Effectiveness of a SPOC and TBL-Based Blended Teaching Model in Ophthalmology Education: A Randomized Controlled Trial in Medical Students

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Abstract

Background: Ophthalmology is a mandatory specialty course for clinical medical students. This study aimed to evaluate the effectiveness of combining Small Private Online Course (SPOC) and Team-Based Learning (TBL) strategies in enhancing the quality of ophthalmology teaching for undergraduate students.

Objective: This study aimed to evaluate the effectiveness of combining Small Private Online Course (SPOC) and Team-Based Learning (TBL) strategies in enhancing undergraduate ophthalmology education for clinical medical students.

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Results: The observation group achieved significantly higher IRAT scores (pre- and post-test), final exam scores, and overall academic performance compared to the control group (P ? 0.05). They also demonstrated significant improvements in independent learning abilities. Additionally, students in the observation group reported greater satisfaction with the teaching method (P ? 0.05).

Conclusions: The SPOC and TBL blended teaching method significantly improved academic performance, independent learning, and satisfaction with teaching experience among undergraduate ophthalmology education. This approach shows potential for broader application in medical education. Clinical Trial: This study was reviewed and approved by the Committee on the Ethics of Shanxi Bethune Hospital, Shanxi Academy of Medical Sciences (Permit Number: YXLL-2023-017).

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Abstract

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Results: The observation group achieved significantly higher IRAT scores (pre- and post-test), final exam scores, and overall academic performance compared to the control group ($P \leq 0.05$). They also demonstrated significant improvements in independent learning abilities. Additionally, students in the observation group reported greater satisfaction with the teaching method ($P \leq 0.05$).

Conclusion: The SPOC and TBL blended teaching method significantly improved academic performance, independent learning, and satisfaction with teaching experience among undergraduate ophthalmology education. This approach shows potential for broader application in medical education.

Keywords: Ophthalmology; blended teaching; Small Private Online Course; team-based learning; medical students.

Introduction

Ophthalmology is one of the core disciplines in undergraduate clinical medical education, emphasizing the development of clinical reasoning and problem-solving abilities in students [1]. The aging population has led to a rise in the prevalence of ophthalmic diseases [2], which in turn has led to a continuous rise in the demand for ophthalmic professionals. Therefore, cultivating high-quality ophthalmic personnel is crucial for preventing poor prognoses in patients with ophthalmic diseases [3]. Evidence suggests that teaching methodologies and the exposure time to medical disciplines are closely related to medical students' future career choices. The range of ophthalmic knowledge and skills acquired during undergraduate studies is of critical importance [4].The Overall Plan for Deepening Educational Evaluation Reform in the New Era emphasizes the transition from a "teaching-centered" to a "learning-centered" approach, underscoring the importance of cultivating independent, lifelong learners [5]. However, studies have shown that there are several challenges in the teaching of ophthalmology. First, the complexity of the teaching content, abstract concepts, and limited course length often hinder students from gaining a deep understanding of ophthalmic diseases [1,6]. Second, traditional didactic teaching methods lack interactive problem-based learning and practical experience are barriers to effective teaching [7]. Finally, the inadequacies of current assessment systems fail to sufficiently foster professionalism and self-directed learning among medical students [8]. Research indicates that the blended teaching model is conducive to the development of learner-centered teaching methods and better aligns with the educational philosophy of universities [9]. Additionally, the blended teaching model, which combines online and offline learning, has become more prevalent in many schools, especially after the pandemic, as it integrates the strengths of both modes to enhance teaching and learning effectiveness [10].

The concept of Small Private Online Course (SPOC) was first proposed and used by Professor Armando Fox at the University of California, Berkeley [11]. The SPOC online teaching model has been widely adopted in the post-MOOC era, it offers tailored teaching content and a more reasonable assessment for university students, better aligning with the requirements of higher education [12]. Additionally, the SPOC model combines the advantages of face-to-face teaching with online learning, allowing for personalized and flexible learning experiences while improving classroom

teaching quality and learning efficiency [13,15]. Platforms such as Chaoxing, a professional learning software developed during the COVID-19 pandemic, enable the implementation of SPOC courses across various devices, including smartphones, desktops, and laptops, further enhancing accessibility and convenience [16,17].

