

The Application of Digital Teaching Platform Moodle in Transnational Teaching and Management

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ABSTRACT

Moodle platform has been more and more widely used in transnational education. Taking the Sino-Finnish cooperative education program of Nanjing Institute of Technology as an example, this paper analyzes the use of Moodle platform in teaching and teaching management during the process of program implementation. The results show that the carrying out of the course slots exercise, quiz, exam et al. highly depends on the use of Moodle platform. Moodle platform has to a certain extent integrated into the ordinary face-to-face offline teaching and has become an indispensable and important support for carrying out the "online + offline" mixed teaching mode. The use of Moodle platform has further improved the examination evaluation mechanism and promoted the formative evaluation of courses. The user log data generated by Moodle can also be used to analyze students' learning behavior and manage the whole course process.

Keywords: Teaching Platform, Moodle, Transnational Education.

1. INTRODUCTION

"Internet + education" gave birth to online teaching. The digital teaching platform in the new era can create rich and diverse online teaching resources, help teachers make flexible teaching plans and assist students to carry out effective autonomous learning. The COVID-19 outbreak as a black swan event has inadvertently become a catalyst for the further widespread use of digital teaching platform in education. During the epidemic period, various universities, provinces, cities, regions and even countries have built their own cloud teaching classrooms of different scales and adopted the online teaching mode. For a long time, face-to-face teaching has been the absolute dominant form of education. Cloud classrooms are generally only used for implementation of students' elective courses or interest courses selected by social individuals. The possibility and advantages of online teaching have not been fully recognized. Online teaching in epidemic situation provides a good opportunity, forcing universities and teachers to think about how to use technology to improve teaching, how to give full play to students' learning initiative when they can't meet students face to face and how to simulate real teaching situations during remote online teaching. Practice has proved that most education and teaching tasks can be accomplished through online teaching. Some researchers predicted that since the remote education

strategy which widely adopted by universities during the COVID-19 outbreak has become more mature, the education after Covid-19 will never get back to the traditional education mode as before [1]. In addition to sharing teaching resources, the obvious advantage of online teaching lies in breaking the limitation of time and space in teaching. Under the background of normalization of epidemic prevention and control, the cross-border flow of teachers is restricted to varying degrees. For transnational education, the online teaching platform has turned from an option into an indispensable teaching method in parallel with offline teaching.

The parallel teaching mode of "online" and "offline" is called blended teaching mode. Blended teaching combines the advantages of traditional offline teaching and digital teaching organically, which increases the flexibility of teachers' teaching and the autonomy of students' learning. The flexibility of teaching involves the integration and utilization of learning resources, teaching environment and teaching methods. The design of online courses is no longer constrained by the traditional teaching chapters. Teachers make full use of the ready-made knowledge resources on the network in the digital teaching environment within the framework of teaching plans. Teachers then refine, break up and reclassify the knowledge points involved in the courses, prepare lessons and teaching basing on new teaching units. The teaching contents can be made into PPT or uploaded to

the teaching platform. The autonomy of students' learning is mainly manifested in that they can carry out personalized learning to a certain extent according to their own situation. Students can log in to the platform anytime and anywhere to check the course materials and participate in the forum discussion, which expands the students' learning time and space. The unlimited playback function of teaching videos also provides students with more opportunities to check and fill gaps in knowledge. Offline courses are mainly used for teachers to guide students to practice and answer questions and for students to carry out group activities. Through the organic combination of the two teaching organization forms, the respective advantages of online and offline teaching could be given full play to and a good teaching rhythm and atmosphere would be formed.

2. LITERATURE REVIEW

The research on online teaching mainly focuses on the construction and operation of online teaching platform, the design of online courses, students' attitude and commitment to online courses, students' evaluation of online courses, factors affecting online teaching effect and so on. At present, the most popular online teaching platform in the world is Moodle (Modular Object-Oriented Dynamic Learning Environment). Derived from modern information technology, this teaching platform is a new curriculum management education platform developed by Martin Dougiamas of Australia based on the educational theory of constructivism, cultural interaction and self-oriented learning. According to the statistics of Moodle's official website, this platform has spread all over 240 countries around the world, with more than 210 million users and more than 260 million courses. More and more primary and secondary schools, institutions of higher learning and educational organizations choose Moodle to meet the needs of education and training. Meanwhile, the research and application of Moodle is also increasing.

