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2026 Volume 4, Issue 3
Educational Innovation Research
ISSN: 3029-1852 (Online)
ISSN: 3029-1844 (Print)

Application Practice of Generative Artificial Intelligence in Data Technology Courses for Economics and Management Majors

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Abstract: Against the backdrop of the new business education reform, teaching in economics and management majors needs to break away from the traditional model of one-way knowledge transmission and shift to a student-centered, practice-oriented, active and constructive new form. Generative artificial intelligence (GenAI), with its deep semantic understanding and personalized precise Q&A capabilities, has gradually attracted wide attention. Guided by constructivist theory, this study implements a GenAI-empowered problem-based learning (PBL) teaching model. It integrates basic business knowledge, abstract algorithm principles, and programming syntax from data technology courses into inquiry-based learning tasks, stimulating students' cognitive shift from passive reception to active construction. Practice shows that this model breaks the barrier between teaching and learning that exists in traditional instruction, creates a new teaching ecology driven by context, problems, and competency cultivation, and significantly enhances students' critical thinking and innovative practical abilities. It provides a useful reference for the practical application of generative AI models in teaching.

Keywords: Generative Artificial Intelligence; Teaching innovation; Constructivism; PBL

Online publication: March 26, 2026

1. Introduction

In recent years, with the rapid development of the digital economy, economics and management majors have been deeply influenced by the new technological revolution and industrial transformation centered on big data and artificial intelligence. New models such as new retail, new manufacturing, new finance, and new management have emerged. At the same time, big data and AI have become important research methods and new research paradigms for economic and management problems. Facing new opportunities and challenges, the Ministry of Education's New Liberal Arts Construction Working Conference in November 2020 issued the *New Liberal Arts Construction Declaration*. Business education, as an important part of the new liberal arts, must respond to major national strategic directions such as consumption upgrading and domestic demand expansion, while also addressing society's urgent need for composite economics and management talents who understand both business and technology.

In March 2024, at the press conference on people's livelihood during the second session of the 14th National People's

Congress, Minister of Education Huai Jinpeng clearly stated: “For the education system, artificial intelligence is a ‘golden key’. It not only affects the future of education but also the future of education”. He emphasized the need to “deepen the application of AI technology throughout the entire process and all aspects of education and teaching, study its effectiveness and adaptability, let the younger generation learn more actively, and let teachers teach more creatively”.

This important statement provides fundamental guidance for this project. At the same time, in March 2024, the Ministry of Education launched the “AI-Empowered Education Action”, introducing four specific actions, including launching AI Learning columns, promoting the intelligent upgrade of the National Smart Education Platform, implementing an AI large model application demonstration action in education, and integrating AI into the opening-up of digital education, all aimed at promoting the integration of AI into teaching and learning. In the same year, the Department of Higher Education of the Ministry of Education announced the first batch of 18 Typical Application Scenario Cases of “Artificial Intelligence + Higher Education”, further proposing to “build new AI-empowered education scenarios, integrate the latest developments and applications of AI in various fields into professional course teaching”, and emphasized shaping a new “AI +” higher education ecosystem, promoting deep changes in higher education in terms of educational concepts, school-running paths, and teaching models.

In current economics and management experimental courses, students generally lack learning motivation and passively complete tasks. Faced with complex problems in real business situations, they often lack the ability to systematically analyze and effectively solve problems, and their innovative thinking is also significantly insufficient. This dilemma of “disconnection between learning and application” urgently requires a fundamental innovation in teaching models. Problem-Based Learning (PBL), which starts with real problems and centers on students’ independent inquiry, can effectively stimulate intrinsic learning motivation, train systematic thinking and creative problem-solving skills, and is highly consistent with the goal of cultivating composite applied talents in economics and management experimental courses. It is worth introducing and practicing.

