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Who can benefit more from massive open online courses? A prospective cohort study

Mengmeng Jia[1], De Gong[1], Jie Luo, Juanjuan Zhao, Jing Zheng, Kun Li*

School of Nursing, Sun Yat-sen University, Guangzhou, China

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ABSTRACT

Background: Massive open online courses (MOOCs) are innovative courses that have aroused great interest in the field of nursing education. However, most studies have focused only on the benefits of MOOCs rather than the issues and how to ameliorate them.

Objectives: To compare the differences between the "blended learners" (who studied at a university and via a MOOC) and "social learners" (MOOC-only learners) in course completion, participation, performance, and online interactions.

Design: A prospective cohort study.

Settings and participants: The participants were social and blended learners registered on a 16-week Health Assessment MOOC on a Chinese MOOC platform.

Methods: The data were collected from the MOOC learning records. The participants were categorized based on their participation: Committed learners (participated in all topic tests and the final exam), Early dropout learners (initially participated but did not finish the course), and Other learners (the remainder). The differences in course completion, participation, performance, and online interactions (in three case discussions and free discussions) between the blended and social learners, and among the three participation types, were assessed.

Results: At total of 4106 participants registered, comprising 57 blended and 4049 social learners. The completion rates for blended and social learners were 100% and 7.14%, respectively. The blended learners showed stable participation rates over the course ($\chi^2 = 0.190$, $P = 0.663$) while the social learners showed a trend of high to low participation ($\chi^2 = 179.602$, $P < 0.001$). The blended learners had better performance than the social learners (all $P < 0.05$) except among the committed learners. The blended learners also had more online interactions than the social learners ($\chi^2 = 25.107$, $P < 0.001$). The Early dropout and Other learners among the social learners participated more in the free discussions than the case discussions ($P < 0.001$).

Conclusion: Blended learners benefit more from MOOCs than social learners, and online-to-offline blended approaches are recommended for future nursing education.

1. Introduction

The use of massive open online courses (MOOCs) is an innovative approach that is challenging traditional medical education. As a term first coined to describe a course facilitated by Stephen Downes and George Siemens in 2008 (Downes, 2008), interest in MOOCs have been thriving in the education field (Maxwell et al., 2018). MOOCs are usually offered as online courses that allow easy access, unrestricted registration, and free participation. MOOCs utilize multiple learning resources such as short video lectures, slide presentations, texts for reading, live chat, and online learning assessments (Maxwell et al., 2018; McCartney, 2015). In addition, MOOCs provide a complete set of teaching management resources for registration, regular release of notices and resources, online discussion organization, and performance management. After the completion of the whole course, free certifications are generally issued, but fees are sometimes required for specific verified certifications.

As a new educational approach, it is obvious that MOOCs have many advantages, such as convenience, flexibility, and affordability, as well as offering collaborative, social, and potentially lifelong learning (Skiba, 2013). On the other hand, it is impossible to ignore the challenges associated with MOOCs, which mainly include poor completion rates, lack of instructor interactions with learners, and limited learning evaluation. Free registration is both an advantage and a disadvantage.

* Correspondence author at: School of Nursing, Sun Yat-sen University, No.74 Zhong Shan Second Road, Guangzhou 510080, China.
E-mail address: likun22@mail.sysu.edu.cn (K. Li).

[1] Mengmeng Jia and De Gong contributed equally to this work.

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A large number of social learners who take part in the MOOC freely have been shown to be bystander learners (who only browse rather than fully participating) or Early dropout learners (who initially participate but do not finish the course) (Gilligan et al., 2018; Reich, 2014). Not having undertaken the prerequisite academic courses may undermine some learners' self-confidence and ability. It has been reported that the completion rates of most MOOCs are extremely low, often 2–10% (Maxwell et al., 2018) and rarely > 15% (Waldrop, 2013), although thousands of learners often register on these MOOCs. Additionally, the roles of instructors in promoting interactions with and the involvement of learners are impeded because of lack of face-to-face communication (Skiba, 2013). Besides the academic credibility issues relating to online evaluation, some practical skills cannot be assessed by only using online evaluation (Childs et al., 2005).

