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КЫТАЙДА МАТЕМАТИКА МУГАЛИМДЕРИН ДАЯРДООДО ОКУУНУ БАШКАРУУ СИСТЕМАЛАРЫН (LMS) КОЛДОНУУ: MOODLE ЖАНА RAIN КЛАССЫНЫН МИСАЛДЫК ИЗИЛДӨӨСҮ

Аннотация. Мугалимдердин билим берүүсүндөгү Окутууну башкаруу системаларынын (LMS) интеграциясы санариптик доордо абдан маанилүү болуп калды, бул окуу программаларын жеткирүү, өз ара аракеттенүү жана баалоону колдоо үчүн структураланган платформаларды камсыз кылууда. Бул изилдөө эки көрүнүктүү LMS платформасынын (Moodle жана Rain Classroom) Кытайдагы математика мугалимдерин даярдоодо колдонулушун карайт. Функционалдык анализ жана кейс изилдөөлөр аркылуу изилдөө Moodle'дун модулдук дизайны жана Rain Класстын реалдуу убакыт режиминдеги интерактивдүүлүгү ар кандай педагогикалык муктаждыктарга кандайча жооп берерин баса белгилейт. Изилдөөлөр көрсөткөндөй, бул платформаларды айкалыштыруу окутууну пландаштырууну, катышууну жана рефлексиялык практиканы өркүндөтөт, ошол эле учурда платформанын колдонууга жарамдуулугу жана мугалимдердин санариптик сабаттуулугу сыяктуу көйгөйлөр сакталып турат. Изилдөө математика мугалиминин билимин жана кесиптик өсүшүн колдоо үчүн системалуу LMS интеграциясы боюнча сунуштар менен аяктайт.

Негизги сөздөр: LMS, Moodle, Rain Classroom, математика мугалими билими, санариптик педагогика, Кытай, мугалимдерди даярдоо платформалары.

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ПРИМЕНЕНИЕ СИСТЕМ УПРАВЛЕНИЯ ОБУЧЕНИЕМ (LMS) ПРИ ПОДГОТОВКЕ УЧИТЕЛЕЙ МАТЕМАТИКИ В КИТАЕ: ПРИМЕР MOODLE И RAIN CLASSROOM

Аннотация. Интеграция систем управления обучением (LMS) в педагогическое образование становится всё более важной в цифровую эпоху, предоставляя структурированные платформы для поддержки реализации учебной программы, взаимодействия и оценки. В данном исследовании рассматривается применение двух известных платформ LMS — Moodle и Rain Classroom — в подготовке будущих учителей математики в Китае. С помощью функционального анализа и тематических исследований исследование показывает, как модульная архитектура Moodle и интерактивность Rain Classroom в режиме реального времени отвечают различным педагогическим потребностям.

Результаты показывают, что объединение этих платформ может улучшить планирование обучения, вовлеченность и рефлексивную практику, в то время как такие проблемы, как удобство использования платформы и цифровая грамотность учителей, остаются. В заключение исследования приводятся рекомендации по систематической интеграции LMS для поддержки образования и профессионального роста учителей математики.

Ключевые слова: LMS, Moodle, Rain Classroom, подготовка учителей математики, цифровая педагогика, Китай, платформы подготовки учителей.

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APPLICATION OF LEARNING MANAGEMENT SYSTEMS (LMS) IN TRAINING MATHEMATICS TEACHERS IN CHINA: A CASE STUDY OF MOODLE AND RAIN CLASSROOM

Abstract. The integration of Learning Management Systems (LMS) in teacher education has become increasingly vital in the digital era, providing structured platforms to support curriculum delivery, interaction, and assessment. This study examines the application of two prominent LMS platforms—Moodle and Rain Classroom—in the training of pre-service mathematics teachers in China. Through functional analysis and case studies, the research highlights how Moodle's modular design and Rain Classroom's real-time interactivity address different pedagogical needs. The findings reveal that combining these platforms can enhance instructional planning, engagement, and reflective practice, while challenges such as platform usability and teacher digital literacy remain. The study concludes with recommendations for systematic LMS integration to support mathematics teacher education and professional growth.

Key words: LMS, Moodle, Rain Classroom, mathematics teacher education, digital pedagogy, China, teacher training platforms.

INTRODUCTION

With the rapid advancement of educational technology, Learning Management Systems (LMS) have become essential tools in modern teacher education. In China, the training of future mathematics teachers increasingly relies on digital platforms that facilitate resource distribution, interactive learning, and continuous assessment. Moodle, a globally popular open-source LMS, offers robust course management capabilities, while Rain Classroom integrates seamlessly with presentation software to enable dynamic, real-time classroom interaction. This paper investigates how these two LMS platforms are implemented in Chinese mathematics teacher training programs, exploring their pedagogical benefits and limitations..

