Effect of blended learning with BOPPPS model on Chinese student outcomes and perceptions in an introduction course of health services management

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Abstract

Although the teaching methods of the blended learning and BOPPPS (bridge-in, objective, preassessment, participatory learning, postassessment, and summary) model are proven to be successful and highly effective at improving the academic knowledge of the students, respectively, it is unclear whether blended learning combined with the BOPPPS model (BL-BOPPPS) could work well in an introduction course of health services management (HSM) for the health management students in China. The study investigated the perceptions and effects of implementing the BL-BOPPPS model on student learning outcomes in an introduction course of HSM. The intervention group consisted of 55 students introduced to the BL-BOPPPS model, while the control group consisted of 54 students who received a conventional lecture. After the end of course, the effectiveness of teaching was self-assessed with questionnaires by all students, and examination scores for the two groups were compared. The students’ satisfaction levels of BL-BOPPPS teaching strategy were up to 81.8% in the intervention group. Compared with the control group, the intervention group showed significant elevation of perception scores of skills ($P = 0.001$), initiative ($P = 0.002$), self-control ($P = 0.008$), self-efficacy ($P = 0.001$), motivation ($P = 0.004$), and the academic performance ($P = 0.001$). The BL-BOPPPS model could stimulate the enthusiasm and interest of health students; boost students’ skills, initiative, and motivation in learning; and improve the self-directed learning ability, academic performance, and teaching quality. The findings provide a basis of evidence for the promotion of the BL-BOPPPS model in various disciplines in Chinese colleges and universities.

blended learning; BOPPPS model; healthcare and management; teaching strategy

INTRODUCTION

Our university in China introduces an introduction course of health services management (HSM) to healthcare and management students in the first semesters. During the autumn semester in each academic year, the introduction of health services management (HSM) is a required 1-credit hour course for all first-year healthcare and management freshmen. In general, a weekly teaching schedule of this course is 2-h didactic lectures and the teaching period is 8 wk. The HSM introduction, a supplementary and transition course, is believed to serve an important role in traditional theoretical learning for first-semester students (1). In addition, the introduction course is expected to play a pivotal role in providing opportunities for students and trigger motivation and learning interest relating to the healthcare field, thus directly contributing to them learning and understanding subsequent curricula knowledge of healthcare and management (2). Traditionally, the instructor is the center of the class teaching with a full lecture in the classroom, which may inhibit the learning initiative and enthusiasm of students, and, consequently, their motivation drops and the development of student innovative talent is limited in China (3). Therefore, instructors need to design student-centered classes with effective teaching strategies to encourage the enthusiasm and interest of students and promoting learning effect of HSM introduction course.

A new educational strategy of blended learning, defined as the combination of traditional face-to-face instruction and online asynchronous or synchronous learning, aims to lead students from a superficial to a deep and full understanding of the courses (4). The introduction of blended learning offers a promising teaching means in educational careers (5). Three systematic review articles reported that blended learning has the potential to improve motivations, competencies, and knowledge acquisition among health students (6–8). Because of the teaching effectiveness in various subjects including in medicines, pharmacies, and nursing science, it is now widely used in colleges and universities education in different forms (6). With the popularization of wireless smartphones and increasing availability of online teaching systems on Chinese campuses, instructors of Chinese universities are implementing a flourish of blended learning reforms based on the known benefits (9). However, blended learning has not yet been attempted in the HSM introduction course in China. In this study, an attempt of blended learning with BOPPPS model is first introduced...
in the teaching of the introduction course for first-semester health students.

The BOPPPS model was first proposed in recent years by the Teaching and Academic Growth Center of the University of British Columbia in Canada (10). This model system constructs six phases, which included bridge-in (B), objective (O), preassessment (P), participatory learning (P), postassessment (P), and summary (S), i.e., BOPPPS. The six phases form a coherent, systematic, and operational teaching step. The core of the model is in the way of student-centered and participating in the interaction to achieve the teaching goal (11). The BOPPPS model can be used to help teachers and instructors in disassembling and analyzing teaching activities to improve the teaching process (12).