After realizing the limitations of MOOCs, educators began to consider how to make better use of them. Many researchers have recommended integrating MOOCs into a blended campus-based learning curriculum, in the form of online-to-offline courses and small private online courses (Maxwell et al., 2018). These blended MOOC courses could be used by much fewer but more specific learners than regular MOOCs, which has been shown to increase the completion rate (Berman et al., 2017). Besides providing online learning resources, instructors could organize offline teaching activities to improve learning effectiveness, such as lectures and “flipped classrooms” (where traditional instructional content is delivered online and activities traditionally considered homework are moved to the classroom under the guidance of the teacher) (De Castañeda et al., 2018; Telang, 2016). Combined online and offline evaluation could be more comprehensive, which could increase the credibility of the qualification.

Due to the potential advantages of MOOCs, numerous nursing-related courses have been created and made accessible to social learners on various MOOC platforms, such as Coursera (https://www.coursera.org/), EdX (https://www.edx.org/), and the Chinese MOOC platform icourse 163 (https://www.icourse163.org/). In addition, many studies have explored the use of MOOCs in nursing education (Sitzman and Muller, 2018; Warren et al., 2016). These studies mostly focused on the benefits of MOOCs on learners' performance and satisfaction. There are very few studies exploring the issues with MOOCs and how to ameliorate these issues. Considering the potentially wide influence of MOOCs, it is worth exploring how to improve the role of MOOCs in nursing education by making better use of MOOC resources.

A MOOC program on Health Assessment was developed by the authors of this study, which was released in the 2018 spring semester on the Chinese MOOC platform icourse 163 (https://www.icourse163.org/course/SYSU-1002533004). When the MOOC was fully launched on the Internet, a MOOC-based blended learning study was simultaneously conducted among the baccalaureate nursing students who were on the Health Assessment course. There were questions regarding whether the social or the school blended learners benefit more from the MOOC and whether there any differences between the two in the usage of MOOC resources. This study aimed to compare the differences between the social and the blended learners in course completion, participation, performance, and online interactions. The results provide more evidence on MOOC-based learning and the usage of MOOC resources.

2. Methods

2.1. Design

This is a prospective cohort study. The data were collected from the Health Assessment MOOC learning records generated by learners on the Chinese MOOC platform icourse 163 (https://www.icourse163.org/course/SYSU-1002533004).

2.2. Participants

After the MOOC was launched on the platform, all learners who registered for the course online were included as study participants. The MOOC was free and there were no restrictions regarding who could register. Some of the participants were second-year nursing undergraduates at the authors' university who were on the Health Assessment course. These undergraduates were invited to participate in the MOOC-based blended learning study and were called blended learners. Their online screennames were required to be “SYSU” combined with their student ID (e.g., “SYSU05210534”) to differentiate them from the social learners. The blended learners were assured that their participation in and performance on the MOOC would not influence their final grade for the offline course. The rest of the participants, who registered freely without any restrictions on the MOOC were called social learners. All the participants were represented on the platform by their screennames, and personal information was not seen by the other MOOC learners or instructors.

2.3. Development of the Health Assessment MOOC

The teaching team was composed of one associate professor, one senior lecturer, two lecturers, one clinical nurse specialist, and one associate chief physician of clinical imaging. It took one year to prepare the MOOC resources on 13 topics, which included a variety of videos, tests, reading materials, and case discussions (Table 1).

There were 57 videos in the MOOC. Each video ranged from 10 to 20 min and had clear learning objectives, problem-oriented contents, and a brief summary. The videos were recorded by a professional video production company. Additionally, references were provided online to

Table 1
Resources of the Health Assessment massive open online course (MOOC).