Team-Based Learning (TBL) is a learner-centered and active teaching strategy that emphasizes group collaboration and self-directed problem-solving [18,20]. TBL addresses the limitations of passive traditional teaching by incorporating dynamic group discussions, interactive learning, and extended mutual teaching. It has been shown to enhance learning outcomes and overall teaching quality[21]. Moreover, TBL fosters the development of students' clinical skills, problem-solving capabilities, as well as their communication skills, teamwork, and interpersonal skills [22]. The International Council of Ophthalmology (ICO) recommends implementing clinical performance and case-based teaching methodologies in ophthalmology education [23]. TBL applied to small-group studies of clinical cases deepens students' understanding of overall performance knowledge and increases student satisfaction with the learning experience [18].This study explores the integration of the SPOC blended teaching model with TBL in ophthalmology education for undergraduates. The findings aim to provide valuable insights and evidence for advancing reforms in ophthalmology education.

Objects and Methods

1.1 Study subjects

This study was conducted in the first semester of the 2023-2024 academic year among undergraduate clinical medicine students of the 2023 cohort at Shanxi Medical University. Two classes were randomly selected as the control group (n=32) and the observation group (n =34). The observation group was further divided into sub-groups of 5-7 students each.

1.2 Teaching Process and Methods

The 9th Edition of Ophthalmology, published by Higher Education Press and edited by Yang Peizeng in 2018 (19), was selected as the teaching material for this study. The course syllabus, objectives, and key teaching points were the same for both groups. The teaching process was carried out by professional teachers. The control group followed the traditional lecture-based learning (LBL) approach, all conducted in face-to-face classroom sessions.. The observation group adopted the SPOC and TBL blended teaching model, combining online and offline learning.

At the start of the ophthalmology course, the grading criteria were explained to all students in

both groups. The final grade for the control group was determined as follows: 50% for the Individual Readiness Assurance Test (IRAT) score and 50% for the final exam score (Figure 1B). The final grade for the observation group was determined as follows: 25% for the IRAT score, 25% for the Team Readiness Assurance Test (TRAT), and 50% for the final exam score [20] (Figure 1C). Both groups completed the same IRAT and final exam questions. Specifically, the IRAT consisted of 10 multiple-choice questions with four reasonable options, with a maximum score of 100 points. The IRAT score was the sum of 50% of the pre-test score and 50% of the post-test score (with a total score of 100 points). Final grades were classified as follows: excellent (≥ 90), good (≥ 80 and <90), medium (≥ 70 and <80), and poor (<70). The percentages of students achieving excellent and good categories were calculated for both groups. To evaluate teaching efficacy, the IRAT scores (pre-test and post-test), final exam scores, and total scores were compared between the two groups.

1.2.1 Teaching Model of the Control Group

Students in the control group were encouraged to pre-study the ophthalmology textbook or related reference materials independently before class. At the beginning of each offline session, students were instructed to log in to the Chaoxing platform to complete the IRAT (pre-test), which consisted of 10 objective one-choice questions. Each question was worth 10 points, with a total score of 100. Students were required to complete the test within 10 minutes. Following the pre-test, the teacher delivered face-to-face lectures covering the theoretical knowledge specified in the syllabus. Students were expected to take notes during the lecture. After completing a chapter, the teacher uploaded the IRAT-post (post-test) questions to the Chaoxing platform. All students in the control group were required to complete the questions within a limited time. The questions consisted of 10 objective multiple-choice items (total score: 100 points). The final exam took place at the end of the semester.