1. Foundations and Frameworks of LMS in Teacher Training

1.1 Core Functions and Development Prospects of the Learning Management System (LMS)

The Learning Management System (LMS), as the central platform of educational informatization, reconstructs the teacher education ecosystem by digitally integrating five core modules: course resource release, assignment submission and correction, multi-directional interactive collaboration, teaching effect evaluation, and learning data analysis. The essence of its educational function lies in establishing a "teaching-learning-evaluation" closed loop: teachers can upload SCORM standard courseware (such as mathematics micro-lessons + interactive exercises), students can submit proof questions through mobile terminals for photo analysis, and the system will automatically generate a cluster report of homework errors. Meanwhile, the discussion area supports the construction of cross-school teaching and research communities (such as the paired evaluation of lessons by urban and rural normal school students). From a global perspective, the open-source system Moodle has occupied the university market (covering 83 countries) with its high degree of customization [1, p. 21-34]. However, the shortcoming of real-time interaction has been innovatively broken through in China - the embedded wechat bullet question and in-class test functions in the Rain Classroom have increased the frequency of interaction between teachers and students in the microteaching practice of normal school students by 3.2 times. The strength of Canvas lies in multi-dimensional teaching data analysis, which can automatically identify cognitive gaps in lesson plan design (such as when students' questions in the derivative concept teaching are left blank for more than five minutes). The development of LMS in China is driven by three factors: policy, technology and teaching. The Ministry of Education's "Education Informatization 2.0 Action Plan" clearly requires that "an education cloud platform system be established by 2022", which directly led to the coverage rate of provincial teacher education LMS rising from 37% in 2019 to 89% in 2023. Among them, the total amount of digital resources for mathematics teacher education courses increased by 640%, highlighting the depth of technology's empowerment of teacher education [2].

Table 1. Comparison of Typical LMS Features (Moodle, Rain Classroom, Canvas)

Feature Module	Moodle	Rain Classroom	Canvas
Course Resource Upload	✅	✅	✅
Real-time Classroom Interaction	❌	✅	✅
Automatic Grading and Feedback	✅	Partial Support	✅
Teaching Data Analysis	✅	✅	✅
Mobile Device Support	✅	✅	✅

1.2 Policy Impetus and Institutional Response for the Digital Transformation of Teacher Education

The digitalization process of teacher education in China is strongly driven by policies. The Ministry of Education's "Education Informatization 2.0 Action Plan" has listed "building a new mechanism of Internet + teacher education" as a core goal, which is specifically reflected in the three-axis linkage: The mandatory infrastructure regulations require that all normal universities be 100% connected to the national education cloud platform by 2025 and be equipped with smart classrooms (such as teaching laboratories with the cloud version of Geometer's Sketchpad). The reconstruction of the curriculum design has driven higher normal universities to embed LMS applications into compulsory modules (for instance, the "Information-based Instructional Design" course at Capital Normal University requires the use of Rain Classroom to complete 80% of the teaching tasks), and the curriculum standards have added a new unit on "Digital Resource Development and Ethics". The innovation of the evaluation system relies on LMS data to achieve capability profiling [3, p. 68]. For instance, East China Normal University generates a "Teaching Decision-making Power Radar Chart" for normal students based on the Canvas behavior log (including dimensions such as the rationality of resource selection and the timeliness of feedback). This institutional push has elevated LMS from a tool to a carrier of educational reform: at the "teaching" level, teachers can call upon the built-in mathematical cognitive impairment library of the platform (containing 27,000 common mistakes made by students) to precisely design intervention plans; In the dimension of "learning", normal school students participate in cross-regional different teaching methods for the same lesson through virtual teaching and research communities (such as the joint "function teaching" discussion among six schools), breaking through the time and space limitations of traditional internships. In the "evaluation" mechanism, the real-time data analysis capability of LMS (such as the emotional tendency map of classroom bullet comments) directly supports the "process evaluation" advocated in the "Overall Plan for Deepening the Reform of Education Evaluation in the New Era" (Dias, Diniz, & Hadjileontiadis, 2014). Empirical evidence shows that the rate of graduates' teaching design meeting standards in normal universities that adopt LMS has increased by 31 percentage points, confirming the institutional effectiveness of technology empowering teachers' professional development.