Topic	Videos	Reading materials	Mid-video questions	In-class test questions	Topic test questions	Case discussion
1. Overview of health assessment	6	–	4	20	15	–
2. Basic examination	5	–	2	20	15	–
3. Head and neck examination	4	–	2	12	15	–
4. Chest examination	6	2	1	28	20	1
5. Cardiovascular examination	5	–	4	19	20	1
6. Abdomen examination	7	–	6	25	20	1
7. Spine and limbs examination	2	–	0	7	15	–
8. Neurological examination	1	–	1	3		–
9. Complete physical examination[a]	2	–	0	20	–	–
10. Laboratory testing	10	–	15	48	20	–
11. Electrocardiography	4	–	1	11	15	–
12. Imaging	4	–	1	11	15	–
13. Nursing documentation	1	1	0	2	–	–
Total	57	3	48	226	170	3

[a] There was no unit test for topic 9, but there was a mid-term test in the form of an in-class test.

supplement the videos. Three case discussions were arranged in the MOOC, which were on the topics of chest, heart, and abdomen examinations.

There were 433 test questions. For all videos > 10 min, a resident question was inserted in the middle. At the end of each video, there was an in-class test with 2–15 questions. Additionally, there was a test for each topic that had 15–20 questions. There were ten topic tests in total because topics 7 and 8 were combined together and topics 9 and 13 had no tests. In addition, there was a final exam that included 70 questions and had a time limitation of 2 h.

All the MOOC resources were reviewed over multiple rounds and audited by the teaching team and the editors of the MOOC platform.

2.4. Intervention

The Health Assessment MOOC was available online from March 5 to June 22, 2018, lasting 16 weeks. Prerequisite academic courses for registering on the MOOC included anatomy, physiology, biochemistry, pathophysiology, and pathology, but there was no requirement to prove that these prerequisites had been met. The learning resources and notices of the launch of each topic were issued regularly according to teaching progress. Members of the teaching team acted as the MOOC instructors. They were responsible for the management of the whole teaching process, including issuing the learning resources and notices, instructing the learners during the case discussions, participating in the online discussions, and managing performance and certification.

2.4.1. Social learners

Social learners could search for the course via the MOOC platform website and freely register before and after the course was released. Besides watching the videos and finishing the related tests, social learners were required to participate online in the three case discussion sessions. They could also ask questions and freely discuss the topics in the discussion area of the platform.

2.4.2. Blended learners

The blended learners at the authors' university received online to offline blended teaching based on the MOOC. These second-year undergraduates were studying the Health Assessment course in the 2018 spring semester. In the first offline lesson, the teachers gave them a 10-minute introduction to the Health Assessment MOOC. They were encouraged to learn autonomously online and were required to register using the screenname “SYSU” combined with their student ID.

The progression of the MOOC and the offline teaching were synchronous. It was recommended to the blended learners to finish watching each video and to complete the tests according to the progress of offline teaching. They were also encouraged to participate in the case discussions and to ask questions freely online. However, they were informed that their performance on the MOOC would not influence their final grade for the offline course.

The offline teaching lasted 17 weeks and consisted of 15 topics in total, which involved two additional topics (Nursing diagnosis and Functional health patterns) besides the thirteen MOOC topics. The offline teaching methods included lectures, practicing physical examinations, recording electrocardiography, simulation scenarios involving abnormal patient signs, and first-hand observation at a hospital. Flipped classroom sessions were implemented for four topics: chest, heart, and abdomen examinations and laboratory testing. Before each flipped classroom session, the students were required to self-learn the corresponding contents. In class, the students were asked to form groups and each group had to complete an online test involving 12–17 multiple-choice questions with a time limit of 10 min. The tests were designed on a survey website (https://www.wjx.cn). Each group had only one chance to finish the test and submitted the answers online by cellphone. After the answers were submitted, the teacher automatically obtained each group's overall score and response time and the rate of correct responses to each individual question. The teacher then discussed each question with the students according to the rate of correct responses, i.e., spending more time on the questions that had lower rates of correct responses. At the end of each flipped classroom session, a comprehensive case discussion was led by the teacher among the groups.