Some researches aim at some specific application fields of Moodle platform in teaching, including disseminating materials and resources related to courses, tracking students' learning progress, communicating with course participants, creating homework and grading etc. [2]. Some studies focus on the use of Moodle platform in a certain type of courses, such as foreign language courses [3] [4], nursing courses [5] etc. Other studies have analyzed teachers' and students' attitudes towards the introduction of Moodle platform into daily teaching and learning. For example, the research results of Lebeaux [6] show that most teachers believe that the interactive test function provided by Moodle platform is helpful to the implementation of teaching. On one hand, teachers can adjust the course content according to students' answers to the questions of embedded and real-time tests. On the other hand, students can get systematic

feedback immediately after the test is over. Because the feedback of a test is more efficient, students' satisfaction is improved. The questionnaire survey conducted by Oproiu [7] shows that students think it is easier to use Moodle platform for learning because they are familiar with the electronic environment.

Some scholars have classified and summarized students' learning styles according to their log-in data and logs of material downloading and uploading. Kolekar [8] has used the e-learning application which has been developed in Moodle framework to capture learners' usage data. The specific steps are as follows: Students learn online courses through the online learning portal and their data is recorded in the platform logs. The data is then stored in the Moodle database on the WAMP server. Through this data, students' learning styles could be analyzed and the clustering of the students would be realized.

Studies have shown that students' online learning data could be linked with students' performance in online course persistence, learning management system achievement and course grades [9] [10] [11]. By sorting out and analyzing students' online learning data, the variables related to students' academic performance could be gained. Generally speaking, students who have used Moodle more frequently, visited virtual classrooms, checked new learning materials and participated in forum discussions regularly finally get higher scores [12]. Other scholars' studies have shown similar results, that is, the behavior of students during online courses and their click data can be used to predict their grades [13]. In addition, by analyzing the user logs, some users' abnormal access characteristics could be found, such as the so-called "monkey click", that is, users don't care about learning materials, but only click [14]. According to the characteristics of students' learning behavior, a series of interventions can be taken to improve students' learning process.

3. APPLICATION OF MOODLE PLATFORM IN SINO-FINISH TRANSNATIONAL HIGHER EDUCATION: A CASE ANALYSIS

Compared with other digital teaching platforms, Moodle's advantages are as follows: First, its free open-source software environment is convenient for users to add new plug-ins according to actual needs. The platform functions could be then expanded and personalized services would be realized. Second, the multi-language configuration interface provides not only English but also official languages of both partners' respective countries. Users (students, teachers and teaching administrators) can choose the interface language according to their language ability and preference.

Taking the Sino-Finnish transnational education program in software engineering of Nanjing Institute of Technology as an example, the cooperative courses in the autumn semester of 2020 are all carried out based on Moodle digital platform, combining the modular object-oriented dynamic learning environment provided by Moodle with face-to-face offline teaching, adopting the "online + offline" blended teaching mode. Teachers of Oulu University in Finland conduct online lecture teaching, and local cooperative teachers of Nanjing Institute of Technology adopt face-to-face instruction to guide students' practice and group activities.

3.1. The Use of Moodle Platform in Different Course Slots

The following table shows the teaching/learning hour distribution of each course:

Table 1. Teaching/learning hour distribution of course slots

Course	Lecture	Exercise	Assignment	Group discussion/ Group work	Feedback/ Q&A	Quiz/ Exam	Self-study
A	28	48	48			7	17
B	24	32	32			8	56
C	23	35	35	12	3	4	39
D	23	13	13	7	2	4	46
E	17			23	6	3	84
F	20						8
G	15			5	3	2	39
H	36	30	30			4	16

As shown in Table 1, the teaching/learning slots of a course consists of several parts: lecture, exercise, assignment, group discussion/group work, feedback/Q&A, quiz/exam and self-study. Figures in the table refer to the teaching/learning time required by the corresponding course slot. For example, the teaching/learning slots of course A include 28 hours of lecture, 48 hours of exercise, 48 hours of assignment, 7 hours of quiz/ exam, and 17 hours of self-study.

Among the various teaching/learning slots mentioned above, the only online teaching in the full sense lies in the "lecture" slot. Lecture is carried out remotely by teachers of Oulu University in Finland in the mode of live teaching or recorded teaching. Exercise is conducted offline by cooperative teachers of Nanjing Institute of Technology, usually in computer classroom. The slots of assignment, group discussion/group work and feedback/Q&A are also completed in computer classroom or normal classroom offline. These slots are usually completed by teachers from both sides. Finnish teachers give guidance to students through remote connection, while teachers of Nanjing Institute of

technology provide support offline and face to face. Quiz/exam is usually completed in the computer classroom and supervised by the teachers of Nanjing Institute of technology. Self-study does not limit the location and students only need to finish reading relevant materials and submit homework within the specified time.

