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# From theory to practice: A case study of technology-enhanced O2O teaching

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## From theory to practice: A case study of technology-enhanced O2O teaching


### Abstract

Stimulated by the isolation requirement of COVID-19 lockdown, online teaching method has been widely adopted by worldwide academic institutions and has been playing an essential role in accelerating education reform. While both traditional classroom teaching and pure online teaching have their drawbacks, an integrated online to offline (O2O) precision teaching model is considered to be the new trend. With the support of information technology, O2O precision teaching is capable of monitoring students' behavior closely and tailoring the curriculum for each student. This study designed a detailed platform-based O2O precision teaching model and applied it to the *Chinese Business Culture* course teaching. Traditional offline teaching was also conducted as a control. Both test scores and student feedback were collected and analyzed. Results show that the technology-enhanced O2O precision teaching model can improve students' test performance and various soft skills and has their high degree of satisfaction in the meantime, indicating that it can work as a promising new teaching model.


### Practitioner Notes

1. This study designs a platform based online to offline precision teaching model.
2. Students' learning behavior and performance data throughout the entire teaching process is collected and analyzed, helping finetune the teaching method.


### Keywords

o2o, precision teaching, platform, homogeneous group, data-driven, questionnaire

## Introduction

As the face-to-face teaching courses have been canceled during the lockdown of COVID 19 pandemic, online teaching approach has been employed worldwide to deliver lessons (Liguori & Winkler, 2020). Unlike traditional offline teaching which is limited by space and time, online teaching method reaches learners quickly and remotely and brings vitality and flexibility to teaching (Cutri et al., 2020; Wadams & Schick-Makaroff, 2022; Zywno & Waalen, 2002). While showing its powerful strengths, drawbacks of online teaching have been exposed at the same time. Communications between students and teachers are rather difficult and low-efficiency, especially when it comes to clarifications and interpretations (Wang et al., 2021). Sandro's study also demonstrated that from students' perspective, offline learning is more amenable compared to online learning in terms of social presence, social interaction, and satisfaction. On the other hand, many students chose online learning over offline classes for the convenience and ease of time and for the opportunity to study when they wanted instead of when they had to (Bali & Liu, 2018). As both pure online and offline teaching have their drawbacks, it is reasonable to believe that an integrated online to offline teaching approach can have both sides' strengths while minimizing their shortcomings (Nepal & Rogerson, 2020).

This study designs an integrated teaching model by exploiting the Chinese University MOOC platform and the precision teaching method, seeking to provide a more effective and efficient teaching approach.

## Literature

The concept of O2O (online to offline) was first presented by Alex Rampell (2010) as a new business service model. The key to O2O is that it finds consumers online and brings them into real-world stores. Deriving from O2O commerce, a new approach of O2O teaching was then presented and has been widely studied. O2O teaching aims to take full advantage of both online technology and offline classrooms. Educators are capable of arranging the proportion of online teaching and offline teaching according to the actual situation. Students can preview and review the course online at their own pace, and enjoy the offline face-to-face class at the same time (Zhao, 2019).

Precision teaching (PT), a behavior analytic strategy, first put forward by Ogden Lindsley in 1960s, monitors each learner's behavior and adjusts the curricula for him to maximize the learning effect (Lindsley, 1991). Instead of being a way of teaching, PT represents a set of strategies and tactics for evaluating whatever program a teacher might choose to implement (Evans et al., 2021). By precisely defining and continuously measuring dimensional features of behavior and analyzing behavioral data on the standard celeration charts, PT helps educators make timely and effective data-based decisions to accelerate behavioral repertoires. The process of PT consists of four basic steps: Pinpoint, Record, Change and Try Again (Kubina, 2012; Gist & Bulla, 2020). Firstly, the target behavior of learner in observable and measurable terms is precisely defined. Secondly, daily measurement and graphing of the learner's behavior is recorded on the standard celebration chart. Then, collected data is analyzed and decisions are made correspondingly. In the end, "Try Again" refers to analyzing the environmental changes and systematically intervening until the desired outcome is achieved (Gist & Bulla, 2020). Though being much more precise, the need for continuous observation and data collection, calculation, and charting puts a heavy workload on educators and makes PT difficult to popularize in larger areas. This issue, however, can be resolved as information technology develops.