2.5. Outcome indicators

2.5.1. Completion rate, pass rate, and rate of excellent performance

The completion rate, pass rate, and rate of excellent performance were calculated. The final MOOC performance score consisted of three parts: 40% was accounted for by the topic tests, 10% by the case discussions, and 50% by the final exam. Learners with a final score were viewed as having completed the MOOC. A final score > 60 was considered to be a pass, and > 80 was excellent.

2.5.2. Participation

Learners who obtained scores for the topic tests and the final exam were viewed as the participants in each of the individual topic subcourses and the final exam. The participation frequency and percentage of learners in the ten topic tests and the final exam were computed individually.

2.5.3. Performance

Since there were different numbers of questions and full scores in each topic tests and the final exam, the learners' performance was not averaged over all the assessments. Instead, performance was assessed based on the number of questions answered correctly in each topic test and the final exam individually.

2.5.4. Online interactions

Submitting a post in the online discussions was regarded as an interaction. The number and percentage of interacting participants and number of interactions in the three case discussions and free discussions were calculated.

2.6. Ethical considerations

This study was approved by the Department of Education Administration and ethics committee of the authors' university. All the learners registered on the MOOC did so on a voluntary basis. The social learners' personal information (except for their screennames) could not be seen by the teaching team or other learners. It was emphasized to the blended learners that their performance on the MOOC would not affect their final grade for the offline course.

2.7. Statistics

SPSS 21.0 software (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Mean and standard deviation were used to describe the number of questions answered correctly per test by the blended and social learners and by the committed learners in both groups. Frequency and percentage were used to describe the completion rate, pass rate, rate of excellent performance, participation rate in the topic tests and the final exam, distribution of different participation types among the blended and social learners, and distribution of learners with different numbers of online interactions among the blended and social learners.

The learners were categorized into three types based on participation: Committed learners, Early dropout learners, and Other learners. Committed learners were learners who participated in all ten topic tests and the final exam. Early dropout learners were learners who participated in test 1 or at least three of first five tests while not participating in any of the other following five tests and final exam. The remainder was called Other learners, including topic-specific, register-only, and

browse-only learners. The distribution of the three learner types were described using percentages.

Regarding the statistical tests, the Cochran–Armitage trend test was applied to analyze the trend in the participation of the blended and social learners as the MOOC progressed. The *t*-test was used to determine the differences between the two groups in each test score and the final exam score. Given the influence of different educational backgrounds, analysis of covariance was employed to examine the differences between the committed learners in each group regarding performance on each test and the final exam. In this analysis, the test 1 results were treated as the covariate representing the original academic level of the learners. The chi-square test was employed to test the differences in the number of online interactions between the two groups and the differences in the number of online interactions in each case discussion vs. the free discussions among different participation types in each group. As ≥1 cell had an expected count < 1, the *P*-value of Fisher's exact test was shown.

3. Results

3.1. Completion rate, pass rate, and rate of excellent performance

During the 16 weeks after the beginning of the course, 4106 accounts were registered, comprising 57 blended learners and 4049 social learners (Fig. 1). At the end of the course, a total of 346 (8.4%) participants completed the course, and the completion rates for blended and social learners were 100% (57) and 7.14% (289) respectively. Among the 346 participants who completed the MOOC, 75 (20.6%) participants passed (final score ≥ 60) and 46 (13.3%) performed excellently (final score ≥ 80). The pass rates for blended and social learners were 89.5% (51) and 8.3% (24), respectively, and the rates of excellent performance were 59.6% (34) and 4.2% (12), respectively.

3.2. Participation

During the 16 weeks, there were ten topic tests and a final exam. For blended learners, the participation rates were all > 85% for each test and the final exam (median 89.5%, interquartile range 89.5–93%), and the rates were generally stable as the MOOC progressed ($\chi^2 = 0.190$, $P = 0.663$). For social learners, the participation rates were all < 65% (median 19.7%, interquartile range 14.5–25.6%), and they gradually decreased stable as the MOOC progressed ($\chi^2 = 179.602$, $P < 0.001$) (Fig. 2).