1.2.2 Observation Group - SPOC Online Course Building

Before the start of classes, a SPOC course on ophthalmology was developed specifically for medical students at Shanxi Medical University. The teachers uploaded course materials and recorded teaching videos covering all the content that needed to be mastered and understood in ophthalmology theory to the respective folders on the Chaoxing platform. Along with additional resources including grading criteria, assignments/examinations, discussion forums, group tasks, surveys, and questionnaires. These materials were uploaded to the Chaoxing platform, which allowed students to access the course via smartphones, desktops, and laptops [13,16].

1.2.3 Teaching Model of the Observation Group

One week before the course started, the teachers added the ophthalmology-related videos to “My Course” section of the Chaoxing platform and instructed the students in the observation group to register and log in. Students were organized into 5 sub-groups of 5–7 members each. The platform provided access to learning resources, such as the course syllabus, grading criteria, assignments/examinations, discussion forums, group tasks, surveys, and questionnaires.

Students could independently complete the online SPOC learning at their own pace and according to their available time, using either their smartphones or computers. In particular, they could repeatedly watch teaching videos to deepen their understanding of difficult concepts. Prior to each offline classroom class, students were required to complete the IRAT (pre-test), organize their study notes, and identify any questions they encountered during their online learning.

During offline classroom sessions, the teachers reviewed key concepts, addressed challenging topics identified through SPOC learning, and personalized the lectures accordingly [14]. After completing each chapter, students took the IRAT (post-test) in class via the Chaoxing platform.

TBL was implemented through group activities based on clinical cases. For example, students analyzed and discussed diagnostic, differential, and therapeutic strategies for clinical scenarios like retinal hemorrhage. Group members collaboratively answered questions and presented their findings via discussion boards, classroom presentations, or PowerPoint slides. teachers evaluated group performance and provided feedback, while peer evaluations were also conducted. A final exam assessed the students’ knowledge at the end of the semester [1].

1.3 Evaluation of Teaching Model

After the completion of the course, we evaluated the two teaching models in terms self-directed learning and satisfaction levels using the Self-Directed Learning Ability Evaluation Scale for Nursing Students, developed by Zhang Xiyan in China (reference), and an anonymous questionnaire based on a 5-point Likert scale. Four indicators of self-directed learning were conceptualized and quantified: learning motivation, self-management ability, learning cooperation ability, and information quality. These sections consisted of 10, 9, 5, and 6 questions, with scores ranging from 10–50, 9–45, 5–25, and 6–30, respectively, for a total of 30 questions and a total scale score ranging from 30 to 150 (maybe 30-150 for consistency in numerical range formatting, or change the above to ‘10 to 50, 9 to 45’. etc.). Higher scores indicate a higher level of independent learning ability [24]. The scale demonstrated high reliability (Cronbach's $\alpha = 0.90$) and good validity.

The five-point Likert scale was used to measure levels of consistency, ranging from "completely consistent" to "completely inconsistent" [24]. Evaluations were conducted both before and after the teaching process, with all students participating.

The questionnaire utilized a 5-point Likert scale, which is a linear rating scale for measuring attitudes, opinions, or behaviors [25]. The scale consisted of 16 statements, with scores of 1–5 representing "strongly disagree," "disagree," "neutral," "agree," and "strongly agree" (Table 6). As the study adopted a "learner-centered" approach, so the design of the scale focused on evaluating students' experiences and outcomes. Specifically, the scale analyzed teaching satisfaction and self-evaluation. Students were asked to select the option that best reflected their feelings after the teaching process.

1.4 Statistical Analysis

Statistical analysis was conducted using GraphPad Prism 9. Data were expressed as mean ± standard deviation (SD). Independent sample t-tests were performed to compare differences between the two groups, and paired sample t-tests were used to compare differences between the pre-test and post-test within each group. Cohen’s d was calculated to measure the effect size of the mean difference, with values of 0.2, 0.5, and ≥0.8 indicating small, medium, and large effects, respectively [26]. Categorical data were presented as frequencies (n) and percentages (%), with comparisons made using the χ^2 test or rank-sum test. A p-value of < 0.05 was considered as statistically significant.