MOOC, known as a massive open online course, provides unlimited enrollment and open access via the Web to learners (Liu et al., 2021). Shortly after being introduced in 2008 for the first time, MOOCs have attracted wide interest from educators, learners, businesses, and the general public, and have become a popular mode of learning since 2012 (Liyanagunawardena & Williams, 2014). The pedagogical model of MOOCs is generally centered on delivering learning content via videos, additional reading material, and discussions among participants and/or within online forums (Gamage et al., 2021).

The Chinese University MOOC is an online education platform jointly launched by NetEase and the Higher Education Society, guided by the slogan "Excellent universities have no walls". It provides the public with over 8000 MOOC courses from over 800 well-known Chinese universities. Educators can post multiple sessions, such as pre-class e-learning materials, in-class discussions, assignments, exams, and surveys on the platform. Learners are provided with equal opportunities to take part in the class activities via smart devices. In the meantime, each learner's learning process and performance are recorded and demonstrated to the educators automatically, saving time for them from drudgery data collection and calculation work while implementing precision teaching. For example, the platform collects data on when each student starts to watch the video and how long has watched; the status of video watching is visualized to the educators in terms of a daily updated dashboard, while detailed data is available for download.

To summarize, different from the traditional "one-size-fits-all" approach, a platform-supported O2O precision teaching approach places more focus on the individual needs and preferences of different students while making it feasible to apply. This study proposes a Chinese University MOOC platform-based O2O precision teaching model which consists of a detailed teaching process and implementation paths. Practice has also been made to examine the teaching effect by applying the newly designed model to *Chinese Business Culture* course teaching.

## Model Design

### *Teaching Process*

Our MOOC Platform based O2O precision teaching consists of three steps.

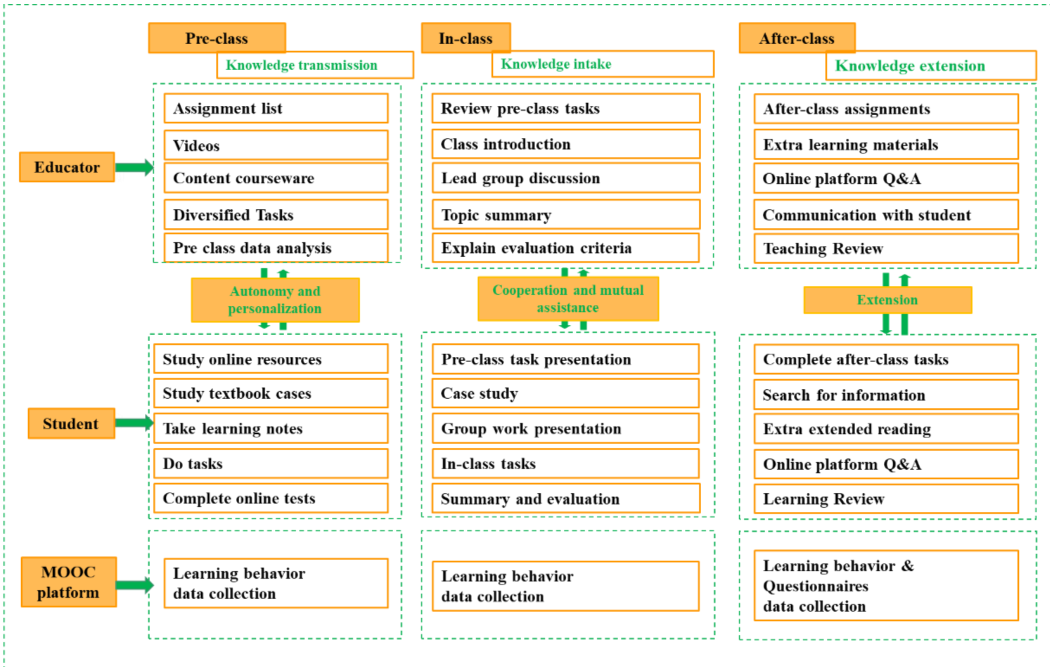
1) Pre-class: online self-learning and student learning data collection. Students preview the course on their own by studying instructional materials uploaded by educators on the MOOC platform, which includes slides, videos, and quizzes. Data of their cognitive and behavioral learning is recorded and visualized synchronously by the platform. By analyzing those data, educators can identify the key factors that will hinder mostly the realization of pre-set goals, based on which, teaching objectives are to be adjusted (Xiao et al., 2021; Layng, 2018).