Among blended learners, Committed learners accounted for the majority (n = 36, 63.2%), followed by the Other learners (n = 19, 33.3%), and lastly the Early dropout learners (n = 2, 3.5%). Among social learners, the distribution of these three types was reversed. Committed learners accounted for the smallest number (n = 17, 5.9%), while Early dropout learners accounted for the majority (n = 146, 50.5%) (Fig. 3).

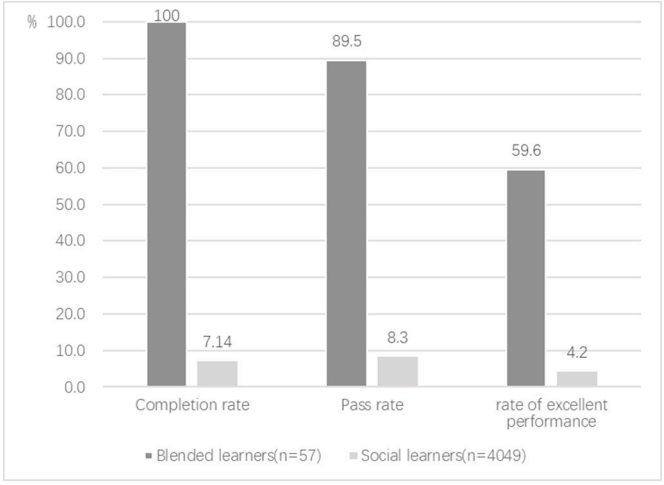

Fig. 1. Completion rate, pass rate, and rate of excellent performance between blended and social learners.

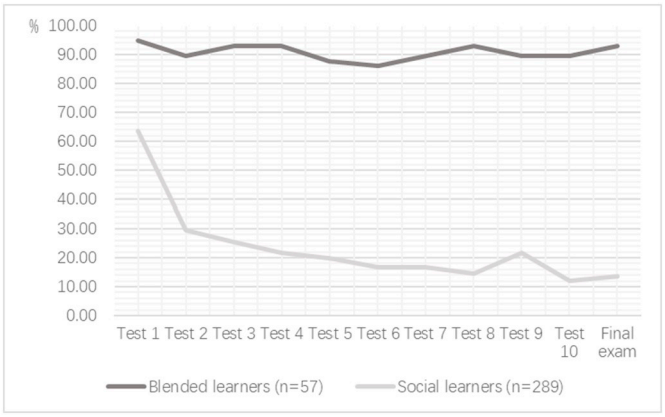

Fig. 2. Participation rates of the blended and social learners for the ten tests and the final exam (n = 346).

3.3. Performance

The number of questions answered correctly by blended and social learners in each test and the final exam was used to evaluate their performance. As shown in Table 2, blended learners had better performance than the social learners in each test and the final exam. For committed learners in both groups, the analysis of covariance (corrected for the original academic level of the learners) showed that there were no significant differences between the two groups in performance on the tests and the final exam except for tests 5 and 10, which were on cardiovascular examination and imaging (Table 3). In addition, the *P*-value for the difference between the two groups in performance on test 9 (on electrocardiography) was near the significance level ($P = 0.058$).

3.4. Online interactions

The online interactions of the learners were classified as either case discussions or free online discussions. There were a total of 61 learners involved in interactions, 22 of whom were blended learners and 39 of whom were social learners ($\chi^2 = 25.107$, $P < 0.001$). The distribution of the learners with different numbers of online interactions in the two groups is shown in Fig. 4. Among the blended learners, there were no

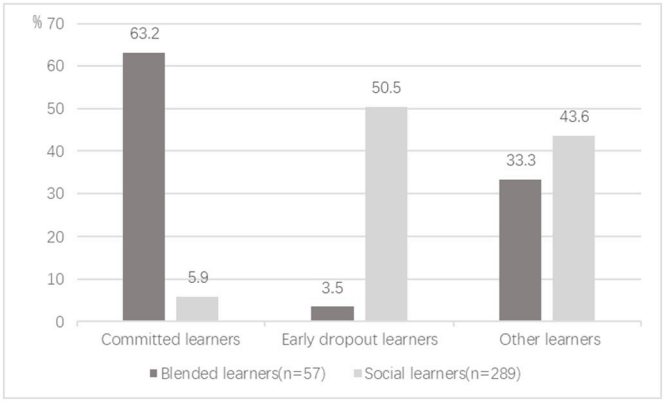

Fig. 3. Distribution of the Committed learners, Early dropout learners and Other learners in the two groups.