In brief, bridge-in is the beginning phase of a lesson. A diverse way of class introduction is used to attract the students’ attention, to generate strong motivation, and to generate interest to further enter the learning of core content (11). The learning objective is the second phase of the class. The learning objectives of each class have the guiding and evaluation functions, so that the students can clearly understand the content of a lesson and their learning outcomes at the end of the course (11). The preassessment phase reviews the concepts that students already know about the course and determines the starting point of learning. According to their performances in the preassessment, the depth and progress of the learning content will improve over time (11). Participatory learning, the fourth phase, is the main body of learning activities. It emphasizes on full interaction between students and classmates and/or teachers, which stimulates students’ enthusiasm and interest and an active learning atmosphere (11). The students’ learning effect is evaluated in the postassessment phase. Through feedback from the learning activities, we can understand the extent to which those students achieved the learning objective (13). A brief summary of the unit learning activities is the last phase. For teachers and students, summaries provide an opportunity to reflect on what they have learned in class (13). Meanwhile, each learning unit with BOPPPS model should be divided into six links and the time of schedules can be adjusted according to the teaching requirements (14).

However, while BOPPPS model is a currently recognized useful teaching model, other investigators have selected alternatives due to the inflexibility and rigidity of the BOPPPS model to some extent (15). The BOPPPS model emphasizes the integrality of whole six-step teaching activities, and it is not easy to make flexible adjustments based on the teaching needs in traditional classroom (15). A flipped classroom is an educational technique that consists of two significant components (16). The use of computer technologies such as micro-video learning is one of the components of the blended learning. The interactive learning is another component that requires student participation. Therefore, blended learning combined with the BOPPPS model was applied in the introduction course education for Chinese students and resulted in better teaching outcomes. The aim of this study was to investigate and analyze Chinese students’ perception and the effects of academic performance on the HSM introduction course.

### METHODS AND PROCEDURES

#### Research Designs

In this study, the quasi-experimental study design and questionnaires were used to examine the effects and perceptions of BL-BOPPPS teaching model for undergraduate health services management students. According to the students’ score on a national college entrance examination in China, computer random placement was used and managed by the academic administration of Xihua university. All first-year students who majored in health services management were divided into two classes with computer placement. One class was randomly selected as an intervention group adopting the BL-BOPPPS teaching model, and in the other class as a control group, the traditional lecture-based teaching method was implemented.

The main objective of the current study was to investigate the perceptions of the blended learning with the BOPPPS model on student performances and abilities. The research questions were addressed as follows:

1. What is students’ satisfaction resulting from the use of the BL-BOPPPS teaching model?
2. Was there any difference in students’ self-assessment of skills of self-directed learning, peer interaction, problem-solving, learning retention, information technology, and oral communication between the intervention and control groups?
3. Was there any difference in students’ academic performance between the intervention and control groups?

#### Study Participants

In this study, a total of 109 first-year healthcare and management students were enrolled in the HSM introduction course. The intervention group (Class A, n = 55) was offered a traditional lecture-based teaching course. The intervention group (Class B, n = 54) was offered a traditional lecture-based teaching model (Table 1). Students in the intervention group were briefly introduced to the research procedure and informed that participation would not affect the introduction course grade. The participants in the intervention group were informed that they had the right to withdraw from the study at any time.

#### Ethical Considerations

Before the study, approval for this teaching study was obtained from the curriculum development committee and the ethics committee at the School of Health Management, Xihua University in China.

#### Traditional HSM Introduction Course

The traditional classroom flowchart of HSM introduction course is shown in Fig. 1. For the control group, the students

| Table 1. Grouping for two classes |
|----------------------------------|
| Group               | Class | Number of students | Teaching Methods |
|---------------------|-------|--------------------|------------------|
| Intervention group  | Class A| 55                 | BL-BOPPPS teaching |
| Control group       | Class B| 54                 | Traditional teaching |

BL-BOPPPS, blended learning bridge-in, objective, preassessment, participatory learning, postassessment, and summary.
first received the reading material including textbooks and syllabus of introduction course. Then, the overhead projector was used to teach in the face-to-face classroom with the students passively receiving the associated knowledge for 2 h in each week. Students had opportunities to use teaching materials and reference books that were also used by students of the BL-BOPPPS model. Finally, the teachers answered students’ questions and repeated any knowledge points that the students did not fully understand in the class.