2) In-class: offline case discussion within homogeneous groups. On the basis of previous analyses of their self-learning performance, students who share similar learning needs are divided into several homogeneous groups, making it possible for educators to provide targeted and differentiated instructions (Zhang et al., 2015; Sarkar et al., 2019). Each homogeneous group is assigned a distinct topic for discussion via the MOOC platform. Responses are collected and shown on the platform simultaneously. Comments and key point explanations are then given by the educators during the discussion, followed by an in-class quiz which is posed on the platform. Students are required to sign up, do the quiz, and post discussions on the platform via their smart devices, like handphones, pads, or computers. In this step, not only students' unique learning needs are met, but also their common misunderstandings are identified and well explained, together with other essential content.

3) After-class: further online differentiated teaching. Additional tailored learning materials and tasks are delivered to each student on the platform. Data can be recorded automatically, and students' self-evaluation and comments for the whole teaching process can also be collected via the MOOC platform.

**Figure 1**

Overview of Chinese MOOC platform based O2O precision teaching model




### *Student Assessment System*

Assessment is a critical process for educators to strategically evaluate the effectiveness of their teaching by measuring the extent to which students are meeting the learning objectives, thus institutionalizing effective teaching choices and revising ineffective ones in pedagogy. Our platform-based O2O precision teaching model adopts the two most frequently discussed forms of student assessment, which are summative assessment and formative assessment. Summative assessment, implemented at the end of the course in terms of final exams, provides information about patterns of student achievement, while formative assessment involves the evaluation of student learning over time (Maki, 2002; Clarke, 2011).

Regarding the assessment methods, self-assessment, peer-assessment, and educator-assessment are employed in this model. Self-assessment and peer assessment enable students to develop their judgment, facilitate a sense of ownership of one's learning, and can lead to greater investment by the student. Our assessment system not only focuses on the scores students earned but also pays great attention to their independent learning skills, problem-solving skills, and collaboration skills.

## Case Study: Chinese Business Culture

A case study in *Chinese Business Culture* teaching was undertaken to examine the effectiveness of the proposed Chinese University MOOC platform-based O2O precision teaching model by comparing it to the traditional way of teaching.

### *Course and Participants*

*Chinese Business Culture* is a general education course set up by Zhejiang Business College aiming to deliver key business principles concluded from Chinese history. By explaining the development of Chinese Business which has thousands of years' history, this course introduces essential business principles to students, thus laying the groundwork for their future business management learning. The course shall include 18 offline periods, one period (90 min) per week.

Two classes of total 89 students enrolled in 2019 at Zhejiang Business College majoring in Logistics were exposed to the traditional offline classroom teaching, as the control group; another two classes of total 112 students with the same background were given our platform based O2O precision teaching, as the experimental group.

### *Model Application*

*Experimental group*

The lecture on "Importance of Innovation", one of the six chapters in this course, was discussed minutely below as an example.

1. Pre-class (30 min per week): fundamental learning materials, tasks, and tests were uploaded onto the MOOC platform. Students were required to finish the preview before each offline class. Data on students' learning performance including video viewing, courseware learning, test scores, and platform discussion participation was collected and analyzed to identify their misunderstandings.

The following findings were concluded according to the data analysis.

- Students have understood the concept and importance of innovation, but do not know much innovation methods and have limited innovation awareness;
- Students don't fully understand the relationship between enterprise innovation and cultural inheritance; they have problems analyzing the innovation approach of particular enterprises independently.

Based on the findings of students' learning difficulties, objectives of in-class teaching were set correspondingly in table 1.