Table 2
Number of questions answered correctly per test by the blended and social learners.

	Blended learners			Social learners			*t*	*P*
	n	Mean	SD	n	Mean	SD		
Test 1	54	8.6	1.7	184	6.7	2.4	6.384	< 0.001
Test 2	51	9.7	0.7	85	8.0	2.2	6.274	< 0.001
Test 3	53	9.5	0.8	74	7.8	2.3	5.761	< 0.001
Test 4	53	13.6	1.7	63	11.3	3.6	4.701	< 0.001
Test 5	50	14.3	1.3	57	11.5	3.6	5.585	< 0.001
Test 6	49	13.9	1.3	48	11.6	3.2	4.976	< 0.001
Test 7	51	9.5	1.1	48	8.0	2.2	4.278	< 0.001
Test 8	53	13.6	1.5	42	11.1	3.5	4.606	< 0.001
Test 9	51	9.5	0.8	63	8.2	2.0	5.085	< 0.001
Test 10	51	9.1	1.2	35	7.6	2.6	3.321	0.002
Final exam	53	43.6	5.6	38	36.4	11.5	3.694	0.001

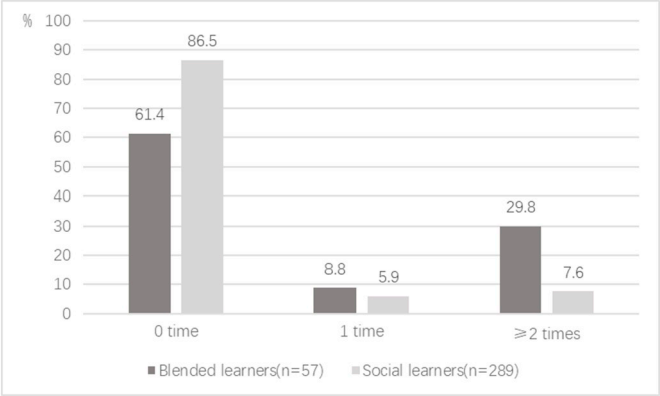

Fig. 4. Distribution of learners with different numbers of online interactions among the blended and social learners ($\chi^2 = 25.107$, $P < 0.001$).

significant differences for the Committed learners, Early dropout learners, and Other learners between the case discussions and the free online discussions (Table 4). Among the social learners, there were no significant differences for committed learners but the Early dropout and Other learners were more likely to participate in the free discussions than the case discussions (Table 5).

4. Discussion

The results indicate that there were significant differences between the blended and social learners, and between the learners with different participation patterns: 1) Although the overall MOOC completion rate was low, the blended learners' completion rate was satisfactory. 2) The participation rates for the tests and the final exam showed that the blended learners participated more and had more stable participation as the MOOC progressed than the social learners. The social learners showed a trend of high to low participation. 3) The blended learners had better performance than the social learners. However, there were few significant differences in topic test scores and final exam scores between the committed learners in each group. 4) The blended learners had more online interactions than the social learners. The Early dropout learners and Other learners among the social learners preferred the free discussions to the case discussions, but for the committed learners there was no difference.

The overall completion rate was 8.4% but it was only 7.14% for the social learners, which is in accordance with the results of other studies (Berman et al., 2017; Bozkurt et al., 2017; Skiba, 2013). In contrast, the blended learners had a completion rate of 100%. Various learning motivations may have accounted for the high dropout rate among the social learners. Some social learners participate in MOOCs just for some specific topics that they interested or needed and do not intend to complete the entire course (Reich, 2014). Additionally, a previous study found that nearly half of a set of MOOC participants were just browsing or auditing the courses or were unsure about their intentions for joining the courses (Reich, 2014). In contrast, the blended learners had the pressure of completing and passing the offline course to encourage them to participate in the MOOC. The synchronous MOOC resources may have increased their knowledge and understanding developed offline and helped them to cope with offline exams and clinical practice.