2. Literature review

Generative Artificial Intelligence (GenAI) is one of the core branches of artificial intelligence. It refers to intelligent systems based on deep learning architectures that obtain deep semantic understanding, autonomous content generation, and contextual interaction capabilities through pre-training on massive data. Currently, commonly used platforms in China include ChatGPT, DeepSeek, and Doubao. The impact and empowerment of GenAI on the field of education is one of the most active topics in educational technology research in recent years. After the release of ChatGPT in November 2022, attention from the global academic community rapidly increased [1]. By early 2026, thousands of articles in both Chinese and English had been published on the theme of using generative AI in education. As early as 2013, Davenport et al. demonstrated the potential transformative role of AI on the teaching content and models of big data courses [2]. Xia Q et al. studied how AI as a human-machine collaboration tool affects the self-regulated learning process [3].

Problem-Based Learning (PBL) is a teaching model that starts with real-world contextual problems, centers on students’ independent inquiry, and uses teachers as facilitators. Since the “four-stage cycle model” (problem presentation, knowledge retrieval, group discussion, evaluation and summary) was proposed by neurologist Barrows, it has become a core paradigm for student-centered teaching reform. Domestic research on PBL began in the early 21st century, initially focusing on medical education, and then gradually expanded to diverse scenarios such as general courses, professional courses, and experimental teaching [4].

The deep integration of GenAI and PBL teaching models is a relatively new direction in the teaching reform of economics and management disciplines, and current research is relatively limited. Nasri N et al. attempted to use AI as a virtual co-facilitator for fourth-year medical students, using scaffolded prompts based on Bloom’s taxonomy, real clinical cases, and real-time AI interaction, providing a teaching practice reference for AI-empowered PBL in medical professional education discussion sessions [5]. Askari M attempted to use AI as a “Socratic dialogue partner” for PBL in economics and management courses [6]. Through designs such as structured prompts, Socratic questioning, and dialogue reflection, he effectively improved students' problem-decomposition skills and critical thinking, providing an operable path for AI-empowered PBL in group collaboration and reflection sessions.

However, existing research mostly focuses on single courses or short-term teaching experiments, and systematic reform practices for data technology courses in economics and management majors are still scarce. Overall, research on the integration of GenAI and PBL in economics and management teaching is in a transitional stage from sporadic exploration to systematic construction, and there is still significant room for research on deep integration mechanisms, inquiry-based experimental design, process evaluation systems, and sustainable resource construction.

3. Methodology

3.1. Teaching pain points

The main problems currently faced by data technology courses include: First, insufficient innovation in teaching models. Specifically, some classrooms focus on knowledge transmission, merely demonstrating code snippets mechanically, lacking independent inquiry into data problems, logical reasoning, and innovative thinking, making it difficult to progress from lower-order cognition to higher-order abilities. Second, disconnection between teaching content and real scenarios. Experimental projects mainly follow fixed steps and cannot build a framework for data-based business decision-making, leading to an inability to transfer knowledge when facing real cases and a lack of ability to solve practical problems.

3.2. GenAI teaching application scenarios

The application scenarios of GenAI in teaching include the following three aspects. First, the development of intelligent teaching tools. Develop an intelligent teaching assistant based on AI models to deliver learning resources and provide precise answers, optimizing teaching support services. Second, upgrading teaching models. For example, a blended teaching method based on GenAI: GenAI connects online and offline teaching scenarios. Online, it enables personalized preview material recommendation and inquiry; offline, based on online learning data, it designs precise practical training, group discussions, and real-time Q&A, achieving deep integration of online and offline. Another example is a differentiated teaching method based on GenAI, using personalized adaptation and learning analytics to accurately identify differences in students' knowledge of economics and management, data analysis programming, etc., and automatically match appropriate learning tasks, inquiry difficulty, and guidance methods for students at different levels, achieving "teaching according to aptitude" and balancing foundational consolidation with ability improvement. Third, optimizing the learning experience. Using AI teaching assistants, virtual humans, etc., to create personalized learning paths, provide instant feedback and Q&A, enrich interactive forms, enhance learning engagement and efficiency, precisely adapt to student needs, and make learning more efficient and more aligned with individual pace.