**Table 1**

*Objectives of in-class teaching of Importance of Innovation*

| Objective | Content |
|---|---|
| Cognition | To know the innovative approach to promote new domestic products; |
| | To understand 3 ways of innovation; |
| | To comprehend the relationship between enterprise innovation and cultural inheritance. |
| Ability | To analyze the innovation approach of particular enterprises; |
| | To perceive the innovation necessity of famous enterprises during times of change. |
| Quality | To enhance the awareness of pursuing innovation; |
| | To strengthen Chinese cultural confidence; |
| | To intensify the connection between culture and innovation. |

2. In-class (90 min per week): students were divided into several homogenous groups based on their pre-class self-learning performance. Four different assignments were delivered to students via the MOOC Platform. Each homogeneous group took an open discussion on the assigned topic and posted their responses on the MOOC platform, which could be seen by everyone in the class. Comments and explanations were given by the educator, followed by an in-class test to know the extent to which students take in the instruction. All the actions, including attendance and the test, were carried out on the platform.

3. After-class (60 min per week): personalized after-class learning materials and tasks were delivered to students according to their learning needs. Competition among groups was organized at the end of the course. Each group was asked to select one domestic product and come up with an innovative approach to sell it via the platform. Each student was given 3 coins that can buy 3 articles. The group that earns the most coins is going to be the winner. Moreover, a course evaluation questionnaire designed on the Likert scale was delivered to students via the MOOC platform. Students were asked to give feedback in response to 12 statements covering different aspects by choosing from 1 to 5 which represents from “strongly disagree” to “strongly agree”.

4. Student Assessment: as mentioned in the model design part, both summative assessment and formative assessment were used in the practice. The evaluation was carried out by the student himself, classmates, and educators. Comprehensive evaluation criteria are demonstrated in table 2.

**Table 2**

*Student performance evaluation appraisal*

| Content | Online/Offline | Point |
|---|---|---|

| | | | | |
|---|---|---|---|---|
| Pre-class (20%) | Self-learning | | Online: MOOC Platform | 10 |
| | Task1 | | | 5 |
| | Test1 | | | 5 |
| In-class (60%) | Attendance | | Offline Class | 5 |
| | Task2 (Case Study) | Self-assessment | | 15 |
| | | Peer-assessment | Online: MOOC Platform (for signing in, assignment and survey collection, test, assessment) | 15 |
| | | Educator-assessment | | 15 |
| | Test2 | | | 10 |
| After-class (20%) | Forum Engagement | | Online: MOOC Platform | 10 |
| | Task3 | | | 10 |

*Control Group*

The lecture in this group was given in a rather traditional way with only offline classes involved. In total 18 offline periods were included, one period (90 min) per week, which is the same as the experimental group. In contrast, all students in the control group received the same teaching regardless of their different abilities, and their before and after class learning status cannot be monitored without the help of online learning platform. The teaching in the control group is divided into three phases as well.

1. Pre-class (30 min per week): learning materials of all the chapters (videos, PowerPoints, etc.) were shared with students via cloud in the very beginning of the course. Students were required to do the preview before each class. Whether they do the preview or not and to what level they have learned stay unknown to educators.

2. In-class (90 min per week): in the beginning of the class, a pre-class test with the same questions as the experimental group was carried out. Teaching objectives were set by the educators before the course and stayed unchanged throughout the whole course. Two types of classes were given alternately, one for theory and one for discussion. In the discussion class, students were divided randomly into several groups, given one same topic. A final test with the same questions and the same course evaluation questionnaire as the experimental group were assigned to students at the end of the course.

3. After-class (60 min per week): continuing learning materials and tasks were provided to students after class, which were uniform to everyone. Assignments were collected before the next class and graded manually by educators afterwards.

### Statistical analyses

All statistical analyses were analyzed by SPSS Statistics version 22.0 (IBM Corp, Armonk, USA). The statistically significant differences between the data of the two groups were determined by using a Student's t-test with $p < 0.05$ required.