2. Results

2.1 Basic Information of Participants

A total of 66 students from Classes 1 and 2 of the Clinical Medicine undergraduate program at Shanxi Medical University, class of 2023, participated in this study. They were divided into a control group (n=32) and an observation group (n=34). The participants' ages ranged from 20 to 23 years, with a total of 28 males and 38 females. The control group consisted of 13 males and 19 females, with an average age of 21.32±1.012 years. The observation group included 15 males and 19 females, with an average age of 21.21±0.9785 years. There were no statistically significant differences between the two groups in terms of age or gender ($P > 0.05$). These details are summarized in Table 1.

2.2 SPOC & TBL Teaching Improved Students' Test Scores

Analysis of the IRAT scores revealed that the control group's post-test scores were higher than their pre-test scores, but the difference was not statistically significant ($P > 0.05$). In contrast, the observation group showed a significant increase in IRAT scores from pre-test to post-test ($P < 0.05$). Additionally, the pre-test scores of the observation group were significantly higher than those of the control group, indicating the effectiveness of SPOC teaching ($P < 0.05$) (Table 2). Furthermore, the post-test scores of the observation group were significantly higher than their pre-test scores ($P < 0.05$), which may be related to the deeper understanding of the knowledge points by the observation group students after classroom learning (Table 3).

Moreover, the final exam scores of the observation group were significantly higher than those of the control group ($P < 0.05$) (Table 3). We calculated that in the control group, IRAT and final exam scores each accounted for 50%, while in the observation group, IRAT, TRAT, and final exam scores accounted for 25%, 25%, and 50%, respectively. As shown in Table 3, the total scores of the observation group were significantly higher than those of the control group ($P < 0.05$). Additionally, the percentage of students achieving excellent or good categories (defined as scores ≥ 80) in the observation group was significantly higher than those in the control group (Table 4).

2.3 Improvement of Independent Learning Ability of Students in the Observation Group

Independent samples t-test results showed that before the teaching process, there were no statistically significant differences in the mean scores of independent learning ability (including learning motivation, self-management ability, learning collaboration ability, and information quality) between the two groups ($P > 0.05$). However, after one semester of study, there were statistically significant differences in the total scores for independent learning ability and the mean scores for the four indicators between the two groups ($P < 0.05$). Notably, the effect size of the different teaching models on independent learning ability was large ($d = 3.502$), particularly for learning cooperation ability ($d = 3.314$) and information quality ($d = 2.762$).

In the control group, the mean total score for independent learning ability was 90.56 ± 3.369 before the teaching process and 92.13 ± 3.077 after the teaching process. Paired-samples t-test showed that this difference was not statistically significant ($P > 0.05$). Similarly, no significant differences were observed in the scores for learning motivation, self-management ability, learning cooperation ability, and information quality before and after the teaching process ($P > 0.05$) (Table 5).

In the observation group, the mean score for total independent learning ability was $91.44 \pm$

3.735 before the teaching process and 108.94 ± 6.014 after the teaching process. Paired samples t-test showed a statistically significant difference ($P < 0.05$). Furthermore, the mean scores for the four indicators (learning motivation, self-management ability, learning cooperation ability, and information quality) were higher after the implementation of the SPOC&TBL teaching model ($P < 0.05$). The effect sizes for learning cooperation ability ($d = 2.981$) and information quality ($d = 2.543$) were notably larger following the blended teaching model. These results suggests that the SPOC&TBL teaching model has clear advantages in improving students' independent learning abilities (Table 5).