**BL-BOPPPS Teaching Model in This Course**

Rain Classroom, an online interactive intelligence teaching tool, was developed by the Online Education Office of Tsinghua University and Xuetang online teaching platform (https://www.yuketang.cn/)(17). According to the course syllabus of Xihua University for the bachelor’s program of health services management, course reading materials, micro-videos, online homework, and pre- and posttest were arranged by teachers online in the Rain Classroom platform for students. Subjects for learning and discussion and course announcements were posted online in the Rain Classroom. The BL-BOPPPS teaching model flowchart of HSM introduction course was showed in Fig. 1. For the intervention group, the BL-BOPPPS teaching model was implemented for 2 h per class and the course lasted 8 wk. Before the class, an online clinical case story or short videos in Rain Classroom was posted online to students in Wechat as the first phase of bridge-in for eliciting students’ learning motivation. Then, students previewed the slides of reading materials, short videos, and learning objectives and the finished an online preassessment within 10 min to analyze the outcomes of the preview in Rain Classroom. For the participatory learning in the classroom, the instructor explained the materials through PowerPoint presentations and guided students in performing the participatory learning activities, including watching videos, online questions, peer interaction, and discussion. Afterward, an online postassessment was posted online for students in the Rain Classroom for evaluation of the outcomes of students in achieving teaching goals, and students had to complete those questions in the Wechat. Finally, the students and instructor summarized the material, discussion, and important and difficult knowledge points. After the classroom, the students were asked to complete the study notes, to further review the course, and to search other teaching material online for finishing the homework. In this course, one chapter on health risk assessment of chronic diseases was as an example of the BL-BOPPPS teaching model, which is shown in Table 2.

**Evaluation**

Before the program, the variables of specialty satisfaction and research importance were measured in the positive, neutral, or negative pattern, and information retrieval skill (four items) (18) and attitudes toward healthcare and management (19) were measured using five-point Likert scales, ranging from one (strongly agree) to five (strongly disagree). Cronbach’s alpha coefficient in this study was 0.95 for information retrieval skill and 0.92 for attitudes toward healthcare and management. In addition, a test of HSM knowledge with 35 multiple choice questions and HSM training/education survey was used to evaluate the baseline about HSM knowledge.

After the program, the students’ satisfaction with the BL-BOPPPS teaching model in the intervention group was assessed with 14 items in the YES/NO pattern (20). The variables of multiple skills (see Table 5)(12) and self-directed learning ability (see Table 6)(21) including the initiative, self-control, self-efficacy, and motivation between the intervention and control groups were assessed using five-point Likert scales. The scales ranged from one (strongly agree) to five (strongly disagree), and then total scores were calculated. Cronbach’s alpha coefficient in this study was 0.81 for students’ perceptions of skills and 0.75 for self-directed learning ability in this study.

After the end of the semester, students’ performance including regular coursework, final exam scores, and comprehensive results were compared between the intervention and control groups. A total score of 100 points for regular coursework was awarded according to the performance of
EFFECT OF BLENDED LEARNING WITH BOPPPS MODEL

