

Research on the Construction of a New "Smart Adaptive – Project-Based" Teaching Model for the EXCEL and Data Statistical Analysis Course Empowered by AIGC

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Abstract: With the development of generative artificial intelligence (AIGC) technology, new ways to achieve digital transformation in higher education and innovation in teaching have begun to emerge. Given the main problems that have arisen in the current teaching of the EXCEL and Data Statistical Analysis course, namely the "separation of knowledge and practice", "teaching homogenization" and "weakening of thinking cultivation", this paper proposes building a new teaching model to focus on developing students' higher-order thinking ability and problem-solving skills. The theoretical basis of the "Smart Adaptive Project-Based Teaching" put forward in this paper is the integration of the three parts of the "AIGC-PBL-Platform", the exploration of how AI-generated content (AIGC) can act as a "cognitive partner", the construction of a special environment for project-based learning (PBL), and the functions that will be provided by the online teaching platform as a "collaborative foundation". Based on the above model, personalised learning will be promoted; students will be more motivated to explore their own knowledge in depth, and they will learn data thinking and intelligent literacy. It will also list the basic requirements for the successful implementation of the reform, possible problems and countermeasures, etc., with the aim of providing a complete and effective Design Plan and theoretical support for the systematic teaching reform in similar courses under the influence of intelligent technology.

Keywords: Generative Artificial Intelligence (AIGC), Project-Based Learning (PBL), EXCEL teaching, Construction of teaching models, Data literacy, Smart adaptive learning

1. Introduction: The Unavoidable Turn of Curriculum Teaching Reform in the Digital Intelligence Era

As the main driving force for the development of the digital economy in China, data literacy has been raised to the level of general education for all kinds of professionals. Microsoft Excel and Data Statistical Analysis is a necessary course in the training of students' abilities to collect, process, analyze and present data; however, there are serious problems in the current teaching situation, most notably a large gap between the high aspirations of the course (cultivating students' data literacy and thinking ability) and the actual teaching methods, which have become too focused on the functions of the software. Specifically, there are three problems: First, there is a "separation of knowledge and practice"; that is to say, students are unable to apply what they have learned in class. Second, there is "teaching homogeneity", and the students are not taught individually. Thirdly, there is no cultivation of deep thinking; students do not know how to learn by thinking critically.

At the same time, Generative AI (AIGC) technology, such as ChatGPT and ERNIE Bot, can be employed as a "personal tutor" and "knowledge collaborator", and project-based learning (PBL) has also been applied to promote deep learning; however, there are still problems of weak instructional guidance and complicated process management at a large scale in the application of PBL.

Therefore, the purpose of this paper is to explore in an organised manner how to organise the "intelligence" of AIGC, the "project" nature of PBL, and the "process" attributes of a digital teaching platform to build a new type of teaching model that is scalable and supports personalised, in-depth inquiry. Hopefully, this paper will offer some new directions for the theoretical construction and pathway design, put forward a new "Smart Adaptive – Project-Based" teaching model, and provide

some theoretical support and practical ideas for future teaching research and curriculum reform.

2. Literature Review and Research Entry Point

At present, the integration of information technology and education and teaching has reached a certain level. Superstar Learning Platform and China University MOOC are typical cases of online teaching platforms that have been widely used, and most of the related research has focused on resource construction, blended teaching management, etc. There is a general problem of "shallow application of platforms"; that is to say, the platforms have only been used as tools to spread content and organise tasks, and their full potential as data-integrated intelligent hubs has not been realised. Although many studies have shown that PBL can motivate students to learn proactively and apply what they have learned, the main problem of PBL implementation has not been addressed. In large classes of over a hundred students, the guidance pressure on teachers is very high, and the project process is often formalistic or out of control. Research on the application of AIGC in education so far has shown a "polarisation": on the one hand, there are many macro-level theories and ethical discussions, and on the other hand, there are many tool-based applications for single tasks, such as lesson preparation and test question generation. There is a lack of research at the meso-level that takes AIGC as the main subject of the entire teaching process for a course and systematically integrates it with PBL and online platforms.

In short, the current research is divided into the categories of "platform", "method" and "technology" and has not been integrated. This very gap is the main subject of this paper. The problem of teaching construction mentioned above will be solved by building this project. The Super Star Learning Platform will be used to collect progress and other data uniformly; according to the circumstances of teaching, Problem-Based Learning (PBL) will be employed to create an authentic and challenging learning environment, and a personalised AIGC agent for a particular course will be developed as the main support to provide personalised and intelligent cognitive assistance at all times during PBL. Build a "trinity" integration model to simultaneously solve the problems of "shallow platform application", "difficult PBL implementation" and "fragmented AIGC application", and explore a new and generalizable way of teaching reform.