The participation rates for the topic tests and the final exam reflected the engagement of the learners with the MOOC assessments. For the blended learners, the participation rates were basically stable as the MOOC progressed, while the social learners showed a trend of high to low participation. Many social learners might not have studied the prerequisite courses (such as anatomy), although notices were released in the MOOC regarding these requirements. Lack of relevant foundational academic knowledge may result in difficulty in completing an entire MOOC, leading to an increased dropout rate (Root Kustritz, 2014). In addition, the long duration (16 weeks) of the MOOC may have accounted for the gradual decrease in the enthusiasm of the social learners, as shown in a different study (Goldberg et al., 2015). Previous studies have shown that the MOOC registration and participation rates decrease with the progress of the course (Bozkurt et al., 2017; Jordan, 2014, 2015). For the blended learners, the synchronous release of the MOOC resources could have helped them to consolidate the knowledge learned offline and the four flipped learning sessions also encouraged them to self-learn the contents online in advance, which may have accounted for their stable participation in the tests and final exam.

The blended learners had better performance than the social

Table 3
Analysis of covariance between the committed learners among the blended and social learners.

	Uncorrected		Covariance corrected[a]		*F/t*	*P*
	Blended (n = 36)	Social (n = 17)	Blended (n = 36)	Social (n = 17)		
Test 1	9.1 ± 1.0	8.1 ± 1.8	–	–	6.771	0.012
Test 2	9.6 ± 0.7	9.0 ± 1.9	9.5 ± 0.2	9.3 ± 0.3	0.309	0.580
Test 3	9.7 ± 0.6	8.7 ± 2.0	9.5 ± 0.2	9.0 ± 0.3	2.171	0.147
Test 4	14.0 ± 1.3	12.6 ± 3.2	13.7 ± 0.3	13.2 ± 0.4	1.184	0.281
Test 5	14.4 ± 1.0	12.2 ± 3.7	14.3 ± 0.4	12.5 ± 0.5	7.869	0.007
Test 6	14.1 ± 1.2	12.6 ± 3.5	13.9 ± 0.3	13.0 ± 0.5	2.258	0.139
Test 7	9.5 ± 1.1	8.6 ± 2.1	9.3 ± 0.2	8.9 ± 0.3	1.144	0.290
Test 8	14.0 ± 1.4	12.8 ± 2.6	13.8 ± 0.3	13.2 ± 0.4	1.369	0.247
Test 9	9.5 ± 0.8	8.6 ± 2.0	9.5 ± 0.2	8.7 ± 0.3	3.747	0.058
Test 10	9.3 ± 0.9	8.2 ± 2.0	9.2 ± 0.2	8.4 ± 0.3	4.942	0.031
Final exam	44.7 ± 4.3	41.9 ± 6.7	44.3 ± 0.8	42.9 ± 1.3	1.119	0.295

[a] Corrected for the test 1 results (representing the original academic level of the learners).

Table 4
Chi-square test between each case discussion and the free discussions for different participation types among the blended learners.

Case discussion		Committed learners in free discussions		χ^2	*P*	Early dropout and Other learners in free discussions		*P*
		Participation	No participation			Participation	No participation	
1	Participation	4	9	0.727	0.394	0	3	1.000[a]
	No participation	3	20			2	16	
2	Participation	4	8	1.086	0.297	1	3	0.352[b]
	No participation	3	21			1	16	
3	Participation	5	7	3.746	0.053	1	3	0.352[c]
	No participation	2	22			1	16	

a, b, c, As ≥1 cell had an expected count < 1, the *P*-value of Fisher's exact test is shown.

Table 5
Chi-square test between each case discussion and the free discussions for different participation types among the social learners.