3.3. GenAI-empowered PBL teaching model

To address the above teaching pain points, this study focuses on data technology courses in economics and management and applies a problem-based learning teaching model based on constructivism.

Constructivist theory points out that the essence of learning is the interactive integration and active construction of new and old knowledge. Learners need to rely on a specific context, supported by the learning environment and relevant materials, to independently build a knowledge framework, and ultimately achieve deep understanding and internalization of the learned knowledge. PBL is an inquiry-based teaching model driven by real, complex disciplinary problems, with students as the main learning subjects. It breaks the traditional knowledge transmission logic of "teaching first, then practicing", and guides students to independently carry out a complete process of "problem presentation–knowledge retrieval–group discussion–self-assessment", with constructivist thinking running through it.

From a constructivist perspective, the PBL teaching model starts with real contextual problems and is highly consistent with the "four-stage cycle model" proposed by Barrows: In the problem presentation stage, students clarify the direction of inquiry by analyzing contextualized problems. In the knowledge retrieval stage, they independently consult literature and materials, combining existing cognition with new knowledge to complete meaning construction. Then, in group discussion, through collaborative communication with peers and teachers, they continuously engage in critical reflection and optimize their cognitive framework. Finally, in the evaluation and summary stage, they use the constructed knowledge to solve practical problems, achieving a closed-loop progression from knowledge construction to problem solving. The specific process is shown in **Figure 1**.

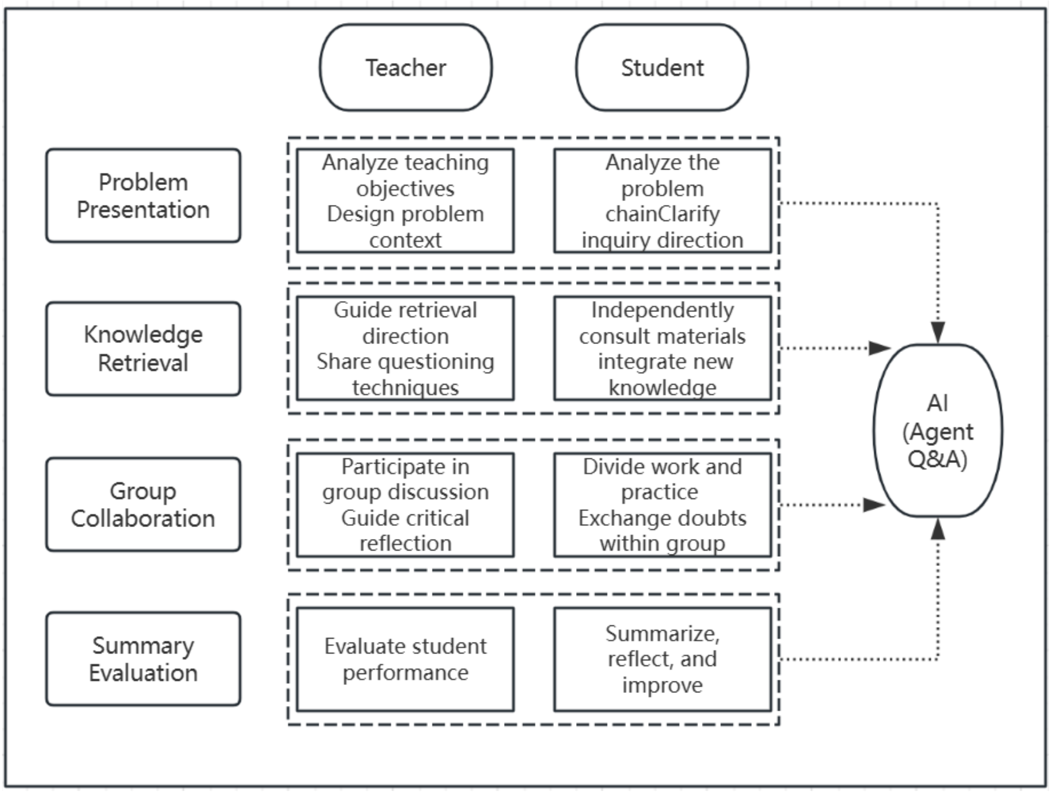

Figure 1. Application process of GenAI-empowered PBL teaching model.