According to the utilization degree of Moodle platform, each teaching slot can be divided into three categories: "strong correlation" with use of Moodle, "general correlation" with use of Moodle and "weak correlation" with use of Moodle. Teaching slots of "strong correlation" include "exercise" and "quiz/ exam". These two slots must be carried out completely on Moodle platform. Teachers upload exercise/exam questions into Moodle platform in advance, students answer questions and teachers correct questions on the

platform. The teaching slots of "general relevance" include "assignment" and "self-study". In the "assignment" slot, teachers explain the requirements for writing assignment in detail and put course materials into Moodle platform. Students should log in to Moodle platform, download and read related course materials, review, submit homework and carry out other self-study activities. For the two parts of "assignment" and "self-study", the main value of Moodle platform lies in providing a place for storing, uploading and downloading materials. Teaching slots weakly related to Moodle platform include "lecture", "group discussion/group work" and "feedback/Q&A". These three teaching slots either rely on live broadcast software, or carry out face-to-face communication between teachers and students and student collaboration. Those activities are not directly related to Moodle platform.

According to the degree of correlation between each course slot and the use of Moodle platform, the teaching/learning hours of corresponding course slots are classified and summarized, then the hours of a course that are strongly related, generally related and weakly related

to the use of Moodle platform are obtained respectively, at least the corresponding proportion of teaching/learning hours is calculated.

Table 2. Percentage of teaching/learning hours according to the usage of Moodle platform

Course	Proportion of teaching/ learning hours which strongly related to the use of Moodle	Proportion of teaching/ learning hours which generally related to the use of Moodle	Proportion of teaching/ learning hours which weakly related to the use of Moodle
A	55.00%	17.00%	28.00%
B	33.33%	46.67%	20.00%
C	33.62%	33.62%	32.76%
D	17.89%	48.42%	33.68%
E	2.26%	63.16%	34.59%
F	0.00%	58.33%	41.67%
G	3.17%	60.94%	35.94%
H	31.48%	35.19%	33.33%

As shown in Table 2, about one-third of the teaching/learning hours of courses A, B, C and H are completely based on Moodle teaching platform (strongly related). The dependence of the course on Moodle platform mainly lies in the course type. Course A with the highest proportion of teaching/learning hours related Moodle is a professional course of programming, students need to complete a lot of exercises and quizzes on Moodle platform. Courses E, F and G with the lowest proportion of teaching/learning hours related Moodle are theoretical course, introductory course and English course respectively, which are more suitable for student group interaction and lecture giving.

There are two points which are worthy of attention in the use of Moodle platform in course slots: First, the teaching slots highly related to the use of Moodle platform are offline slots (exercise and quiz/exam) and the role of Moodle is to provide a complete system for practice and examination. Combined with the data in Table 2, the number of teaching/learning hours in the corresponding slots accounts for a certain proportion of the total hours, that shows that Moodle platform has been integrated into the ordinary face-to-face offline teaching to a certain extent and has become an indispensable part of teaching. Second, although some course slots are not directly related to Moodle platform, Moodle has become an important support for the organic whole of teaching, which runs through the whole process of teaching. For example, the live content of "lecture" is usually made into recorded video, which is embedded in Moodle to provide students with option of playing back and revision. The tasks of "group discussion/group work" and requirements can be downloaded from Moodle and students could

check them at any time. The answer points in the "feedback/Q&A" section are usually sorted into text versions and put into Moodle for students to do revision.

3.2. Process Evaluation of Courses based on Moodle Platform

The use of Moodle platform in teaching has further promoted the reform of evaluation mechanism. Concerning grading in the contemporary higher education, process evaluation has been paid more and more attention. Process evaluation refers to continuously evaluating students' learning progress through various evaluation means and methods such as their interest, attitude and degree of participation in the learning process [15]. In the teaching process, on one hand teachers design the teaching process according to the teaching objectives, so that students' original knowledge level can be improved. On the other hand, students will also have an impact on teachers in this process, giving feedback about their own learning state and emotions to teachers. Teachers could adjust and optimize teaching contents and methods according to students' feedback. To a certain extent, students are not only recipients of information, but also builders of knowledge. Therefore, the process evaluation of students is a process of judging the value of the learning process, a process of promoting students' development and a process of emphasizing students' participation. This concept determines that the process evaluation cannot be completed by one evaluation, but needs to run through the learning process. In the general offline course evaluation mechanism, mostly factors of "performance in class + final written test/experimental report" would be taken into account to do the grading. The use of Moodle can further strengthen the evaluation weight of "learning process". The following table shows how the grading of the above-mentioned courses is made:

Many courses of the major in software engineering have strong practicality, when grading, the proportion of process evaluation should be increased to examine students' ability to solve practical problems. As shown in Table 3, the factors of grading include normal classroom performance, group interaction, assignment, test, exercises, quizzes, exam and so on. It has been analysed above that the implementation of exercise, quiz and exam is highly related to the use of Moodle platform and the submission of assignment should also be completed on Moodle. Therefore, it can be said that Moodle platform has become the most important support for course process evaluation. Based on the question pool and test function of Moodle, the staged quiz and evaluation in the process of classroom teaching can be realized. Before carrying out exercise, quiz and exam, teachers can establish a database of exercises and exam questions, so that the questions can be repeatedly applied to different exercise, quiz and exam. A limited time window for

doing the exercise, quiz and exam could also be set. If the time exceeds the specified time, students cannot go on with answering the questions anymore. On the premise of setting answers in advance, Moodle platform can also realize an automatic grading of objective questions. The function of automatic grading can effectively save time and make the teachers pay more attention to other types of teaching activities in class [16]. Not only is teachers' work pressure reduced, but also the efficiency of exam feedback is improved. Studies have shown that e-examination is widely accepted by students and has a positive effect on the assessment of teachers [17].

3.3. Data Support of Moodle Platform for Teaching Activity Analysis

In Moodle's course module, it generally includes some or all the following sections: Announcements, Q&A discussion forum, videos replay, slides, code examples, exercises, quiz, final exam, resist-exam and grades. The process of preparing a new online course is complex and time-consuming, which requires teachers to participate in many tasks [18]. However, once the module of the new course is set up, the follow-up course implementation can obtain various conveniences. From the perspective of teachers' carrying out of teaching activities, online course module can inherit the course materials from the previous course modules, which greatly saves the course-preparation time. From the students' point of view, Moodle platform extends teaching, integrates it with students' self-study. From the perspective of teaching administrators, the course module in Moodle not only preserves the course materials, but also preserves the specific operation of each user, which can record the whole process of course implementation completely and facilitate teaching supervision and management.

Moodle platform can track user's log files and record the whole process of user operation. For example, the platform can record students' page browsing records, times of interaction, content and frequency of discussion, times of downloading and browsing course material, time of submitting assignment, assignment content, quiz and exam grades and so on. These data can form personalized learning reports for students and provide support for personalized learning guidance and adjustment of teaching strategies. Through the report data, teachers can observe the dynamic multi-dimensional growth process of students, clarify the problems existing in the operation of teaching activities, give targeted guidance to students, adjust, and optimize the teaching activities implementation plan in time. Thus, more ideal teaching effect would be obtained.

Analysis of user logs can take a specific user as the entry point, as shown in the following figure.

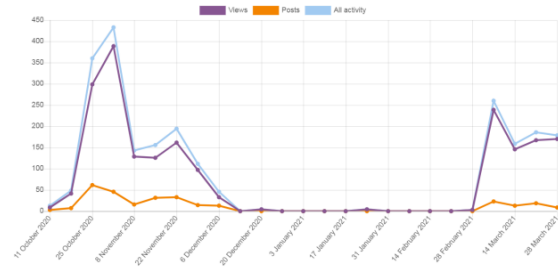


Figure 1 A Student's Statistic in Moodle

Figure 1 depicts the statistics generated by a student user's operation in Moodle. The statistics records the operation frequency at a certain time point and the operations are divided into the types of views, posts and all activities. According to this statistics, students' activity at a certain time point or time period can be described. Similarly, the platform can also generate data according to teachers' operations. By analysing the data of teaching activities such as preparing, question answering, doing assessment of assignment and examination, supervisors can monitor teachers' teaching attitudes and teaching methods.

The analysis of log can also take each course as the entry point.

As shown in Table 3, the log of a course can record the relevant operation details of users concerning the course, including operation time, operation user, the user affected by the operation, course module involved in the operation and specific description of the operation. For example, manager can enroll teacher users in courses, teacher can establish course module, upload file, view a student's profile, do the grading and so on. Student users can view corresponding modules of courses, submit assignment, etc.

