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DEVELOPMENT OF OPEN ONLINE COURSES AND BLENDED TEACHING PRACTICES FOR POSTGRADUATE EDUCATION IN THE ERA OF ARTIFICIAL INTELLIGENCE: EVIDENCE FROM THE COURSE "STATISTICAL ANALYSIS AND SOFTWARE APPLICATIONS"

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Abstract: Rapid advancements in artificial intelligence (AI) are fundamentally reshaping postgraduate education and imposing new demands on methodology-oriented courses. Using the core postgraduate course Statistical Analysis and Software Applications as a case, this study investigates the development of open online courses and AI-enabled blended teaching practices within the framework of competence-oriented education reform. First, a multidimensional competency profile is constructed to reconceptualize course objectives, emphasizing data literacy, research competence, software proficiency, and responsible AI use. Second, an integrated framework for open online course development is proposed on the Rain Classroom platform, which integrates diverse learning resources, explicit norms for AI use, and data driven instructional support. Third, an AI-enabled blended teaching model that integrates pre-class online learning, in-class interaction, and post-class research tasks is designed to facilitate problem-driven and project-based learning. Finally, a diversified and intelligent assessment system that combines formative evaluation, course papers, and learning analytics is established. The findings indicate that the proposed approach effectively enhances students' statistical thinking, software application skills, and research capabilities and provides a scalable reference for methodological course reform in the AI era.
Keywords: Artificial intelligence; Postgraduate education; Blended learning; Open online courses; Statistical methodology

1 INTRODUCTION

The rapid development of artificial intelligence (AI), big data, and the digital economy is reshaping the objectives and implementation pathways of postgraduate education [1]. In fields such as economics, management, and applied statistics, statistical analysis is no longer limited to understanding and manually deriving classical models. Instead, it is closely linked to competencies in multisource data processing, the integrated use of statistical software, and intelligent tool-assisted decision-making. Postgraduate students increasingly rely on statistical software such as Stata, R, and Python, as well as AI-based tools for literature retrieval, code generation, and text editing in their research and academic writing [2]. However, without solid training in statistical thinking and methodology, the mechanical use of software or excessive reliance on "AI-generated outputs" may compromise research quality and pose risks to academic integrity and technological ethics [3]. In the era of AI, systematically enhancing postgraduate students' data literacy, software application skills, and research competence through curricular reform has emerged as an urgent issue for higher education institutions.

The advancements in "Internet + Education" and "AI + Education" have created new opportunities for reform in postgraduate curricula. Compared with undergraduates, postgraduate students differ substantially in terms of learning content complexity, levels of learning autonomy, and research orientation [4]. These characteristics imply that open online courses for postgraduate education cannot merely replicate general-purpose MOOC models; rather, they require more targeted designs in terms of course objectives, resource formats, interaction modes, and evaluation mechanisms. Accordingly, the development of high-quality open online courses should move beyond a single format of recorded lectures and uploaded videos toward an integrated instructional design encompassing objectives, content, resources, and data. This approach aims to build a comprehensive learning environment that supports self-directed learning, discussion-based interaction, and research training, thereby enabling coherent integration of online and offline instruction.

Statistical Analysis and Software Applications is a core methodological course offered by Zhengzhou University of Aeronautics for postgraduate students in economics, management, engineering, statistics, and related disciplines. It plays a foundational role in developing students' proficiency in quantitative research tools and their capacity to conduct empirical analysis. However, existing teaching practices still face several challenges, such as insufficient integration between theoretical instruction and software-based practice, limited alignment between course cases and students' actual research topics, fragmented and outdated learning resources, and inadequate use of learning process data. As a result, students often "learn many methods and master a number of commands" but struggle to apply this knowledge to concrete research contexts and have a limited understanding of the appropriate role of AI tools in data analysis and academic writing. The recent approval of a postgraduate high-quality open online course development project, supported by the Rain Classroom platform, has provided a valuable opportunity to systematically promote the online openness and blended teaching reform of *Statistical Analysis and Software Applications*.