2.4 Students' Satisfaction with Teaching in Both Groups

At the end of the course, a questionnaire using a five-point Likert scale was administered to assess students' satisfaction with the teaching model. The course evaluation included both teaching satisfaction and self-evaluation. A total of 66 questionnaires were distributed and returned, with a 100% response rate. The responses were categorized as “strongly disagree,” “disagree,” “neutral,” “agree,” and “strongly agree.” The results indicated that more than 90% of the students in the observation group selected “neutral” or above (3-5 points). In contrast, more than 60% of students in the control group selected “neutral” or above (3-5 points) (Table 6).

The independent samples t-test revealed that, overall, the observation group had significantly higher satisfaction with the teaching process compared to the control group, except for the operability of the APP (3.13 ± 0.87 vs. 4.32 ± 1.09, $P = 0.5464$) and mastery of basic knowledge (3.50 ± 0.72 vs. 3.91 ± 0.97, $P = 0.1687$). Regarding the SPOC and TBL teaching models, the observation group rated the content and organization as reasonable and feasible (94.12%), the assessment methods as integrated and comprehensive (85.3%), the online platform as easy to operate (88.23%), and the teacher’s guidance as timely and detailed (97.06%). Furthermore, 91.17% of the students in the observation group believed they had mastered the basic knowledge and methodology of the subject and felt that the teaching method improved their overall understanding of the course. Additionally, 90.2% of the students felt that the assessment methods comprehensively evaluated their mastery and application of the course content. Over 94% of students felt that this teaching model encouraged differentiation and diversity and facilitated interaction between teachers and students, as well as among students (Table 6).

In contrast, the control group rated much lower than the observation group in areas such as timely teacher guidance, encouragement of differentiation and diversity, teamwork skills, communication skills, critical thinking skills, clinical practice skills and the impact of this teaching

model on student initiative and motivation. Specifically, encouragement of differentiation and diversity and communication skills dropped to 62.5% in the control group. Moreover, only 28.12% of students in the control group agreed or strongly agreed that this instructional model facilitated communication between students and teachers as well as among students, which was considerably lower than in the observation group. Overall satisfaction with the teaching model showed that 88.23% of students in the observation group and 40.62% in the control group agreed or strongly agreed (Table 6).

More than 79.41% of the students in the observation group reported high satisfaction with their self-improvement, particularly in terms of initiative and motivation—key factors in teaching evaluation [6]. Analysis of the questionnaire showed that 94.12% of students agreed or strongly agreed that the teaching model improved their initiative and motivation. Further analysis of important learning indicators revealed that students in the observation group reported improvements in teamwork (91.18%), communication (91.18%), creativity (85.29%), and critical thinking (88.24%), all of which were significantly higher than in the control group. Additionally, 82.35% of students agreed or strongly agreed that the teaching model improved their clinical practice skills and ability to apply learned knowledge flexibly. The independent samples t-test showed a significant difference between the two groups in terms of students' satisfaction with self-efficacy (Table 6).

Discussion

Ophthalmology is an attractive field in both medical and surgical discipline[25]. Traditional ophthalmology education in China typically involves face-to-face instruction in large classroom settings, where the knowledge acquisition process is relatively passive [1]. Given the abstract and complex nature of ophthalmic diseases, along with the increasing volume of medical content and limited time for practice in medical school curricula, the teaching hours dedicated to ophthalmology has been decreased[4,28], leading to unsatisfactory learning outcomes in the field of ophthalmology. Furthermore, insufficient time has been identified as a major barrier preventing undergraduate medical students from selecting ophthalmology as a specialty during their postgraduate training, as well as pursuing it as a career path[29]. This suggests that traditional educational methods is no longer sufficient to meet the growing demand for innovative ophthalmology professionals.