3. Theoretical Framework: Systematization of Construction for the Trinity Integration Model of "AIGC-PBL-Platform"

3.1 Basic Idea

The two main changes in the mode of teaching are as follows: The first change is in the goal of education; that is to say, we will no longer aim to cultivate "proficient software operators" but rather "competent data interpreters and strategic advisors". The second amendment is to change the method of teaching; we will move away from "teacher-centered linear teaching" and adopt an "ecological intelligent adaptive learning" model that is student-centered and project-oriented. Teachers will be the designers and guides of the learning environment in this new era, and students will be able to solve problems independently and use intelligent tools.

3.2 Framework Analysis of the "Trinity" Integration Model

The main strength of the "Smart Adaptive-Project-based" teaching model developed in this paper is that it has good integration and cooperation among AIGC, PBL and the online teaching platform. The three are in a good state of coordination and will form a new teaching ecology.

AIGC: A Very Capable Cognitive Companion and Intelligent Scaffold. AIGC is a "domain-specific intelligent agent" that has been given disciplinary knowledge in this model. It is not a general-purpose chatbot; rather, a course knowledge graph has been added to organise core concepts, typical scenarios, common errors, project methods, etc. The first few are:

a. Offer timely and accurate cognitive support: Answer questions on concepts, how to operate, errors, code generation, etc., promptly and do not have to wait for feedback.

b. Always have thinking scaffolds: Be a "brainstorming partner", an "analytical strategy advisor" and a "report polishing assistant" in the PBL process to lead students' thinking with high-quality conversation and achieve the goal of "teaching by example".

c. Data-Driven Understanding of Learning Conditions: According to the analysis of interaction logs, identify deficiencies in students' knowledge, interests and thinking bottlenecks, etc., to provide a foundation for targeted teacher intervention. One of the advantages of AIGC is that it can free up teachers and students from answering a large number of routine, factual questions, allowing them to concentrate more on higher-order thinking activities such as evaluation, creation and emotional expression, distributing cognitive labour more evenly.

PBL: Contextual Carrier and Driving Framework for Reconstructing Learning Experience. PBL is the foundation for all the other parts in this model. We plan to design a series of authentic, challenging and open-ended "macro-tasks" as projects, such as the "Consumer Behaviour Insights and Marketing Strategy Simulation Based on Public E-commerce Data" and "Campus Carbon Emission Data Estimation and Emission Reduction Scheme Research". The projects will have the following characteristics:

a. Grounded in reality: The problem context and data sources are very real, directly obtained from the real world, so the learning materials have intrinsic meaning and motivation.

b. Integrated Knowledge: All the links in the chain of knowledge can be covered naturally, such as data collection and cleaning, organisation, descriptive statistics, multidimensional analysis, visualisation, etc., without being divided into different chapters.

c. Promote inquiry: There is no single correct answer; many ways of exploration, iteration on solutions and critical discussion are allowed, and failure is regarded as a way to learn. PBL can make the individual knowledge points a "toolbox" to help students solve difficult problems, achieve deep knowledge construction and organic development of abilities through "learning by applying", and thus solve the problem of "separation of knowledge and practice".

Online Teaching Platform: All-around Digital Foundation and Process Engine. Superstar Learning Platform is the present teaching platform, and it will be the "operating system" of this model. The two work together as follows:

a. Process Management Centre: Release project tasks, organise group collaboration, manage document versions, plan time nodes, etc., to ensure the orderliness and transparency of the complex PBL process.

b. Resource Aggregation Portal: A single place for all kinds of digital materials, such as course notes, short videos, datasets, guides on AIGC applications, good practice cases, etc., to build a "knowledge supermarket" that is available 24 hours a day.

c. Data Aggregation and Perception Centre: Collect data on how students use AIGC for studying, their study habits (e.g., login time, browsing patterns and frequency of interaction), and the progress of their projects to build an all-round digital learning profile; provide data-driven "smart adaptation" recommendations; adjust teaching plans based on the data, etc.

d. Multi-dimensional Assessment Support Platform: Offer support for peer assessment, process-oriented portfolio assessment and all-round evaluation of various types of quantitative data and qualitative evidence to promote reform in assessment methods. The platform is the connection point of AIGC and PBL, and intelligent empowerment can be used to organise all the links in the project in an orderly and traceable way.