Against this background, this study focuses on the development of open online postgraduate courses and blended teaching practices in the era of AI, with statistical analysis and software applications as representative cases. It focuses on four key research questions. First, in the context of AI extensively empowering research and learning, how should postgraduate statistics-related courses define students' competency profiles and accordingly reconstruct course objectives and content structures? Second, how can online platforms be leveraged to develop course websites that have clear structures, abundant resources, a strong AI orientation, and comply with the standards for high-quality open online courses? Third, how can an integrated "pre-class, in-class, and post-class" blended teaching model be designed in contexts involving AI tools to balance knowledge acquisition, methodological application, and research training? Finally, how can learning behavior data, online assignments, and course papers be used to construct a diversified and intelligent evaluation system that integrates both formative and summative assessments?

2 LITERATURE REVIEW AND MARGINAL CONTRIBUTIONS

2.1 Research on Postgraduate Curriculum Reform

Mainstream trends in international postgraduate education reform indicate that the systematic reconstruction of competence development pathways has reached a global consensus, reflecting a fundamental shift from a teaching paradigm centered on knowledge transmission to one oriented toward competence construction. In this process, the principles of competency-based and outcome-oriented education have been widely adopted, which requires curriculum design to move beyond content coverage and toward the deliberate structuring of pathways for competence attainment [5]. Existing international experiences can be categorized into three representative models. First, project-based learning emphasizes learning in authentic contexts to facilitate interdisciplinary collaboration, thereby enabling students to develop research, communication, and teamwork skills through integrated tasks [6]. Second, problem-based learning promotes students' active construction of knowledge by embedding learning in complex problem contexts, thereby fostering critical thinking and independent problem-solving abilities [7]. Third, seminar-based teaching highlights the co-construction of knowledge and fosters the development of research awareness through intensive discussion and reflection [8]. Although these models have been supported by relatively mature institutional arrangements and practices across countries, substantial differences persist in competence assessment approaches, task-chain designs, and learning support systems, suggesting that they are not universally applicable, one-size-fits-all solutions [9].

Scholars in China tend to emphasize the local adaptability of institutional contexts and training objectives in discussions of postgraduate curriculum reform, and their research has focused primarily on the structural optimization of curriculum systems, the dynamic updating of teaching content, and the innovative application of instructional methods. Among these, methodology-oriented courses have attracted more attention because of their foundational role in cultivating research capabilities [10]. Existing studies suggest that the value of reforming such courses lies primarily in shifting from a knowledge-delivery model to a research-training model, thereby restructuring the learning process through practice-oriented and open-ended tasks [11]. However, the literature presents a clear pattern of well-articulated concepts but insufficient operationalization. Most studies remain largely at the level of articulating reform principles and offer limited in-depth analysis of key issues, such as how to construct competence-oriented curriculum objectives, how to integrate specific instructional platforms into an overall course design, and how to use process data to evaluate teaching effectiveness.

Overall, although the existing studies have converged in their general orientations, systematic research on the reform of specific methodology-oriented courses remains insufficient, leaving pronounced gaps in operable design under a competence-oriented framework and in empirically grounded effectiveness evaluation. These gaps constitute critical challenges that future research must address.

2.2 Research on Open Online Course Development

In recent years, the emergence of MOOCs, SPOCs, and high-quality open online courses at multiple levels has created important opportunities for the digital transformation of postgraduate education [12]. Existing studies largely concur that open online courses can overcome temporal and spatial constraints, expand learning spaces, and facilitate instructional diagnosis and continuous improvement through platform-generated data [13]. Building on this foundation, prior research has sought to characterize high-quality online courses across multiple dimensions, including course objectives, knowledge unit structures, resource diversity, and learning support services [14]. However, much of the existing research shows a tendency to merely list features, emphasizing which elements should be included while paying limited attention to how these elements operate synergistically or contribute to verifiable learning outcomes.

In the field of postgraduate education, recent discussions have increasingly focused on integrating research activities into the course process to better support the development of core postgraduate competencies [15]. These activities include literature review, research design, and data analysis. While these studies offer clear directions for developing online courses in postgraduate education, they often remain at the level of normative advocacy and lack mechanism-based analyses grounded in specific course contexts. For example, the literature rarely examines how task chains can be constructed around research-oriented objectives, how platform functionalities support the development of research skills [16], or how online and offline components can be effectively coordinated within blended learning environments [17]. Methodologically, the current research also has notable limitations. Most studies largely rely on instructors' experiential reflections, with limited systematic analyses of learning data, interaction behaviors, or instructional experiments [18]. Additionally, insufficient attention has been given to aligning online platforms such as Rain Classroom within an integrated "objective-content-resources-assessment" framework. This has led to a disconnect between theoretical explanations and platform-based instructional practices [19].