Table 2. Example (the chapter of health risk assessment of chronic diseases) of class design for BL-BOPPPS teaching model

| Procedure/Phase          | Teaching Content                                                                 | Time     | Tool                                  |
|--------------------------|----------------------------------------------------------------------------------|----------|---------------------------------------|
| Before Class Bridge-in   | Introduction and background of health hazards of chronic diseases                | Unlimited| Online with Rain Classroom            |
|                          | Learning a clinical story or video of hypertension lead to a stroke              | Unlimited| Online with Rain Classroom            |
|                          | Significance and application of health risk assessment                            |          |                                       |
|                          | Characteristics and classification of health risk factors                          |          |                                       |
|                          | Procedures and methods of health risk assessment                                  |          |                                       |
|                          | Students completed assessment of 10 choice questions                              | 10 min   | Online with Rain Classroom            |
| During Class Preassessment| Using hypertension case as an example of noninfectious chronic diseases, students stated and discussed health risk factors and health risk assessment, and the role of the teachers were to help students focus on learning objectives and ensure teaching dynamics and answering related more difficult questions. | 50 min   | In Classroom                          |
| Postassessment Summary   | Students completed assessment of 20 choice questions                              | 15 min   | Online with Rain Classroom            |
|                          | Students summed up the knowledge they have learned                               |          |                                       |
|                          | Instructor summarized the focus and difficult knowledge points                    |          |                                       |
|                          | Focus: classification of health risk factors                                      |          |                                       |
|                          | Difficulty: methods of health risk assessment                                     |          |                                       |
| After class Review and feedback | Students completed the study notes and knowledge points again                     | Unlimited| Online with Rain Classroom            |
|                          | Students searched for useful websites to further review the course                |          |                                       |
|                          | Providing online learning feedback to students for self-assessment               |          |                                       |

BL-BOPPPS, blended learning bridge-in, objective, preassessment, participatory learning, postassessment, and summary.

answering questions and speaking in the classroom (25%), completion of the learning task (25%), pre- and postassessment scores (25%), and students’ attendance (25%). The same final examination of 100 points for both class groups was arranged by the Office of Academic Affairs, Xihua University. The students’ comprehensive scores were comprised of 50% of the regular coursework scores and 50% of the final exam scores (i.e., comprehensive score = ordinary score × 50% plus final examination score × 50%).

Data Analysis

Cronbach’s alpha coefficient and quantitative data were analyzed using SPSS 22.0 for Windows software (SPSS, Inc., Chicago, IL). All data of students’ perception and performance scores are reported as means ± SE. Chi-square tests or independent-samples t tests were used to investigate statistic differences between the intervention and control groups. Statistical significance was defined as $P < 0.05$.

RESULTS

The general characteristics of the two groups are shown in Table 3. All students of two groups completed the course learning and survey. The intervention group included 41 women and 14 men students. The mean age of the intervention group was 18.5 yr. The control group consisted of 42 women and 12 men students. The mean age of the control group was 18.7 yr. No significant differences in general characteristics including age, gender, satisfaction with this specialty, HSM knowledge, awareness of learning resources or attitudes to healthcare, and management were found between the intervention and control groups ($P > 0.05$).

The students’ response to the BL-BOPPPS teaching model in the intervention group was assessed with 14 items in Table 4. The results showed that the BL-BOPPPS teaching strategy was agreed with 81.8% of students, and negative response was in 18.2% of students. In particular, students believed that BL-BOPPPS teaching model stimulated their interest (81.8%) and intrinsic motivation (72.7%) in learning this course and improved their self-directed learning skills (87.3%) and would be beneficial in terms of long-term memory (85.5%). There were 92.7% students who believed that they can easily browse and gain course materials according to their own situation any time without increasing their workload. Furthermore, 80%-92.7% students believed that the BL-BOPPPS teaching strategy may be feasible for the current educational environment and be worthy of recommendation for use by more instructors in China.

The assessment of multiple skill learning was for the 10 items in Table 5. The mean score of the intervention group (40.85 ± 5.07) was higher than that of the control group (36.35 ± 6.50). The results appeared that the statistical difference between the mean scores of the two groups ($P < 0.05$). The students’ perception scores of skill learning indicated that the BL-BOPPPS teaching model was more beneficial to the multiple skill development of students than the traditional face-to-face didactic lecture teaching. Compared with the control group, the student skills of self-directed learning, concentrated learning, peer interaction, information retrieval, clinical reasoning, and learning retention were significantly increased in the intervention group ($P < 0.05$). However, there were no significantly different perception scores in both groups on the student skills of problem-solving, oral communication, critical thinking, and creative thinking ($P > 0.05$).