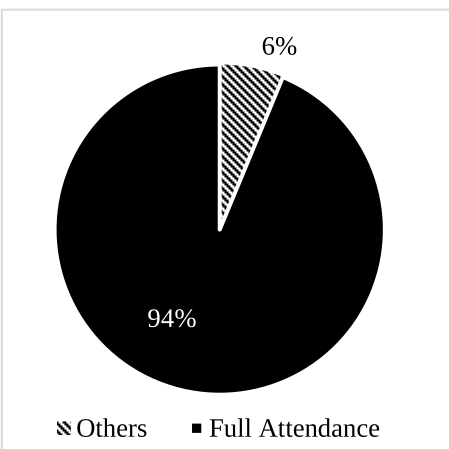
## Results

### Students' learning behavior can be monitored and visualized in the experimental group

While it was hard to track students' learning progress in the control group, students' learning behavior can be monitored in the experimental group, including attendance, length of pre-class video viewing and in-class discussion engagement (as shown in Figure 2-4). Figure 2 shows that 94% of students in the experimental group had full attendance of the offline classes. Figure 3 shows that 61.6% of students in the experimental group had finished the pre-class video viewing for over 5 hours while only 5.4% of them watched for less than 2 hours. According to Figure 4, 68.8% of students in the experimental group had participated in all 6 in-class discussions, while 17.0% of them engaged in 0 discussions.

**Figure 2**

Student attendance of offline class in the experimental group




*Note.* "Others" includes being late or absent for at least once.

**Figure 3**

Student pre-class video viewing status in the experimental group

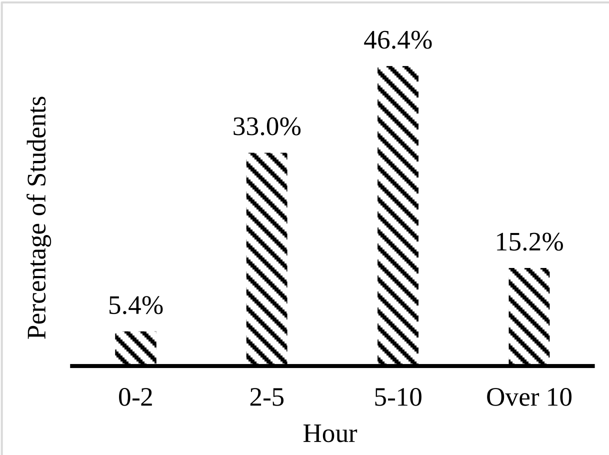
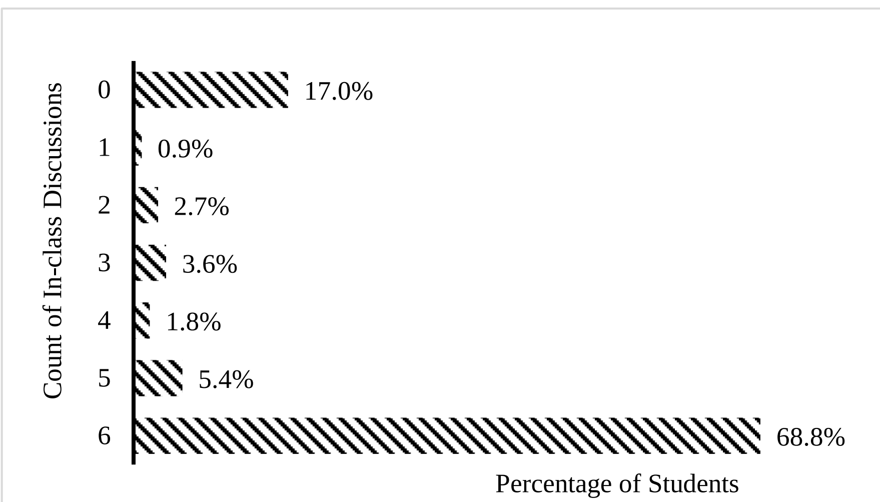