Overall, although research on open online courses has generated a substantial body of conceptual work, there remains a pressing need to move beyond descriptive accounts of educational ideas towards the articulation of underlying mechanisms and the empirical testing of design-oriented propositions. Future research could draw on case studies, data-driven analyses, and instructional experiments to systematically examine how online courses contribute to the development of postgraduate students' research capabilities and to identify coherent pathways for optimizing platform-based instructional design.

2.3 Research on Blended Learning and AI-Enabled Instruction

Blended learning, which integrates the flexibility of online learning with the interactive advantages of face-to-face instruction, has become a major direction of reform in higher education [20]. Research generally indicates that this model enhances learner autonomy and higher-order cognitive and practical skills through face-to-face interaction [21]. In methodology-oriented courses, online micro-lectures are typically used to introduce concepts and foundational methods, whereas offline classrooms focus on theoretical derivation, case analysis, and software operation, thus forming a progressive structure from knowledge to skills and ultimately to application [22]. However, some studies have noted that the online and offline components are often fragmented, resulting in a lack of coherence in learning pathways and undermining the potential effectiveness of blended learning [23].

The rapid advancement of AI has further driven the evolution of blended learning models [24]. Learning analytics, intelligent recommendation systems, and automated assessment technologies have enhanced personalized learning support, enabling instructors to implement data-driven interventions based on learners' performance data [25]. Moreover, the application of large language models in literature retrieval, code debugging, data analysis, and writing assistance has reshaped how students engage in research activities [26, 27]. Some studies indicate that AI can improve learning efficiency by allowing students to allocate more effort to higher-order tasks, thereby aligning with the competency development objectives of methodology-oriented courses [28].

However, critical studies indicate that the convenience of AI tools may undermine students' independent thinking, problem formulation, and analytical reasoning, leading to an overreliance on technology [29, 30]. In addition, academic integrity risks linked to generative tools—such as the limited traceability of automatically generated code or text—present significant challenges for course assessment and the development of academic norms [31]. Consequently, scholars widely call for achieving a balance between technological empowerment and competency development by clarifying usage boundaries, strengthening normative guidance, and optimizing task design to ensure that students maintain an appropriate level of academic rigor while leveraging tools to improve efficiency.

Overall, although existing studies acknowledge the potential of integrating blended learning with AI, they remain largely descriptive and technology-oriented, lacking systematic examinations of pedagogical mechanisms and learning outcomes. This gap highlights the need for more in-depth practical and empirical research grounded in specific course contexts.

2.4 Potential Marginal Contributions

Compared with existing studies, our work makes two primary contributions.

First, we develop a competency profile for postgraduate statistics courses that is aligned with the demands of the AI era and propose a systematic reconstruction pathway that ensures coherence among learning objectives, course content, and learning tasks. Moving beyond the predominantly principle-based discussions of competency development in the literature, this study is, to our knowledge, the first to delineate learners' competency structures in methodology-oriented courses along three dimensions—data literacy, software proficiency, and research competence—and to translate these dimensions into an operationalized system of course objectives. Building on this framework, we reorganize course content through a multichain task-based structure encompassing theory, methods, software, and AI tools, thereby establishing a systematic, research-oriented instructional design logic that addresses the core demand for a competency-based transformation in postgraduate education.

Second, we propose a new blended learning model for postgraduate education in AI-participatory learning contexts and develop a verifiable framework for open online course construction and intelligent evaluation. Unlike much of the existing research, which remains at the level of technological description or platform-level application, we adopt Rain Classroom as the instructional platform and integrate open online course development, norms for AI tool usage, learning analytics, and formative assessment into a unified framework. By designing an integrated structure of pre-class self-study, in-class discussion, and post-class research, together with AI-assisted learning task chains, we achieve deep integration between online and offline learning environments. Moreover, we construct an intelligent and diversified evaluation system based on learning behavior data, online assignments, and research paper performance, thereby providing a scalable model and empirical evidence to support the reform of methodology-oriented courses.