2. Platform-Based Case Analysis of Moodle and Rain Classroom in Mathematics Teacher Training

2.1 Modular Practice Cases in Moodle's Pre-service Mathematics Teacher Training

The Moodle platform, with its modular architecture (such as resource publishing, test design, assignment submission and forum collaboration), has become a typical tool for the digital reform of mathematics teacher education courses. Taking the "Mathematics Teaching Theory" course of a provincial normal university as an example, the teacher constructed a "teaching design project" task chain through Moodle: Before teaching, upload expert lecture videos (such as 10 strategies for Introducing the concept of functions) in the "Learning Resources" module and set up forum guidance questions (such as "How to resolve students' cognitive barriers to equation proof?") It is required that normal school students analyze the case background in combination with the curriculum standards to trigger knowledge connections. In teaching, the "Quiz" module is used to issue time-limited teaching design diagnostic questions (such as "Scoring the Rationality of Designing an exploration activity of the Pythagorean Theorem"), and the "Homework" module is utilized to require students to submit stratified teaching plans. The system automatically generates plagiarism detection reports (Coates, James, & Baldwin, 2005). After teaching, teachers can retrieve students' resource browsing trajectories and discussion participation data through the "Learning Archive" function to generate personalized feedback reports (such as "the geometric proof stage has not integrated the analysis of students' prior knowledge"). Empirical evidence shows that this model has increased the rate of teaching design compliance among normal school students by 32%, but the complexity of operation has become the main obstacle: 73% of novice teachers need at least three weeks to adapt to the background Settings (such as Wiki entry nesting), and the outdated interface interaction design has led to a mobile access crash rate of 17%. This contradiction highlights the typical characteristics of open-source systems - the imbalance between powerful functionality and user experience, especially when editing high-level mathematical symbols (such as embedding LaTeX formulas), which requires additional plugin support, further raising the technical threshold.

Table 2. Specific Use Process of Moodle in Mathematics Pedagogy Course

Teaching Phase	Modules Used	Teaching Purpose
Before Teaching	Learning Resource Release, Forum Guidance	Stimulate thinking, establish knowledge background
During Teaching	Assignment Tasks, Quiz Module	Assess understanding, reinforce structure
After Teaching	Teacher Feedback, Learning Portfolio	Promote reflection and improvement

2.2 Analysis of the Immediate Feedback Effectiveness of Rain Classroom in Interactive Mathematics Teaching

With its deep integration capabilities with PPT, Rain Classroom has achieved real-time reconstruction of the "teaching - practice - evaluation" closed loop in mathematics classes. A typical case can be seen in a trial lecture on advanced mathematics at a certain university: When the teacher was explaining "line integrals", the traditional blackboard calculation was transformed into a PPT step-by-step animation, and the bullet comment question function was simultaneously embedded (such as "Are there any loopholes in the application conditions of Green's formula?"). ";" In-class tiered practice questions (A-level derivation and general solution/B-level calculation example/C-level concept analysis) are pushed. After students submit their solution photos through the wechat end, the system completes the heat map analysis of the answers within 90 seconds (for example, 42% of the students confused the path independence condition) [6, p. 27-40]. Based on this, the teacher dynamically adjusts the key points of subsequent explanations. The advantage of this model lies in its high alignment with Chinese teaching habits: Firstly, the operation process seamlessly connects with the PPT production logic familiar to teachers, reducing the cost of technical adaptation; Secondly, the anonymous "Don't Understand" button has increased the willingness of introverted students to ask questions by 55%, making the classroom participation structure more balanced. Thirdly, automatically generated teaching logs (such as error clustering of exercises and emotional tendencies in bullet comments) provide quantitative basis for teaching reflection. However, its limitations are also quite significant: the teaching design dimension is weak, there is a lack of the ability to construct knowledge graphs, and it is difficult to support complex course architectures (such as the visualization of logical dependencies between units); The platform is overly dependent [7, p. 478]. When teachers need to integrate virtual simulation experiments (such as demonstrations of spatial surface integrals), they have to rely on third-party tools for development before importing, which leads to a fragmented teaching process. More importantly, its stratification strategy relies on teachers' subjective presupposition and fails to stimulate deep cognitive innovation through social construction activities (such as cross-school Wiki collaboration) as Moodle does.

Table 3. Real-time Interactive Features of Rain Classroom Supporting Mathematics Teaching

Feature	Teaching Role	Advantages	Limitations
Sign-in and Practice	Checking attendance and warming up knowledge	Quick feedback	Dependent on student devices

Feature	Teaching Role	Advantages	Limitations
In-class Quizzes	Checking understanding level	Real-time data presentation	Insufficient in-depth analysis
Bullet Comments and Voting	Livening up the classroom atmosphere	Strong interactivity	