**Figure 4**

Student in-class discussion engagement in the experimental group

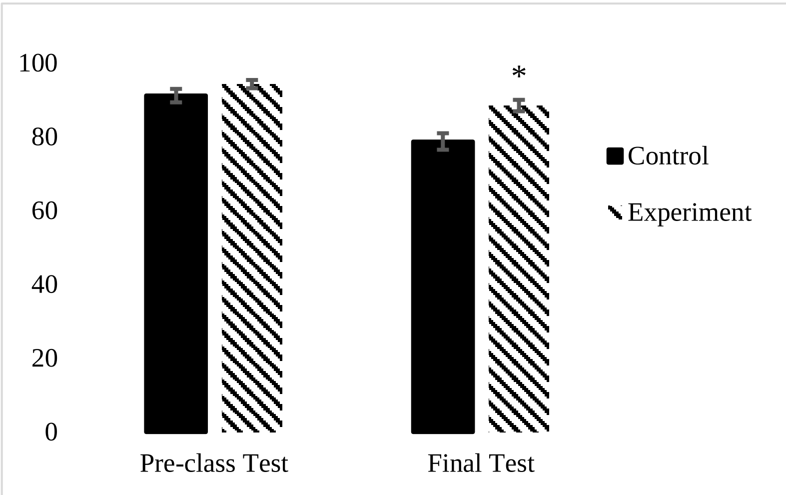



### ***Students from the experimental group scored better on test***

Figure 5 illustrates students' performance in pre-class and final tests in two teaching groups. In the pre-class test, though no significant difference was identified, students in the experimental group got higher scores than the control group, which is 94.3 vs 91.2. The difference became significant in the final test with students in the experimental group scoring 88.5 and those in the control 78.8 ($p<0.05$). In a word, students scored better on tests when given the MOOC platform-based O2O precision teaching.

**Figure 5**

Students' scores in pre-class test and final test




*Note.* Asterisk (*) represents a significant difference between the control and experimental group (Student's t-test, $p < 0.05$).

### ***Experimental group earned higher scores on the student perception questionnaire***

In total 88 students from the control group and 108 students from the experimental group have finished the questionnaires. Results are shown in Table 3. 12 statements from 3 aspects were selected. Consecutive numbers from 1 to 5 represent from "strongly disagree" to "strongly agree". Though in some statements, there is no significant difference between the control group and the experimental group, generally, the experimental group earned higher scores. In the pre-class section, students exposed to the new model were more motivated to do self-learning and held more positive attitudes toward pre-class learning, and the differences were proved to be significant ($p<0.05$). In the in-class section, though no significance was observed, students in the experimental group perceived better engagement in class and were more satisfied with the way that educators interacted with them and they with peers. In the overall section, the new model again had a higher degree of satisfaction among students and was believed to improve students' self-motivation, teamwork ability, and problem-solving skills.

**Table 3**

*Questionnaire result of student perception regarding two teaching approaches*

| Question | Control | New Model |
|---|---|---|
| Pre-class | | |
| I finished the preview assignment on time with high quality | 3.66±1.04 | 4.20±0.87* |
| The preview gave me a basic understanding of the sessions and helped me to better take in the class teaching | 3.57±0.83 | 4.32±0.85* |
| The preview before class stimulated my interest in learning | 3.63±1.17 | 4.26±0.79* |
| In-class | | |
| I was motivated to engage in class more actively, including raising questions and participating in discussions | 3.80±1.04 | 4.07±1.06 |
| I am satisfied with the way educators interact with students | 4.05±0.82 | 4.13±0.75 |
| I was able to learn from my peers | 3.76±1.17 | 4.08±1.02 |
| Overall | | |
| I have had a comprehensive understanding of the course | 4.03±1.20 | 4.31±0.91 |
| I feel motivated and confident to learn by myself in the future | 3.78±1.11 | 4.27±0.90* |
| My communication skill and teamwork ability are enhanced | 4.05±1.10 | 4.23±0.98 |
| My problem-solving skill is enhanced | 4.06±1.05 | 4.25±0.84 |
| I am satisfied with the teaching approach and hope to have it applied in more courses | 4.17±0.95 | 4.45±0.79* |
| I am satisfied with the student evaluation system | 4.07±1.03 | 4.20±1.06 |

*Note.* Data were presented as “Mean±Standard Deviation”;

*Asterisk represents a significant difference between the control and experimental group (Student's t-test, $p < 0.05$).

## Discussion

COVID-19 pandemic has triggered a surging demand for online teaching, which brings huge convenience to both educators and students. However, pure online teaching is blamed for being of lower quality and less interaction in comparison to traditional offline face-to-face teaching. Both educators and students find it more difficult to communicate online. In the meantime, traditional classroom teaching has been challenged of being inefficient, considering each student has his own learning pace and needs. Theories like precision teaching have been put forward to take each student’s characteristic into account while teaching. However, it requires massive data collection and calculation work to implement precision teaching, which overwhelms educators (Ramey et al., 2016). With the support of technology, this study aimed to design a blended teaching model that can have the strengths of both online and offline teaching while implementing precision teaching much easier.