To address these challenges, China's Ministry of Education issued two key policy documents in 2018 and 2019: “Opinions on Accelerating the Construction of High-level Undergraduate Education to Comprehensively Improve Talent Training” and the “Implementation Opinions on the Construction of First-Class Undergraduate Courses”. These documents emphasized the importance

of teaching reforms, such as small-class teaching, blended learning, and flipped classrooms, and advocated for a teaching model that integrates both online and offline learning. This approach aims to stimulate students' desire for knowledge, enhance learning efficiency, and improve independent learning abilities[30]. Furthermore, it highlights the need to strengthen teacher-student and student-student interactions, which are essential for fostering innovative and critical thinking. Improving students' evaluation of both in-class and out-of-class learning, as well as the integration of online and offline teaching, is vital. The creation of blended first-class courses, based on the integration of online content (comprising 20%-50% of teaching time) and offline teaching, has become a central focus of educational reforms in higher education[31]. With the arrival of the digital information age, the concept of blended teaching has gradually been integrated into the education field, becoming a key initiative in the educational and teaching reform in colleges and universities. This learning model can facilitate the role of teacher guidance while also promoting student autonomy, combining the advantages of both classroom teaching and online learning [32]. In this study, we conducted a preliminary investigation into the teaching outcomes of ophthalmology using the SPOC and TBL teaching models. The results indicated that, compared to the control group, the mean IRAT scores (both pre-test and post-test), final exam scores, and total scores of the observation group were significantly higher ($P < 0.05$). This suggests that blended teaching enhanced the quality of teaching and learning in the ophthalmology course, confirming its effectiveness.

Previous studies have demonstrated that SPOC-based teaching reforms contribute to the enhancement of teaching quality[13,14]. This approach aligns with the trend of blended learning, which integrates face-to-face and online learning to improve learning outcomes and foster the development of students' learning abilities[33]. In the SPOC teaching model, the role of the teachers is not only that of a knowledge transmitter but also a course designer and organizer [15]. Based on copyright protection, teachers can fully utilize existing resources and make personalized adjustments to guide students' learning[15]. Additionally, teachers serve as both teachers and facilitators of the curriculum[32]. Analyzing students' IRAT (pre-test) scores enables targeted guidance to be provided during the classroom sessions. Furthermore, offline teaching content is reduced due to SPOC online learning, which allows for the introduction of more open-ended and inspiring questions. In this study, the pre-test IRAT scores of the observation group were significantly higher than those of the control group ($P < 0.05$). Since academic performance is a key indicator of learning outcomes, we believe that SPOC-based teaching has positively impacted the learning effectiveness of the observation group.

The TBL teaching model encourages students to solve problems through collaborative learning,

discussion, and communication within groups. This approach increases student participation and motivation, thereby enhancing their ability to apply theoretical knowledge[34]. Clinical skills are essential for completing medical curricula[35]. Through TBL, students recognize that small, seemingly insignificant details may be important causes or mechanisms for clinical diagnosis or explaining specific ophthalmic diseases, rather than simply memorizing the textbook content. TBL promotes active engagement with the textbook material, making it more relevant to real-world clinical practice. Studies have shown that the TBL model not only improves students' ability and interest in independent learning but also deepens their understanding and retention of theoretical knowledge. Additionally, it supports the development of critical thinking skills among students[34]. The findings of this study indicate that the TBL model significantly enhanced teamwork, communication, innovation, and critical thinking skills among the observation group, compared to the control group. Moreover, it facilitated greater interaction both between teachers and students, as well as among the students themselves.

In this study, we introduced an innovative scoring and evaluation system to assess the effectiveness of the novel ophthalmology teaching model. This system departs from the traditional evaluation method, which typically rely solely on final exam scores to dertermine student performance—an approach often criticized for its lack of comprehensiveness and scientific rigor[8]. The results demonstrated that this new evaluation system effectively motivated students, fostering greater interest and engagement with the course content.

To further enhance students' independent learning, innovation, clinical thinking, and job-related skills, further deepening of teaching reforms is necessary [36]. It is essential for students to understand that the development of learning abilities is much more important than simply acquiring knowledge[14]. In this study, prior to the implementation of the new teaching model, both the observation and control groups had similar total scores for independent learning abilities, as well as for learning motivation, self-management, cooperation skills, and information quality, with no statistically significance. However, after the teaching intervention, the blended teaching model significantly improved the independent learning abilities of the observation group, compared to the traditional teaching model. By assessing whether the blended classroom teaching enhanced students' learning abilities, we can determine whether this method should continue to be used [10]. Clearly, the blended learning model is a promising avenue for further research and optimization.