3 POSTGRADUATE COMPETENCY PROFILES AND COURSE OBJECTIVE RECONSTRUCTION IN THE ERA OF AI

Amid the rapid evolution of AI, postgraduate training objectives are increasingly shifting from traditional knowledge-acquisition models to problem-solving-oriented models. This trend is particularly evident in courses centered on statistical methods. Students are expected not only to master statistical techniques but also to understand their underlying theoretical logic, conditions of applicability, and normative requirements. This shift moves students beyond merely "knowing how to use" methods toward explaining results, exercising methodological judgment, and adhering to academic standards.

Drawing on the characteristics of disciplines such as economics, management, statistics, and engineering, we define the competency profile required for the course *Statistical Analysis and Software Applications* across four dimensions (see Figure 1). First, statistical thinking and problem-modeling capability enable students to formulate quantifiable research questions from real-world contexts and to understand the fundamental principles, underlying assumptions, and limitations of statistical inference and regression analysis. Second, the integrated application of statistical software allows students to conduct data import, cleaning, modeling, and visualization on platforms such as Stata, R, or Python, thereby establishing standardized and reproducible analytical workflows. Third, empirical research design and academic communication skills enable students to formulate sound research hypotheses based on systematic literature reviews, select appropriate statistical and econometric methods, and produce analytically rigorous, well-structured research reports or course papers. Fourth, the appropriate use of AI tools and awareness of technological ethics require students not only to employ AI tools to assist with literature retrieval, code verification, and result presentation but also to recognize their limitations and actively avoid potential risks of academic misconduct.

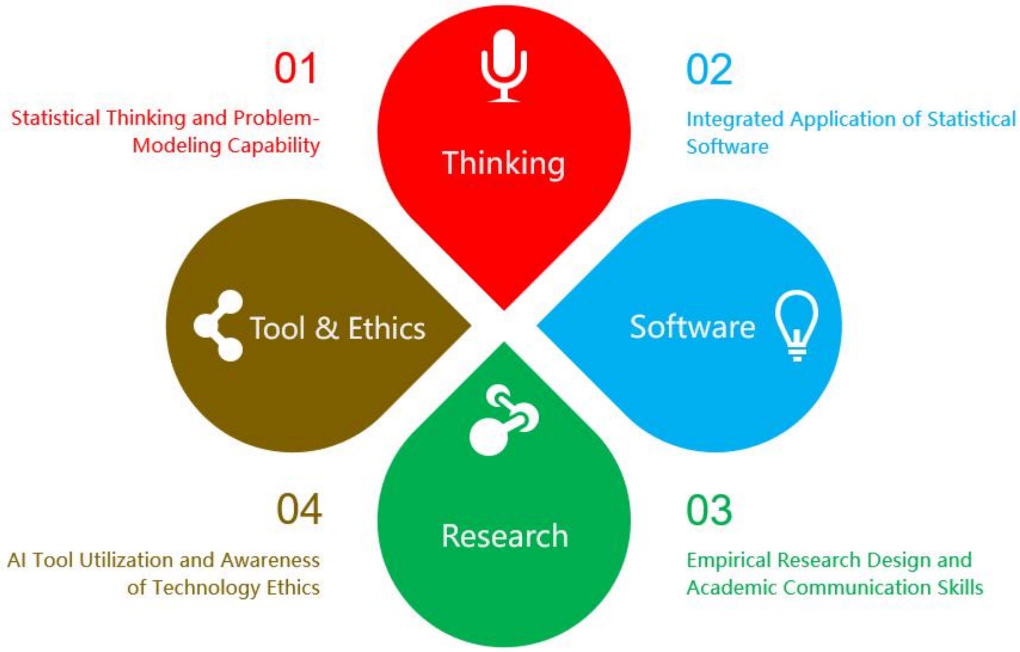

Figure 1 Four-Dimensional Postgraduate Competency Profile

Building on the competency profile, the course objectives are reframed away from a traditional focus on method mastery and software usage toward a multilevel objective framework. At the cognitive level, students are expected to comprehend the underlying logic, key assumptions, and applicability conditions of statistical and econometric methods. At the operational level, students are expected to demonstrate proficiency in the estimation, diagnostics, and extension of commonly used models. At the applied level, students are expected to independently complete at least one full empirical research project. At the reflective level, students are expected to critically evaluate the rationale for model selection, the robustness of the results, and the appropriate use of AI tools.