3.3.1. Problem context design and AI-assisted presentation

First, teachers rely on GenAI's scenario generation and data simulation capabilities to provide complex problems from real industries or positions. Such problems have the characteristics of non-uniqueness of answers, incomplete information, and challenging nature, requiring the integration of multidisciplinary knowledge. Students need to master basic humanities and social science theories such as economics and management, while also skillfully using data technology to mine information and solve practical financial problems.

The "Fund Customer Churn Risk Prediction" project in the "Financial Big Data" course is used as an example. The task students face is not a simple classification exercise but a real business problem: a company's fund business department hopes to accurately identify customers who are about to churn and identify the core reasons for churn. To complete this task, students need to master basic economic principles (such as customer utility theory, switching costs), management frameworks (such as customer relationship management, CRM), and behavioral finance theories (such as investor psychological biases), while also skillfully using data science techniques, including data cleaning, feature engineering, imbalanced classification processing, and model interpretation, to mine hidden churn signals from massive transaction records.

Specifically, GenAI first generates a highly realistic, desensitized dataset containing fund customers' transaction flows (time and number of purchases, redemptions, conversions, etc.), holding behaviors (shares and duration of each fund product), and basic customer information (age, risk preference, customer lifetime, etc.). To simulate the incompleteness of information in real business, GenAI also actively implants some data noise (e.g., abnormally large redemption records) and missing values (e.g., some customers' occupation information or risk assessment results are empty). After receiving the data, students need to diagnose data quality themselves and choose appropriate imputation or deletion strategies. On this basis, students can freely construct predictor variables, such as calculating customers' transaction frequency in the last 30 days, holding concentration, return volatility sensitivity, and other derived features. They can also independently choose modeling methods, using either highly interpretable linear models such as logistic regression or complex models such as random forest, XGBoost, or neural networks, with prediction accuracy, recall, or AUC as the main evaluation criteria. During this process, GenAI can also provide real-time industry reference information, such as the typical benchmark range for customer churn rate in the fund industry (e.g., monthly churn rate of about 2–5%) and hints for variable construction (e.g., "try constructing derived features reflecting customer activity, such as 'days of silence' or 'time interval since last transaction' "). This open-ended task design without hard constraints effectively encourages students to engage in exploratory learning and innovative practice. They can repeatedly compare the effects of different models and different feature combinations, and even try to further segment the churn prediction results into different customer groups for attribution analysis, thereby developing comprehensive abilities to solve complex financial problems in real business contexts.

3.3.2. Knowledge retrieval and AI-empowered information acquisition

Driven by the real business problem of "accurately identifying churned customers and identifying the core drivers", students first need to independently decompose their knowledge needs. They think: to solve this problem, what concepts need to be understood? What techniques need to be mastered? Thus, students use generative AI to quickly search and locate multiple key knowledge modules, such as the "customer value life cycle" theory to define churn stages, "fund customer churn influencing factors" to sort out business-level potential features, "financial time series data feature engineering" to process time series information of customer transaction behavior, and "machine learning classification model principles" to build prediction and attribution models.

GenAI can not only provide structured knowledge frameworks for these modules (e.g., presented as mind maps or outlines) but also, by analyzing students' initial problem descriptions and preliminary solution ideas, intelligently identify knowledge gaps, for example, students may overlook the impact of imbalanced data on churn prediction models, or have a vague understanding of "sliding window statistics" in feature construction. In response to these gaps, GenAI actively recommends targeted learning resources, including relevant paper excerpts, key sections of online tutorials, or annotated example code. On this basis, students compare and integrate their existing knowledge (e.g., basic statistics, database query experience) with the new concepts and methods provided by GenAI. For example, they may try to transfer the idea of significance testing from traditional regression analysis to machine learning feature importance evaluation, or combine their original RFM customer segmentation logic with time series feature engineering. Through this process, students initially achieve the integration of old and new knowledge, form an overall understanding of the problem-solving path, and lay a solid knowledge foundation for subsequent specific steps such as data cleaning, feature construction, model training, and result interpretation.