Then, we assessed the two groups’ perceptions of initiative, self-control, self-efficacy, and motivation with total 25 items in Table 6. Based on the development of a measurement tool for Chinese students, the initiative, self-control, self-efficacy, and motivation were major variables for this measurement tool to assess Chinese student self-directed learning ability. The scores of initiative, motivation, self-
control, and self-efficacy of the intervention group were 27.49 ± 3.06, 22.72 ± 2.77, 21.63 ± 2.85, and 26.09 ± 3.53, respectively. The scores of initiative, motivation, self-control, and self-efficacy of the control group were 24.98 ± 4.92, 20.83 ± 4.37, 19.37 ± 2.85, and 24.05 ± 3.77, respectively. The score of self-directed learning ability including initiative, motivation, self-control, and self-efficacy in the intervention group was higher than that in the control group, which showed that the statistical difference in self-directed learning ability between two groups ($P < 0.05$). The students' perception scores indicated that the BL-BOPPPS teaching model was more beneficial to the development of students' self-directed learning ability than the traditional face-to-face didactic lecture teaching.

Finally, the course test scores of two groups are shown in Table 7. The intervention group had significantly higher scores than the control group for final examination results and comprehensive performance ($P < 0.05$).

### DISCUSSION

In China, the HSM introduction course education still followed the traditional teacher-centered teaching method. According to the syllabus of the course, all the topics in the

| Table 3. Characteristics of students and homogeneity tests between the intervention and control groups |
|---|---|---|---|---|
| Variables/Characteristics | Intervention Group ($n = 55$ students) | Control Group ($n = 54$ students) | $\chi^2$ or $t$ Test | $P$ Value |
| Gender | | | | |
| Male, $n$ (%) | 14 (25.5) | 12 (22.2) | 0.15 | 0.823 |
| Female, $n$ (%) | 41 (74.5) | 42 (77.8) | | |
| Age, yr | | | | |
| Range of age | 18–20 | 18–20 | | |
| Means ± SD | 18.5 ± 0.89 | 18.7 ± 0.88 | -1.30 | 0.195 |
| Source of the students | | | | |
| City, $n$ (%) | 21 (38.2) | 23 (42.6) | 0.22 | 0.639 |
| Country, $n$ (%) | 34 (61.8) | 31 (57.4) | | |
| Satisfaction with specialty | | | | |
| Satisfied | 11 (20.0) | 15 (27.8) | 1.84 | 0.379 |
| Neutral | 19 (34.5) | 21 (38.9) | | |
| Dissatisfied | 25 (45.5) | 18 (33.3) | | |
| Importance of this research | | | | |
| Important | 19 (34.5) | 20 (37.0) | 0.08 | 0.962 |
| Neutral | 22 (40.0) | 21 (38.9) | | |
| Unimportant | 14 (25.5) | 13 (24.1) | | |
| Test of HSM knowledge | | | | |
| Range of score | 18–32 | 10–32 | -0.44 | 0.659 |
| Means ± SD | 28.16 ± 3.45 | 28.50 ± 4.44 | | |
| HSM training/education | | | | |
| No, $n$ (%) | 53 (96.4) | 53 (98.1) | 0.32 | 0.569 |
| Yes, $n$ (%) | 2 (5.6) | 1 (1.9) | | |
| Learning information retrieval | | | | |
| Range of score | 8–18 | 8–19 | | |
| Means ± SD | 15.90 ± 3.05 | 15.87 ± 2.52 | 0.07 | 0.943 |
| Attitudes toward healthcare and management | | | | |
| Range of score | 8–20 | 9–20 | | |
| Means ± SD | 15.98 ± 3.02 | 16.04 ± 2.51 | -0.10 | 0.918 |

HSM, health services management.