According to the competency profile and the objective framework, the course content shifts away from a traditional chapter-based organization toward a "modular and task-based" structure. Specifically, the course consists primarily of the following modules: data cleaning and descriptive statistics, statistical inference and regression analysis, practical statistical software application, appropriate use of AI in statistical analysis, and comprehensive projects and term papers. These modules not only ensure a logical progression of knowledge but also emphasize the gradual development of competencies, thus providing a solid foundation for the subsequent development of course resources and blended instructional design.

4 DEVELOPMENT OF OPEN ONLINE COURSE RESOURCES BASED ON RAIN CLASSROOM

The Rain Classroom was jointly developed by the Office of Online Education of Tsinghua University and XuetangX, with the aim of supporting the digitalization and intelligent transformation of the entire teaching process through information technology. Guided by the concept of "data-driven teaching", the platform optimizes the entire instructional chain by covering key stages such as pre-class preparation, in-class interaction, and post-class assessment. Its core technological architecture is built on an integrated architecture that combines a PowerPoint plug-in with mobile terminals. Instructors can directly embed exercises, videos, and other multimedia materials into PowerPoint slides and deliver them synchronously to students via WeChat. Students can participate in learning activities through WeChat or web-based interfaces, which enables cloud-based management of instructional resources and real-time collection of classroom behavioral data.

Built on the Rain Classroom platform, the overall design of the course website adheres to the principles of "clear structure, comprehensive functionality, and distinctive features". The website consists of several core modules, including the course overview, syllabus, lesson plans and courseware, guidance on key and challenging topics, online assignments and question banks, instructional videos, literature and extended resources, and guidelines for the standardized use of AI tools. The platform's integrated functions—such as attendance tracking, pop-up quizzes, discussion forums, and data analytics—provide strong technical support for the effective integration of online and offline instruction.

With respect to resource types and content development, the course prioritizes the following core resource types. First, textual resources—including the syllabus, detailed lesson plans, study guides, and practical laboratory manuals—are designed to provide students with a systematic learning pathway and clear operational guidance. Second, video resources include theoretical lectures, software operation demonstrations, and case studies. All videos are produced through high-quality classroom recordings or studio-based filming, with a total duration exceeding 300 minutes, which helps avoid the limitations of single-format PPT screen recordings. Third, data and case resources offer authentic datasets and accompanying demonstration codes on key topics in China's contemporary economic development, such as the digital economy, low-altitude economy, green development, and regional coordination. This approach encourages students to engage in extended inquiry beyond analytical replication. Finally, assignment and question-bank resources are structured hierarchically according to knowledge structures and competency levels, integrating practice exercises and project-based microtasks to foster both conceptual understanding and practical skills.

To emphasize the course's distinctive orientation toward the "AI era", a dedicated module on AI tools and their responsible use is introduced. This module systematically presents categories of AI tools relevant to statistical analysis and academic writing, their functional applications, and typical use scenarios while conveying the principle of "assistance rather than substitution" through short videos and practical demonstrations. Moreover, the course establishes explicit guidelines for AI use, specifying unacceptable practices such as data fabrication, result manipulation, and the direct adoption of AI-generated text. In project briefs and learning guides, students are expected to disclose their use of AI tools, thereby integrating technological application with instruction in academic integrity.

Furthermore, the course adopts a periodic evaluation mechanism that dynamically adjusts the resource structure and content quality based on student feedback and learning analytics. High-quality assignments and project outputs are anonymized and integrated into the resource repository, forming a virtuous cycle of "teaching-learning-resource regeneration" that continually enhances the adaptability and sustainability of course resources.

5 AI-ENABLED "ONLINE + OFFLINE" BLENDED TEACHING DESIGN

Building on the established teaching resources, the course is structured to develop an "online + offline" blended teaching model that integrates the pre-class, in-class, and post-class stages (see Figure 2). In the pre-class phase, instructors use Rain Classroom to deliver instructional videos, reading materials, and preparatory quizzes. This approach supports students in building foundational concepts and methodological frameworks, facilitating a shift from "passive reception" to "active preparation". During the in-class phase, offline instruction focuses on explaining key and challenging concepts, case studies, practical software operations, and group seminars. In addition, digital tools—such as attendance checks, pop-up quizzes, polling, and discussion forums—are used to enhance teacher–student interactions. In the post-class phase, online assignments, project-based tasks, and reflective learning logs are used to promote knowledge consolidation, transfer, and deeper understanding, contributing to a closed-loop learning process.