3.3.3. Group collaboration and AI synergy

Students form groups of 3 to 5 people, combine newly acquired financial knowledge, modeling methods, and existing experience, fully discuss within the group, and jointly form a complete solution for fund customer churn risk prediction, followed by results reporting. The collision of views and deep reflection in group collaboration effectively promote deep processing of knowledge. During this process, GenAI can not only record points of disagreement and consensus in group discussions in real time, but also provide reference suggestions and evidence chains for core issues such as modeling ideas and feature selection. It can also provide personalized step-by-step practical guidance for weaker students in collaboration, helping them quickly catch up with the collaboration pace and achieve efficient participation and collaborative problem-solving for all members.

It is particularly important to note that students tend to directly ask generative AI questions and obtain ready-made source code, which may lead them to accept results without careful thinking, thus reducing deep thinking and even creating dependence. Therefore, teacher guidance is crucial, teachers should guide students on how to construct clear, professional questions and effectively interact with the model using contextual prompts. If the problem statement itself is vague or the terminology is inaccurate, the model will also find it difficult to return high-quality answers. GenAI can assist with code completion, error correction, optimization, documentation generation, and testing, providing students with explanations, examples, and real-time support. It is an important technical learning resource. For this reason, students need not only to master professional knowledge but also to learn how to ask precise questions; both together constitute the key to effectively using AI. Questioning techniques are summarized in **Table 1**. University teachers should focus on cultivating students' critical thinking. Students need to professionally evaluate the code generated by AI, checking its correctness, completeness, and robustness. Teachers should guide students to consider different implementation solutions, address security issues, and improve code maintainability and readability, thereby enhancing their ability to understand, improve, and optimize code.

Table 1. Examples of question chain design

Strategy	Questioning angle	Example for fund customer churn prediction project (asking AI)
Set goals	Clarify the specific goal and business context of the prediction task	Does churn specifically mean no transactions for how many consecutive months? Is the prediction window for the next month or the next quarter?
Test assumptions	Examine potential implicit assumptions in data and modeling	How to design features to distinguish between true churn and product switching?
Build arguments	Organize key evidence or feature logic chains needed for modeling	To predict churn, besides transaction frequency, what other key features are there? For example, are age and number of products held necessary?
Switch perspectives	Introduce analytical perspectives from other fields (e.g., user behavior analysis, marketing)	What non-transaction indicators could be introduced? For example, behavioral data such as page dwell time, news reading completion rate?
Predict outcomes	Evaluate possible biases or business impacts of the model	If an imbalanced dataset is used to train the model, will the prediction results be biased towards the majority class (non-churn)? How to evaluate and mitigate this bias? What business risks would arise if the model misclassifies a high-net-worth customer as churn?

3.3.4. Summary evaluation and AI-assisted assessment

To comprehensively, scientifically, and objectively evaluate students' learning outcomes in the PBL teaching model, the teaching team introduced formative assessment throughout the teaching implementation process, incorporating scenario-based evaluation forms such as self-assessment, double-blind peer review of papers, real-time practical operation comments, GenAI preliminary evaluation, and outcome presentations. Using this evaluation method, teachers can monitor students' learning progress in various aspects of financial analysis, problem decomposition, data cleaning, feature engineering, model construction, etc. in real time. They use GenAI to record feedback information throughout the teaching process and timely adjust and optimize for issues such as deviations in solution ideas, lack of business logic, and insufficient practical skills. For students, the results of formative assessment help them clearly identify their own weaknesses in risk control business understanding, machine learning model application, group collaboration, etc., and clarify their direction for improvement, thereby improving learning efficiency and enhancing their initiative to actively participate in programming practice and explore financial problems.