| Table 4. Students' responses in the intervention group to BL-BOPPPS teaching model |
|---|---|---|
| Questions | Yes (%) | No (%) |
| In this teaching strategy, do you think: | | |
| 1. BL-BOPPPS stimulates your interest in learning this course? | 45 (81.8) | 10 (18.2) |
| 2. BL-BOPPPS strengthens your intrinsic motivation? | 40 (72.7) | 15 (27.3) |
| 3. BL-BOPPPS develops your self-directed learning skills? | 48 (87.3) | 7 (12.7) |
| 4. BL-BOPPPS improves your problem-solving skills? | 38 (69.1) | 17 (30.9) |
| 5. BL-BOPPPS provides benefits in terms of long-term memory? | 47 (85.5) | 8 (14.5) |
| 6. BL-BOPPPS helps you understand the course objectives? | 51 (92.7) | 4 (7.3) |
| 7. BL-BOPPPS helps you prepare for course exams? | 48 (87.3) | 7 (12.7) |
| 8. BL-BOPPPS may bring an increase in workload? | 18 (32.7) | 37 (67.3) |
| 9. The knowledge delivery is fragmented and unsystematic? | 19 (34.5) | 36 (65.5) |
| 10. The knowledge delivery of this model is not fragmented and unsystematic? | 36 (65.5) | 19 (34.5) |
| 11. BL-BOPPPS should be used by more teachers? | 47 (85.5) | 8 (14.5) |
| 12. BL-BOPPPS is a more scientific way for medical teaching? | 47 (85.5) | 8 (14.5) |
| 13. BL-BOPPPS is feasible for the current educational environment? | 44 (80.0) | 11 (20.0) |
| 14. BL-BOPPPS is worthy of promotion? | 51 (92.7) | 4 (7.3) |
| Average (%) | 45 (81.8) | 10 (18.2) |

BL-BOPPPS, blended learning bridge-in, objective, preassessment, participatory learning, postassessment, and summary ($n = 55$ students).
BL-BOPPPS model was categorized under eight main titles: health service policies and laws, basis of medicine, basis of health management science, disease risk assessment, health management strategies, means of health intervention, traditional Chinese medicine, and physical examination. The traditional teaching methods relied mainly on textbooks with the whole presentation of course contents in the classroom, which emphasized the memory of basic concepts and contents from the introduction course. The traditional teaching methods that heavily employed lecturing made it hard for students to understand certain introduction knowledge within a limited time (22). These shortcomings directly impaired students' motivation, initiative, and enthusiasm in learning the introduction course, thus reducing the effectiveness of learning this course (23). In the current study, blended learning combined with the BOPPPS model was introduced to the HSM introduction course teaching. According to the syllabus of introduction course, eight learning units were used in the blended learning with the BOPPPS (BL-BOPPPS) model. After the baseline screening, students' final scores and perceptions of teaching effectiveness were compared between intervention and control groups. The results showed students in the intervention group with the BL-BOPPPS model outperformed those students in the control group who used traditional teaching methods. In terms of the students' self-assessment of perceptions, the learning

| Question/Statement | Intervention Group | Control Group | t (P) |
|--------------------|--------------------|---------------|-------|
| 1. Self-directed learning skills | 4.36 ± 0.77 | 3.91 ± 0.85 | 2.91 (P = 0.004)* |
| 2. Concentrated learning skill | 4.67 ± 0.47 | 3.59 ± 1.07 | 6.81 (P = 0.001)* |
| 3. Peer interaction skill | 4.05 ± 0.93 | 3.33 ± 1.22 | 3.45 (P = 0.001)* |
| 4. Problem-solving skill | 3.71 ± 1.01 | 3.79 ± 1.01 | −0.45 (P = 0.655) |
| 5. Information technology skill | 4.05 ± 0.93 | 3.43 ± 1.21 | 3.45 (P = 0.001)* |
| 6. Clinical reasoning ability | 3.91 ± 1.02 | 3.46 ± 0.91 | 2.41 (P = 0.018)* |
| 7. Oral communication skill | 3.69 ± 1.00 | 3.85 ± 0.98 | −0.85 (P = 0.397) |
| 8. Learning retention skill | 4.40 ± 0.76 | 3.70 ± 1.09 | 3.86 (P = 0.001)* |
| 9. Critical thinking skill | 3.96 ± 0.90 | 3.62 ± 0.97 | 1.85 (P = 0.066) |
| 10. Creative thinking skill | 4.03 ± 0.90 | 3.74 ± 1.06 | 1.54 (P = 0.125) |
| Sum of perception scores (5 x 10 = 50) | 40.85 ± 5.07 | 36.35 ± 6.50 | 4.03 (P = 0.001)* |