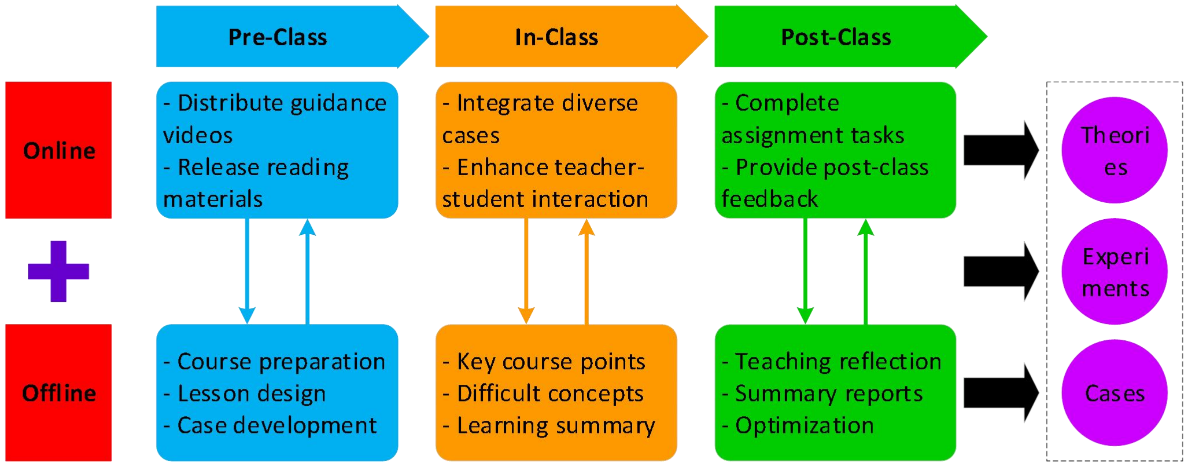

Figure 2 Blended Learning Model

In blended teaching design, problem-driven and project-based learning form the core of the design. Each instructional module is organized around a representative research question that serves as the central learning thread, accompanied by aligned exercises and project tasks. This structure enables students to achieve progressive development in cognition and research skills, from reproducing baseline models to conducting mini research projects aligned with their thesis topics. The online platform provides project guidelines, data resources, and demonstration code, whereas the offline classroom focuses on model specification, interpretation of results, and discussion of methodological limitations. Furthermore, instructors and teaching assistants offer tiered and differentiated guidance through staged project presentations, in-class feedback, and online Q&A sessions, which helps ensure the effective implementation of project-based learning.

In terms of AI empowerment, the course has undergone systematic exploration from both the instructor and student perspectives. Instructors use AI tools for assignment grading, summarizing common errors, generating multiple versions of exercises, and refining instructional explanations, thereby increasing the efficiency of teaching preparation and feedback. Students, under clearly defined guidelines, are permitted to use AI assistance for tasks such as literature translation and screening, code syntax checking, and figure and table refinement, thereby reducing their technical burdens and allowing greater effort to be devoted to problem formulation and empirical interpretation. To mitigate the risk of AI misuse, the course clearly distinguishes between "assistance" and "substitution" through thematic micro-lectures and in-class discussions. It emphasizes that AI must not replace independent thinking, fabricate data, or directly generate the main body of academic manuscripts, thereby reinforcing education on academic integrity.

Using the instructional unit "Panel Data Models and Stata Implementation" as an example, pre-class preparation employs guided videos and online quizzes to help students understand core concepts such as fixed effects and random effects. During in-class instruction, after a brief review of theoretical foundations, real-world data are used to demonstrate model specification, estimation procedures, and result evaluation, together with group discussions on model selection and interpretation of estimation outcomes. After class, students are assigned an analytical report based on a designated dataset. When addressing coding issues, students are allowed to use AI tools for preliminary debugging, with disclosure required upon submission; instructors then assess and provide feedback on the appropriateness and compliance of such use during grading. This approach effectively integrates knowledge acquisition, skill development, and the responsible use of analytical tools.

