Writing- Original draft preparation, Writing- Reviewing and Editing. Chirathit Anusitviwat.: Data curation, Writing- Original draft preparation. Pakjai Tuntarattanapong: Visualization, Investigation. Chaiwat Chuaychoon: Validation, Writing- Reviewing and Editing

Acknowledgement

The authors sincerely thank Nannapat Pruhetkaew of the Epidemiology Unit, Faculty of Medicine for providing methodological and statistical supports and David Patterson for his linguistic support.

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Tables

Due to technical limitations, table 1,2 is only available as a download in the Supplemental Files section.

Figures

Figure 1

The scores of each assessment tool comparing between the blended learning group and the traditional learning group are shown in Figure 1.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Table1.jpg](#)
- [Table2.jpg](#)