Values are means ± SD. Students scored statements according to their perceptions from 1 (strongly disagreeing) to 5 (strongly agree), and total perception scores were calculated. *P < 0.05.
initiative and motivation skills, self-directed learning skills, peer interaction skills, clinical reasoning skills, and the course performance of the intervention group were superior to students in the control group.

A recent meta-analysis in nursing students reported that many qualitative researchers found student satisfaction related to the blended learning was superior to traditional teaching methods (24). The satisfaction of students in an intervention class was up to 81.8% in this study. Most of the students believed that the BL-BOPPPS model could stimulate their interest and intrinsic motivation in learning this course and help to improve their self-directed learning skills. Furthermore, the model of BL-BOPPPS helped most students to better understand the course objectives and prepare for course exams without increasing workload. One of reasons seems to be that students can conveniently review online introduction course materials wherever and whenever they wanted inside or outside the class, and face-to-face participatory learning in the BOPPPS model may prevent the losing of interest in subject matter in class (25). A positivity of the students toward introduction courses showed that BL-BOPPPS model was effective and feasible for the course education in China.

An active approach of blended learning could increase student enjoyment and engagement by creating an online and offline blended environment that encourages deeper learning and urges students to take ownership of their education (26). Because of these reasons, it has been widely used and achieved better performances. Most of the research suggested that the blended learning model positively impacted on students’ learning. However, there are also findings that showed that the use of the blended learning model did not yield significant positive effects (16). Cabi (16) pointed out that the problems in the blended learning model were categorized under three main titles: motivation, content, and learning. Many students had difficulties adapting to this new blended learning approach. Specifically, most of the students believed that the course included heavily loaded requirements, and they did not have time to prepare lessons or watch the micro-videos outside the class (16).

In this study, the BOPPPS model with six-phase framework was adapted to organize and accelerate the teaching cycle as a whole including goal, behavior, learning activity, and evaluation (15). The course requirements outside the class included online micro-videos and/or PowerPoint presentations of bridge-in, objective, and assignments for the course. Usually, most of students working time outside the class was about 2 or 3 h for each chapter. The BL-BOPPPS phases of preassessment, participatory learning, postassessment, and summary were finished inside the class. Most of the students (92.7%) in intervention group stated that the course with the BL-BOPPPS teaching model did not increase their workload outside the class.

Furthermore, the BL-BOPPPS model could be helpful for students’ multiple learning skills, particularly self-directed learning, concentrated learning, and learning retention. In the BL-BOPPPS model, relating the contents to real environment was likely to attract the students’ attention and activate the students’ interests. Most of the students who would be willing to put effort into learning tend to have the initiative to get motivated (16). The participatory learning in BL-BOPPPS model could inspire a mutual cooperative spirit in class, consequently boosting interactions and affection among students. The BL-BOPPPS model may have affected the students’ motivation and satisfaction in the class, which could be helpful in improving the students’ skills of peer interaction, self-directed learning, clinical reasoning, and learning retention.