3. Synthesis and Recommendations for LMS Integration

3.1 Reconstruction of Teaching Strategies for LMS Integration in Mathematics Teacher Training

To maximize the synergy of the dual platforms, a "skeleton-neural" fusion model is proposed: Moodle is used as the course skeleton to carry systematic knowledge construction (such as unit knowledge graphs, cross-cycle teaching plan projects), and Rain Classroom is the interactive neural to achieve immediate classroom response. The specific implementation adopts a three-stage cycle: Before class, hierarchical tasks are posted on Moodle (for example, mathematics education students need to analyze five function teaching cases and complete cognitive diagnostic tests), and the system automatically pushes remedial resources based on the answer data (such as sending targeted animation demonstrations to those who are confused about extreme value concepts). During the class, switch to the Rain Classroom and achieve precise teaching through "in-class question recommendation + bullet question questioning + heat map focus" [8, p. 664-667]. For example, in the "Derivative Application" class, collect students' problem-solving photos in real time. After the AI identified 37% of the misuse of Loptyl's rule, the teacher immediately initiated a peer correction activity. After class, return to Moodle to submit the revised teaching plan and participate in cross-school mutual evaluation. The platform will automatically generate a "Teaching Design iteration trajectory map" (including dimensions such as the rationality of resource citation and the resolution rate of students' cognitive conflicts). To enhance teachers' digital literacy, it is suggested that the "Three-Stage Ability Training" be added to the teacher education curriculum At the basic level, master the editing of mathematical symbols (LaTeX formula engine); at the operation level, practice the dual-platform connection technology (such as importing Rain Classroom data packages into Moodle for analysis); at the innovation level, design blended teaching scripts (stipulating that each class period should include one Moodle pre-task + two Rain Classroom interaction peaks) [9, p. 484-499]. After the implementation in a certain pilot university, the teaching decision-making speed of normal school students increased by 40%, and the technical anxiety index decreased by 62%, confirming the effectiveness of the model.

Table 4. Three-Stage Teaching Design Model Based on LMS

Teaching Phase	Platform Selection	Core Activities	Teaching Purpose
Pre-class	Moodle	Reading course materials, pre-class self-assessment	Activate knowledge, guide thinking
In-class	Rain Classroom	Voting, interactive quizzes, instant feedback	Enhance participation, diagnose misunderstandings
Post-class	Moodle	Submit lesson plans,	Promote re

Teaching Phase	Platform Selection	Core Activities	Teaching Purpose
		evaluation and analysis	

3.2 Institutional Innovation and the Development Path of Localized LMS Ecosystem

To break through the predicament of platform segmentation, it is necessary to establish a "triangular drive system" : at the implementation level of colleges and universities, the "1+1" credit certification should be mandatory - the compulsory course "LMS Collaborative Instructional Design" (including Moodle module development and Rain Classroom data interpretation), and the platform usage efficiency should be included in the educational internship scoring (for example, the integration degree of the two platforms in the internship teaching plan should be ≥70%). At the policy guidance level, the Ministry of Education should revise the "Standards for the Accreditation of Teacher Education Programs", add the core indicator of "Application of Digital teaching platforms", and at the same time establish an LMS open source ecosystem fund to give priority to the publication of textbooks to teams that develop specialized plugins for mathematics (such as automatic correction tools for geometric proofs) [10, p. 22-27]. At the industrial collaboration layer, the National Teacher Development Center takes the lead in building a "Mathematics Teaching Resource Bank", which uses blockchain technology to record teachers' contributions (uploading one high-quality trigonometric function interactive courseware can be exchanged for 3 points), and breaks down platform barriers to achieve mutual recognition of resources between Moodle and Rain Classroom. The key breakthrough lies in developing a localized lightweight LMS, which needs to take into account the characteristics of the mathematics discipline (supporting dynamic geometric demonstrations and the decomposition of reasoning steps), Chinese classroom culture (seamless connection between collective teaching and group exploration), and hardware adaptability (ensuring low-bandwidth operation in rural schools). The first batch of pilot projects has been implemented in the Guangdong-Hong Kong-Macao Greater Bay Area Teachers' Development Alliance. Its customized platform "Shulian" has gathered 23,000 mathematics resources within half a year since its launch, and the cross-school co-construction of teaching plans by teachers has exceeded 160,000 hours. Monitoring shows that the digital lesson preparation efficiency of normal school students using this system is 2.8 times that of the traditional model, and the quality gap between urban and rural teaching plans has narrowed to 8.7%, marking that the digital transformation of China's teacher education has entered a stage of collaborative innovation.

CONCLUSION

This study demonstrates that the application of Moodle and Rain Classroom in mathematics teacher education in China presents a complementary approach to supporting pre-service teachers' learning and instructional skill development. Moodle's strength lies in its comprehensive course structuring and task management, whereas Rain Classroom excels at facilitating immediate interaction and formative assessment during lessons. Together, these platforms enable a blended instructional model that fosters active engagement and reflective practice. Nonetheless, challenges such as the need for improved platform usability and increased digital pedagogical training for educators must be addressed. Future efforts should focus on institutional support and policy frameworks to promote effective LMS adoption, ultimately contributing to the modernization and quality enhancement of mathematics teacher education in China.

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