After one semester, the satisfaction with teaching strategies was analyzed through questionnaires. The results revealed that, compared to traditional teaching methods, students in the

blended teaching group reported significantly higher satisfaction. Compared with traditional teaching models, the SPOC and TBL teaching models emphasized the central role of students in the learning process. These models enhanced student engagement, enthusiasm, and creativity. Learning literacy refers to the students' ability to organize and flexibly adjust their own learning, including collaboration, communication, innovation, critical thinking, and problem-solving skills. Learning literacy is not just passive or purely applicative learning but embodies the transformative characteristics of high-level learning that can shift traditional problem-solving to creative thinking about new challenges[5]. In the questionnaire of this study, the evaluation results indicated that, compared to the control group, the observation group had a significant improvement in learning literacy. Moreover, previous studies have demonstrated that self-efficacy in independent learning has a positive impact on students' academic performance [37], and our findings align with this. In conclusion, this new teaching model, which is learner-centered, encourages active learning, promotes independent thinking, stimulates students' curiosity, fosters a sense of achievement, cultivates cooperative skills, and enhances students' overall competencies. Additionally, through SPOC and collaborative learning, students deepened their understanding of ophthalmology theory and were able to conduct in-depth explorations of clinical cases. Overall, the results of these questionnaire provide valuable feedback for further refining and enhancing the teaching experience. Furthermore, learner-centered teaching methods are instrumental in cultivating ophthalmology professionals with both specialized knowledge and clinical skills.

This study has several limitations. First, the research was conducted at a single university in northern China with a relatively small sample size, which may limit the generalizability of the findings. Future studies with larger, more diverse sample populations are necessary to validate these results. Second, the blended learning model was implemented over only one semester of the ophthalmology course, which does not provide sufficient data to fully assess the long-term benefits and effects of combining SPOC with TBL. Third, there is a potential for bias since the trial was not blinded, and the allocation was known throughout the study. Future teaching initiatives should focus on staying up-to-date with developments in ophthalmology, further optimizing course content, and maximizing the advantages of blended teaching. In conclusion, the SPOC and TBL ophthalmology teaching model requires further exploration and refinement to develop a more effective blended teaching approach for undergraduate ophthalmology. This will facilitate the reconfiguration of the teaching process and the innovation of the teaching structure.

Abbreviations

SPOC Small Private Online Course

TBL Team-Based Learning

IRAT Individual Readiness Assurance Test

TRAT Team Readiness Assurance

LBL Testlecture-based learning

Declarations

Ethics approval and consent to participate

This study was reviewed and approved by the Committee on the Ethics of Shanxi Bethune Hospital, Shanxi Academy of Medical Sciences (Permit Number: YXLL-2023-017). A consent form was provided to all participants. There was no incentive provided to students to who completed the study. Informed consent was obtained from all participants prior to starting the survey. This study adhered to the declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare no competing interests.

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Authors’ Contributions

Y. D. and Y.L. designed and conducted the study. S.H. and X.Z. collected and analyzed the data. Y.L. and F.Y. wrote the manuscript, while Y.D. and J.L. provided assistance in revising it. All authors read and approved the final manuscript.

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Supplementary Files

Multimedia Appendixes

Table.
URL: http://asset.jmir.pub/assets/9c64c5219ba7280547b9b6a47f2c4e61.pdf

Related publication(s) - for reviewers eyes onlies

supplementary material.
URL: http://asset.jmir.pub/assets/57e6d9a816373d2591b6a2a69cc18466.pdf

Self-learning Ability Evaluation Scale.
URL: http://asset.jmir.pub/assets/a88324e22b37f1a849b1f45d61e08aab.pdf