Case discussion		Committed learners in free discussions		*P*	Early dropout and Other learners in free discussions		*P*
		Participation	No participation		Participation	No participation	
1	Participation	2	8	0.485[a]	5	6	< 0.001[d]
	No participation	0	7		13	248	
2	Participation	2	9	0.515[b]	5	6	< 0.001[e]
	No participation	0	6		13	248	
3	Participation	2	10	1.000[c]	3	8	0.029[f]
	No participation	0	5		15	246	

a, b, c, d, e, f: As ≥1 cell had an expected count < 1, the *P*-value of Fisher's exact test is shown.

learners, which is in line with previous studies (Liu et al., 2016; Mangione et al., 1991; Rouse, 2000; Shomaker et al., 2002). Besides the learning motivations discussed above, the students' knowledge base and level of engagement and the instructors' encouragement may all have influenced the performance of the MOOC learners. And the Health Assessment course is a professional course that requires practicing on healthy people and patients in addition to learning theoretical knowledge, but only MOOC could not tender both aspects. Owing to the help of instructors and the pressure to pass the offline course, it was reasonable that the blended learners performed better than the social learners.

It is worth noting that the committed learners in the two groups participated in all ten topic tests and exams, completed the MOOC, and showed no differences in performance on most tests. This indicated that the social learners who intended to complete the MOOC and had high participation rates had similar performance to the blended learners, even without the help of instructors offline, as shown in a different study (Gagnon et al., 2013). However, there were significant differences for tests 5 (cardiovascular examination) and 10 (imaging), and the difference for test 9 (electrocardiography) was near the significance level ($P = 0.058$). From the perspective of teaching, the three topics were more difficult to be understood and mastered than the other topics, and so they required more learning effort, more leaning resources, and more help from teachers. However, the limited MOOC resources could not ensure that the learners completely grasped the contents on their own. Therefore, learning more complicated topics is clearly easier for blended learners when there is help from instructors offline.

In this study, the blended learners were more active than the social learners in terms of the numbers of interacting participants and the number of interactions. For the blended learners, teachers' requirements, encouragement, and advise may have increased participation in the online discussions. It was also found that the Early dropout and Other learners among the social learners had increased numbers of interactions in the free discussions than in the case discussions, while there was no significant difference for the Committed learners. The committed learners among the social learners showed relatively stable and satisfactory manifestation in all aspects of the MOOC, which may be related to their strong motivation to learn. Owing to the diverse motivations, the Early dropout and Other learners focused more on the specific learning resources that attracted them. These social learners might have experienced difficulties in understanding the MOOC contents due to lack of instructions from teachers offline, which might have increased their participation in the free discussions rather than the case discussions.

The study has several limitations. First, under the privacy protection principles of the MOOC platform, the learners' demographic data could not be seen, and data on the number of videos viewed and the viewing duration could not be collected either, so deeper analyses could not be conducted. Second, the sample size of the blended learners was small, so many comparisons between the blended and social learners were limited. Further studies with larger sample sizes should be conducted in the future.

5. Conclusion

This study compared the differences between the social and blended learners on the MOOC. It showed that the blended learners had better performance and better usage of the MOOC resources (such as discussions and tests) than the social learners. Additionally, the learners with different participation types also performed differently. Committed learners among the social learners mostly performed the same as the committed learners among the blended learners, even without the help of offline instructors. However, for some difficult topics, the help of instructors was necessary. Therefore, the blended learners benefited more from the MOOC, and online-to-offline blended approaches are recommended for future nursing education.

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Contributions

Mengmeng Jia and De Gong drafted and revised the manuscript. De Gong was responsible for the statistical analysis and management of the

massive open online course. Jie Luo also administered the massive open online course. Jing Zheng and Juanjuan Zhao revised the manuscript and were responsible for the production of MOOC resources and the implementation of blended learning research. Kun Li was responsible for the project design, implementation, quality control, MOOC management, and manuscript revision.

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Declarations of interests

None.

Ethical approval

The survey was approved by Sun Yat-sen University's Department of Education Administration and Sun Yat-sen University's ethics committee.

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