Table 3. Factors concerning grade-making

Course	Compositional Factors of Grade-making
A	6 quizzes +1 final exam
B	activity during the course + 8 quizzes + 8 exercises + 1 mid-term assignment + 1 final assignment
C	1 mid-term quiz + 1 final quiz
D	2 exercises + 1 mid-term quiz + 1 final quiz
E	group work activity + 1 final exam
F	7 assignments +1 learning diary
G	classroom activity + 1 essay + 1 test + 1 assignment + 1 presentation
H	7 exercises + 8 assignments +1 mid-term exam + 1 final exam

Table 4. Logs of one course

Time	User full name	Affected user	Event context	Event name	Description
15/08/20, 23:50	Manager	Teacher	Course	User enrolled in course	The user with id '16' enrolled the user with id '255' using the enrolment method 'manual' in the course with id '53'.
29/08/20, 10:38	Student 1	-	Forum: Announcements	Discussion viewed	The user with id '52' has viewed the discussion with id '939' in the forum with course module id '1808'.
1/09/20, 19:13	Teacher	-	Folder: Week 1	Folder updated	The user with id '255' updated the folder activity with course module id '1844'.
10/09/20, 16:45	Teacher	-	Quiz: Week 2	Course module created	The user with id '255' created the 'quiz' activity with course module id '1877'.
10/09/20, 18:29	Teacher	Student 2	Course	User profile viewed	The user with id '255' viewed the profile for the user with id '65' in the course with id '53'.
11/09/20, 15:41	Student 3	Student 3	Assignment: week 2	Submission created	The user with id '36' created a file submission and uploaded '1' file/s in the assignment with course module id '1882'.
9/11/20, 18:14	Teacher	Student 4	Course	User graded	The user with id '255' updated the grade with id '41322' for the user with id '31' for the grade item with id '669'.

Accelerating the construction of educational informatization is an important part of deepening the reform of education and teaching and it is also an important development trend of promoting the transformation of teaching methods and improving the quality of student cultivating. In the Internet era, the development of digital teaching platform has been accelerated. Moodle platform provides richer educational resources and a more flexible environment, which can better meet individual needs, interests, and abilities [19]. For teachers, they can find useful educational materials suitable for creating courses or supplementing course materials through the network. For learners, they can get a lot of learning resources free of charge through the Internet and interact with their peers, so as to achieve the effect of continuous learning [20].

4. CONCLUSIONS

As a network teaching platform, the use and promotion value of Moodle digital platform in transnational education include: First, the time and space barriers of teaching is broken down, the long-distance asynchronous course preparation by teachers and the long-distance asynchronous communication between teachers and students is promoted. In the post-epidemic era with limited mobility of personnel, the flow of educational resources across time and space can be realized. Second, a professional teaching resource pool based on the storage function of platform module is

realized, the problem of slow update of paper teaching materials could be partly solved and resource sharing could be promoted. Third, the platform can provide all-round support throughout all aspects of teaching and learning, such as course preparation, teaching, learning, practice, examination, and grading. This modular object-oriented dynamic learning environment can complement the traditional face-to-face offline teaching and deeply integrates into offline teaching. Thus, would strengthen students' independent learning and make it more convenient for teachers of the two universities to cooperate in teaching activities. To a certain extent, Moodle compensates for the disadvantages brought by centralized teaching offline. The platform proves to be the important auxiliary means for the cooperative teachers of the two universities to create "online +offline" blended teaching. Fourthly, the big data of user log provided by the platform can be used to analyze students' learning behavior characteristics, manage the whole teaching activities, and provide teaching feedback data.

AUTHORS' CONTRIBUTIONS

Jingyao Su contributed to the conception of the study, performed the data analyses, and wrote the manuscript. Jing Jiang helped perform the analysis with constructive discussions.

ACKNOWLEDGMENTS

This research was financially supported by three projects including the 2020 Jiangsu University "Quality Education and Digital Curriculum Construction" Special Project: Application of Moodle Digital Teaching Platform in the Teaching Management of Chinese-foreign Cooperation in Transnational Education (No: 2020JDKT139), the 2019 Higher Education Research Project of Nanjing Institute of Technology: Research of Student-centred Foreign Curriculum Teaching Feedback Mechanism (No: 2019YB10) and the 2020 Special Research Project of Sino-Foreign Transnational Higher Education: Research on the Educational Practice of Sino-Finnish Transnational Higher Education in order to build a Community of Shared Future (No: Research of China Education Association for International Exchange 2020-005).

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