As compared with the group of traditional lecture instruction, there were significant increase of perception score in the initiative, self-control, self-efficacy, and motivation in the BL-BOPPPS class (P < 0.05), which are the measurement items to assess self-directed learning ability (9). In BL-BOPPPS model, the model constructs of six components were flexibly dispersed in the whole procedures of online and face-to-face teaching. The BL-BOPPPS model could improve students’ concentration learning and relieve the fatigue of continuous learning (15). The BL-BOPPPS model with student-centered learning had the potential to stimulate their enthusiasm in learning the introduction course and increased interaction between teachers and students, which led to a great improvement of learning interest and self-directed learning abilities for health management students (14). This BL-BOPPPS model absorbed the advantages of BOPPPS model and blended learning to promote an active learning atmosphere, improve students’ enthusiasm for learning, and encourage instructors to pay attention to the feedback obtained from evaluations. Moreover, the distribution of teaching time and content became more rational, and the combined teaching strategy satisfied the needs of students.

Students’ examination in the introduction course was used to evaluate the effectiveness of improving students’ ability, theoretical knowledge mastered, and retention in the class. There was no difference in regular coursework score between the intervention and control group. On the same campus, the increase in online and offline interaction improved attendance and learning curiosity of students in the control group. Outside of the classroom, students in the control group had more opportunity to communicate and share their experience of coursework with students in the intervention group. However, the students’ final examination scores and comprehensive scores were significantly improved in the intervention teaching group (P < 0.05). The evidence from this single trial displayed that the BL-BOPPPS model achieved better performances by these students.

| Variable                      | Intervention Group | Control Group | t (P)     |
|-------------------------------|--------------------|---------------|-----------|
| Regular coursework score      | 86.36 ± 8.81       | 84.96 ± 13.66 | 0.63 (P = 0.526) |
| Final examination score       | 87.82 ± 9.24       | 82.50 ± 6.18  | 3.34 (P = 0.001) |
| Comprehensive score           | 86.90 ± 9.02       | 83.66 ± 7.31  | 2.06 (P = 0.042) |

Values are means ± SD.

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Table 7. Comparison scores of course test between the intervention and control groups

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 Advances in Physiology Education • doi:10.1152/advan.00180.2020 • http://advan.physiology.org
may be necessary to follow up and provide further support by more trials from other universities and a longer term study in China.

However, this study has some limitations. First, the sample size was not large enough. Only 109 students were enrolled in the study. Secondly, the leading questions and dichotomous nature of the questions used in Table 4 may have created some bias. Naturally, there would be a greater tendency for respondents to select Yes as the answer, and students’ satisfaction to BL-BOPPPS model was high at up to 82% in the intervention group. Third, the four lengthy questionnaires in this study may be give rise to potential survey fatigue for respondents. Finally, students’ binary performance in class was nonblinded outcome and was evaluated by members from the research team.

In conclusion, we integrated the BOPPPS model into blended learning and probed the perceptions of students’ learning. In the BL-BOPPPS model, the procedure of each teaching unit was disassembled into six phases (the bridge-in, objective, preassessment, participatory learning, postassessment, and summary phases) and three stages (before, during, and after class). The blended learning combined with the BOPPPS model made the teaching activities of the blended learning more structured than the teaching of traditional lecture in class. The education of the BL-BOPPPS model in the HSM introduction course was effectively organized and welcomed by these health students. On the basis of the students’ learning performance, students in the intervention group achieved outcomes superior to those students in the control group. In terms of the students’ self-assessment of perceptions, students in the intervention group had the positive overall perceptions of the BL-BOPPPS model. In addition, the results further indicated that the BL-BOPPPS model could also stimulate their learning initiative, motivation, and self-directed learning ability and improve learning satisfaction. Thus the BL-BOPPPS teaching strategy is worth promoting in current teaching practices in Chinese colleges and universities.

ACKNOWLEDGMENTS

We thank all the student participants for the time dedicated to this study. The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

GRANTS

This work was supported by the Project for Excellent Talents in Xihua University Grant 202026 and the Key Project for Education and Teaching Reform in Xihua University Grants XJJG2019005 and XJJG2019006.

DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS

X.M. and L.L. conceived and designed research; X.L., H.Z., and Y.L. performed experiments; X.M., X.M.* X.L., H.Z., and Y.L. analyzed data; X.M. and X.M.* drafted manuscript. *Xuewei Ma.

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