In this study, the Chinese University MOOC Platform was employed to implement online teaching and record each student's behavior data throughout the entire teaching cycle, including his performance in offline classes, thus making it possible for students to do the preview at their own pace. Educators may focus on providing students with differentiated instructions other than spending a huge amount of time doing tedious calculation work. While asynchronous learning could be accomplished online with pre-recorded lectures, tests, and assignments uploaded onto the platform, interactive discussions, and higher-order learning activities like problem-solving occurred during the offline class as synchronous components (Sletten, 2017). In addition, by analyzing the behavior data and performance collected automatically by the platform, each student's learning need was well studied, and customized instructions were given correspondingly. When it comes to student evaluation, both summative assessment and formative assessment were adopted in this model to better reflect students' performance.

As demonstrated in "Results", students' behavior in the experimental group can be recorded and visualized. Just take the preview as an example, educators in the experimental group were capable of tracking each student's video watching status, knowing how long he has watched and even when, but those in the control group had no idea whether their students did the preview or not. This strength is also verified by the results of pre-class test. Moreover, by dividing students into several homogeneous groups, high engagement in class discussion was observed, and students got significantly higher scores in the final test than those exposed to the traditional approach, indicating that the new model can improve students' performance. On the other hand, students' feedback justifies the positive effect of the new model on their self-motivation, class engagement and teamwork, and so on. In the pre-class part, thanks to the powerful function provided by the Chinese MOOC platform, students can do the preview by simply following the instructions given on the platform and finishing each task, and educators can easily obtain each student's learning status and analyze students' learning difficulties, all of which results in the significantly higher scores the new model got in the first three statements of the questionnaire. In the in-class part, homogenous groups allow students who share a similar learning level to discuss together and learn with each other, thus providing a more comfortable atmosphere. Briefly, students' preference towards our new model that is observed in the questionnaire could be attributed to the technology empowerment and student centricity. In general, results from both direct test performance and students' perception imply that our Chinese MOOC platform-based O2O precision teaching model can contribute to a better teaching effect than the traditional teaching model.

## Conclusion

The MOOC platform-based O2O precision teaching model takes advantage of online teaching, traditional face-to-face teaching, and precision teaching while minimizing their limitations, thus making it a promising teaching model that meets the new challenges of modern teaching. The innovation points and strengths of our model are concluded as follows.

- From educator-centered to student-centered. By taking each student's specialty into consideration, students are given autonomy to schedule the online learning at their own pace and are encouraged to do the investigation by themselves. What's more, the design of offline case study improves students' engagement, teamwork skills, and presentation skills.
- From experience-driven to data-driven. Unlike traditional teaching, educators in our teaching model are equipped with comprehensive data on students' behavior and performance. By analyzing the data, each student's learning needs can be identified. Common and specific problems can also be recognized, thus giving suggestions to the design of offline differentiated teaching.
- From summative assessment to summative and formative combined assessment. Apart from the final test score, student's performance during the entire learning cycle is taken into consideration for assessment. As for the assessment method, self-assessment, peer-assessment, and educator-assessment are involved in this model, adding accuracy to student evaluation.
- From single teaching method to multi-dimension. Our model provides online self-learning resources like pre-recorded videos and quizzes, and homogenous group-based offline discussions, as well as personalized after-class assignments, maximizing students' engagement while delivering entertainment.

## Declaration of interest statement

This study participated in the following projects, Zhejiang Province Education Scientific Planning Project (2020YQJY451):"Precision teaching model construction based on MOOC analysis under COVID 19 pandemic control".Zhejiang Province Education Scientific Planning Project (2022SCG363):"Background,connotation and path research of the new business technical talents training under the sequential training of secondary vocational,high vocational and undergraduate education".China Business Economics Society Project(2022ZSZJZD07):"Research on the curriculum of the new business technical talents training under the sequential training of secondary vocational,high vocational and undergraduate education".

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