6 CONSTRUCTION OF A DIVERSIFIED AND INTELLIGENT LEARNING ASSESSMENT FRAMEWORK

To better leverage the role of assessment in guiding learning behaviors and promoting instructional improvement, our course establishes a comprehensive assessment system that includes formative assessment, summative assessment, and the evaluation of responsible AI use. In addition, learning analytics methods are introduced to further examine assessment outcomes and integrate the diagnostic, developmental, and feedback functions of assessment.

The formative assessment primarily consists of four categories of indicators. First, online learning behavioral data—including video completion rates, preparatory quiz performance, and participation in pop-up questions—are used to monitor students' learning engagement. Second, regular assignments and interim project outputs are used to evaluate students' understanding of theoretical knowledge and their ability to apply analytical methods in practice. Third, class participation—including offline oral presentations and interactions in online discussion forums—is assessed to reflect students' initiative and cognitive involvement in the learning process. Fourth, learning reflections and periodic summaries encourage students to conduct self-diagnosis, identify weaknesses, and formulate strategies for improvement. These indicators are incorporated into the overall course evaluation with assigned weights to encourage sustained learning engagement.

Summative assessment is primarily based on a course paper or research report, supplemented with a limited amount of comprehensive testing. The course paper requires students to carry out a complete data analysis workflow on either a self-selected or assigned topic. The evaluation criteria cover multiple dimensions, including problem identification, methodological choice, software implementation, interpretation of results, and academic writing standards, thereby highlighting students' integrated competencies in authentic research contexts. The comprehensive assessments adopt open-ended question formats, deemphasizing rote memorization and emphasizing the understanding of statistical reasoning, model logic, and conditions of applicability, to assess students' overall mastery of the subject matter.

Given the widespread use of AI tools in the learning process, the course integrates standards for AI use into the assessment framework. Students are required to truthfully disclose the specific context and extent of AI tool use in major assignments and course papers. During the evaluation process, instructors issue warnings or request revisions for assignments that show excessive reliance on AI and insufficient evidence of independent understanding. Through a standardized mechanism encompassing ex ante notification, process monitoring, and ex post feedback, students are guided to develop an appropriate understanding of technology use and a strong awareness of academic integrity in practice.

Building on this foundation, the course further explores learning data generated through Rain Classroom to conduct learning analytics. For example, students are categorized on the basis of their online learning behavior patterns, and performance differences across assignments and course papers are compared across these groups. Correlations between variables such as video viewing completion rates, online quiz scores, and classroom participation and final course performance are examined to assess the appropriateness of assessment indicators and their assigned weights. The resulting analyses not only provide instructors with evidence to identify students at learning risk and implement targeted support but also offer data-driven guidance for adjusting course objective weightings, refining instructional strategies, and optimizing resource allocation in subsequent course iterations.

7 CONCLUSIONS

In this study, we take the postgraduate course *Statistical Analysis and Software Applications* as a case to systematically examine the implementation pathways for online open course development and blended teaching practices in the AI era. The findings indicate that reconstructing course objectives and content structures on the basis of a competency profile promotes the coordinated development of knowledge acquisition, skill development, and academic literacy. Using the Rain Classroom platform to develop a course website with a clear structure, rich resources, and explicit AI features provides strong support for the effective implementation of blended teaching. In the instructional process, a structured sequence of "online guidance-offline discussion-online extension" integrates problem-driven and project-based learning into teaching practices, significantly enhancing students' statistical thinking, software application skills, and research design capabilities. With respect to assessment design, a comprehensive evaluation framework integrating formative assessment, course papers, and standards for AI use—supplemented by learning analytics—provides actionable evidence for differentiated student support and a data-driven basis for continuous course optimization and iterative improvement.

Notably, this study is subject to limitations, including a relatively narrow sample scope and a comparatively short data period. Moreover, as AI technologies and instructional platforms continue to undergo rapid evolution, it is difficult for course design to fully stabilize in the short term. Future research may conduct comparative analyses across courses and institutions to further explore adaptive pathways for AI-enabled blended teaching across different disciplines and course types. In addition, the stability and scalability of the assessment indicator system and learning analytics models warrant examination across broader contexts. Overall, the course development experiences and practical pathways summarized in this study provide useful references for advancing online openness, blended reform, and the high-quality development of methods-oriented postgraduate courses.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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