AI-assisted assessment is introduced. On the one hand, generative AI is used to automatically provide preliminary scores and improvement suggestions for students' code style, comment quality, and logical structure. On the other hand, teachers conduct final reviews based on the AI evaluation results, focusing on students' innovation, business insight, and problem-solving strategies. At the same time, students are encouraged to further incubate excellent course project outcomes into projects for the College Student Innovation and Entrepreneurship Training Program, academic competition entries, or graduation thesis topics. The research will track the output rate of these derivative outcomes to verify the actual effectiveness of the teaching reform.

4. Results

Participant observation, questionnaires, interviews, and other methods were used to evaluate the effectiveness of this teaching innovation. Since its implementation at the end of 2023, student attendance, classroom interaction, and participation have significantly improved. Student satisfaction with classroom teaching has been above 92 points, significantly higher than in traditional teaching models. According to questionnaire results, most students felt that their programming skills had become more proficient and that the experimental course was practical and interesting. In the final course reports, more than half of the students were able to skillfully use the methods taught in class to conduct complete data analysis and result presentation for the experimental projects, accompanied by correct code, which fully demonstrates the improvement in students' programming ability and comprehensive literacy brought by this teaching model.

Data technology courses are important foundations for some subsequent courses, some academic competitions, and certificate examinations. Since implementation, students have successfully secured 17 provincial-level or higher College Student Innovation and Entrepreneurship Training Program projects, and several university-level projects. They have won more than 50 awards in national and provincial academic competitions. Nearly one hundred students have obtained relevant vocational skill certificates. Nine student papers have received acceptance notices or been published in academic journals, serving as strong evidence of the success of this innovative education.

5. Conclusion and outlook

This study explored a generative AI-empowered PBL teaching model and carried out a teaching reform practice in data technology courses for economics and management majors, showing preliminary positive results. The study believes that the core value of this model is reflected in the following three aspects:

First, at the instructional design level, guided by constructivist learning theory and leveraging GenAI's scenario generation and data simulation capabilities, the traditional "knowledge transmission" classroom has been transformed into a "problem inquiry" classroom. Real, open, information-incomplete financial business problems effectively stimulate students' intrinsic motivation, prompting them to actively decompose knowledge needs, integrate multidisciplinary theories and technical tools, and achieve a learning paradigm shift from passive reception to active construction.

Second, at the evaluation mechanism level, a dual-track system of "formative assessment throughout the process and summative assessment focusing on outcomes" has been established. Formative assessment uses self-assessment, peer review, and GenAI instant feedback to visualize and dynamically adjust the learning process. Summative assessment introduces a combination of AI-assisted preliminary evaluation and teacher final review, maintaining efficiency while upholding the depth of professional judgment. This mechanism not only improves the timeliness and personalization of feedback but also avoids the biases that might come from complete reliance on algorithms.

Third, at the outcome extension level, students are encouraged to incubate excellent project outcomes into innovation and entrepreneurship projects, academic competition entries, or graduation thesis topics, and the output rate of these derivative outcomes is tracked. This practice organically connects course learning with innovation ability cultivation and career development preparation, allowing the effectiveness of teaching reform to be quantified and continuously verified.

Looking to the future, the research can be further expanded in the following directions: First, explore differentiated adaptation strategies of GenAI for different disciplines and student levels to improve the precision of personalized learning support. Second, conduct long-term follow-up studies comparing the differences between experimental classes and control classes in terms of professional competencies, employment competitiveness, and innovation outcomes, providing a solid empirical basis for the wider promotion of teaching reform. It is hoped that the practical paradigm of this study can provide a useful reference for integrating AI into teaching in economics and management majors and other applied disciplines.

Disclosure statement

The author declares no conflict of interest.

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