3.3 Detailed Description of the "Four Stages and Six Links" Project Implementation Process and AIGC Empowerment Points

Based on the above framework, we have designed a closed-loop implementation process for the "Four Stages and Six Links" and have detailed the main empowerment points of AIGC and the core activities of teachers and students at each stage. The first is to make the teaching "script" very user-friendly.

3.3.1 Stage 1: Launch and Definition

Link 1-Context Immersion and Problem Anchoring: The teacher introduces an interesting project problem and some related data. Student groups discuss and learn about the business environment. AI Generation: Students can have AI generate an introduction to the background knowledge of their project area or quickly learn essential business terms for better study.

Link 2 - Analysis Planning and Scheme Design: Determine the main problem of the group, divide it

into several specific analytical sub-problems, and develop a preliminary technical plan. AIGC Empowerment: Students can give the general idea of their AIGC project to the AIGC system, and then the AIGC system will help organise the analysis logic; thus, an initial project plan containing elements such as "analysis dimensions", "required data fields" and "Excel functions to be used" will be generated. AIGC can be employed as a "devil's advocate" to point out the infeasibility of the plan and have the students revise it.

3.3.2 Stage 2: Construction and Research

Link 3 - Data Collection and Management: Students collect data, and there are many problems in real life, such as missing values and outliers. AIGC Empowerment: The student provides a small amount of the data or a description, and then asks the AIGC system, "What quality problems are in this data?", to obtain the corresponding data cleaning formula (e.g., TRIM, CLEAN, IFERROR, VLOOKUP for standardisation). AIGC should explain the formula of cleaning so that students can learn the concept of cleaning and not just copy the code.

Link 4: The two main difficult links are Multi-dimensional Analysis and Visual Exploration. Students try to learn all kinds of knowledge from the data. AIGC Empowerment: The student can express the goal of analysis in simple words, such as "I want to compare the sales in different areas and for various products to find the best and worst items", and AIGC can suggest using "nested classification pivot tables" in conjunction with "conditional formatting" or a "3-D clustered column chart" and provide step-by-step operating instructions. If you need some statistics (such as correlations and regressions), AIGC can explain the corresponding conditions and basic implementation methods in Excel.

3.3.3 Stage 3: Integration and Creation

Link 5 - Insight Extraction and Report Synthesis: Based on the analysis results they have obtained, students write an organised and well-supported report. AIGC Empowerment: AIGC can be a "cooperative writer".

- a. According to the scattered conclusions provided by the students, build a narrative logic for the report (e.g., Introduction-Content-Summary or Problem-Solution).
- b. Enhance the style and conciseness of the description to make it more professional.
- c. Create several expressions for the main data conclusions (e.g., conservative, aggressive, innovative recommendations) and have students compare them, choose one or more, and combine them to form their own ideas.

3.3.4 Stage 4: Assessment and Reflection

Link 6 - Achievement Presentation and Metacognitive Reflection: Each group will present the results of their work to the class and be questioned by the teacher and other students. Have all the students write an extended reflection paper. AIGC Empowerment: Before the defence, students can use AIGC to create a panel of judges and some questions on the reliability of the data, the strictness of the method and the application of the results as "stress tests". At the reflection stage, some leading questions can be given by the teacher to help students review their first application of AIGC and think about "Which of my questions worked better, and why?" and "Which answer gave me an idea for my study, and how did I verify its accuracy?". Thus, the students improve their metacognition and critical thinking.

4. Potential Outcomes, Main Problems and Systemic Promotion Plans for Model Implementation

4.1 Expected Results and Multi-dimensional values

Based on the above theoretical reasoning and practical experience, it is hoped that the following four aspects will perform well:

Dimension of Learning Outcome: It is hoped that the model can enhance students' general ability to use data in daily life and improve their skills in visual storytelling and report writing. The results of this project will be more in line with the actual needs of the industry, and the students will gain some confidence and ability in solving real problems.

Dimension of Learning Experience: Promptly offer personalised help from AIGC so that students

do not feel lost and are more motivated to study independently. It is very likely that many people will report feeling "individually supported" and "involved in learning" in the satisfaction survey.

Dimension of Teaching Efficiency: Many of the repetitive Q&A tasks can be handled by the AI teaching assistant, freeing up teachers' time for more important work, such as instructional design, cultivation of high-order thinking ability, providing individualised assistance for students with learning difficulties, etc.; thus, the efficiency of teachers' work will be improved.

Dimension of Competency Cultivation: In the process of learning, students will also spontaneously acquire the following necessary abilities for life in an intelligent era: the ability to "work with artificial intelligence" (how to use AI effectively), "critical thinking" (how to evaluate the results of AI), and "problem-modelling ability" (how to state problems for AI clearly). These are not the usual goals of learning; rather, they are the students' long-term development.

4.2 Main Difficulties and Coping Strategies

The construction of this model should be able to solve the following problems:

A new type of "digital divide" has appeared, and some students will have better skills in creating prompts for AIGC and evaluating information. The problems mentioned above can be solved by adding "effective dialogue with AI" and "critical evaluation of AI outputs" to the required courses, and then these skills can be systematically improved through the provision of templates, case-based teaching, good questions during the process, and process-oriented assessment.

Academic honesty and test modification: The works produced by artificial intelligence may be mistaken for a student's own. Therefore, we will carry out a full reform of the assessment system, build a process-oriented and traceable mechanism, increase the weight of process-based evidence such as project plans, data logs, key AI dialogue records, report revisions and defence source tracing, and shift the focus of evaluation from the "correctness of results" to the "soundness of process and depth of thinking".

Anxiety about the change in the role of teachers: Teachers need to change from "lecturers" to "facilitators" and are thus anxious about learning new skills. Enhance support for the all-round development of teachers in course design, use of technology and process management through all sorts of means, such as organising workshops, building teaching and research communities, providing incentive funds, etc.

Balancing Technology Dependence and the Essence of Education: We should not have technology replace real face-to-face interaction among people. The Role of Technology should be set to "support". Teaching activities that need to be led by people, such as project value discussions, ethical debates and emotional feedback, should be planned in advance so that technology can support the main goal of education.

5. Conclusion and Outlook

Based on the problems in the current situation of course teaching, this paper has built an integrated system of the "Smart Adaptive - Project-based" teaching model and "AIGC - PBL - Platform". One does not need to improve only one technology or method; rather, by reorganising the main content, goals, process and ecological environment of learning, one can address the root causes of persistent problems such as "separation of knowledge and practice", "teaching homogeneity" and "superficial cultivation of thinking", and provide frontline teachers with a full-coverage plan of action from conception to implementation.

The actual effect of the above model has not been observed or optimised in teaching practice yet. The three parts of the future research direction are as follows: First, conduct teaching experiments; collect all kinds of data; carry out both quantitative and qualitative analysis; and then make revisions based on the results. Second, build a library of shareable course resource packages (e.g., a PBL project library and an AIGC knowledge base guide) to reduce the threshold for use. Third, introduce learning analytics to change the kind of support for AIGC from "reactive" to "proactive" and realize intelligent application.

We believe that teaching innovation focused on students, supported by technology and driven by system design, will be one of the main ways to promote the high-quality development of higher

education. We hope that this study will provide some new directions for future research, and together we will be able to change the current mode of "skill training" to "thinking training grounds" and "innovation incubators" to nurture outstanding talents in the digital age.

Fund Projects

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References

- [1] Zhao Jianqing; Song Zhenshi; Xiong Zequan; Guo Jinchi. "Construction of a Teaching Model for Higher-Order Thinking in Information Literacy under the AIGC Context: Based on the ICAP Learning Framework." *Journal of the National Library of China*, 2025(06).
- [2] Xiang Ruoxi; Zhao Huizhou; Wang Zhenting; Li Jimei. "Teaching Practice of Web Front-End Development Empowered by AIGC." *Computer Education*, 2024(10).
- [3] Liu Shaoli. "Exploration of Strategies for Enhancing University Teachers' Digital and Intelligent Teaching Competence in the Age of Artificial Intelligence." *Science and Technology Wind*, 2026(11).
- [4] Chen Xinrui. "Innovative Research on Aerobics Course Driven by Online-Offline Blended Teaching." *Contemporary Sports Technology*, 2025(23).
- [5] Li Lei; Gao Xue; Qin Huiping; Yu Xiangyu. "Reform and Exploration of the Experimental Course on Embedded Artificial Intelligence Systems." *Laboratory Research and Exploration*, 2025(03).
- [6] Han Yingying; Zhou Jing; Huo Kai. "Research on the Application of PBL Teaching Method in Innovation and Entrepreneurship Education of Art Design." *Theory and Practice of Innovation and Entrepreneurship*, 2023(06).
- [7] Liu Wenxuan; Gao Xia; Yan Lina; Zhang Liwen; Li Tao; Yang Lei. "Course Teaching Practice Based on Internet and Statistical Analysis." *Electronic Technology*, 2023(03).
- [8] Ren Jie; Yang Sen; Zhao You. "Research-Oriented Teaching Design and Practical Exploration for the Multivariate Statistical Analysis Course: Taking Principal Component Analysis as an Example." *Neijiang Science and Technology*, 2025(06).