

Research on Tiered Project Design for Statistics Courses Under the OBE-PBL Dual-Drive Model

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Abstract: This paper addresses issues such as the disconnect between theory and practice in statistics courses for business and economics majors, as well as significant disparities in student abilities. It proposes establishing an OBE-PBL dual-drive teaching model. Guided by the objectives of Outcome-Based Education (OBE) and utilizing Project-Based Learning (PBL) as its practical vehicle, this model incorporates tiered project design as a key differentiated adaptation strategy, forming a three-tiered closed-loop system of “Objectives-Projects-Tiered Design.” The study systematically outlines the construction principles and implementation pathways for tiered project design within this model. It aims to implement differentiated instruction and effectively enhance students' comprehensive ability to apply statistical thinking to solve complex real-world problems, and provide a curriculum reform solution for cultivating the interdisciplinary data analysis talent required in the digital economy era.

Keywords: OBE-PBL; Statistics Courses; Tiered Project Design

1. Introduction

Amid the current wave of digital economy and intelligent manufacturing, statistics serves as the cornerstone of data science and big data analytics in the era of artificial intelligence. The quality of its teaching directly impacts the cultivation of national data analysis capabilities and innovation capacity. China is at a critical juncture in its transformation from a major manufacturing nation to a manufacturing powerhouse, and from a data giant to a digital powerhouse. The “14th Five-Year Plan for Digital Economy Development” explicitly states the imperative to cultivate a large cohort of high-caliber, multidisciplinary talents proficient in both technology and management.

Against this backdrop, this paper explores the deep integration of the Outcome-Based

Education (OBE) philosophy with the Project-Based Learning (PBL) methodology. By establishing an OBE-PBL dual-drive model, it seeks to break the closed loop of traditional education. It proposes a teaching reform pathway centered on tiered project design and supported by dynamic evaluation, aiming to cultivate applied talents who possess both a solid foundation in statistical theory and the ability to solve complex real-world problems.

2. Current Status and Practical Needs Under the Dual-Drive OBE-PBL Model

Higher education teaching reforms are shifting from traditional knowledge-transmission models toward new student-centered, competency-oriented pedagogies. Against this backdrop, Outcome-Based Education (OBE) and Project-Based Learning (PBL) have emerged as key directions for university curriculum reform. Historically, the early phase was characterized by exploratory research and theoretical introduction, with studies primarily focusing on the separate application of Project-Based Learning (PBL) and Outcome-Based Education (OBE). Although OBE concepts have been widely discussed in higher education, systematic reform studies for statistics courses remain scarce and largely confined to theoretical exposition. The systematic development of OBE emphasizes its significant influence on course objective setting.[1]

As the OBE philosophy gradually takes root, research has begun to focus on its specific implementation in statistics courses, particularly in the design of statistics curricula for business and economics majors. Concurrently, PBL teaching methodology, as a tool for cultivating students' innovative abilities, has been progressively integrated into statistical education practices. In statistical teaching experiments, PBL designs have been employed to enhance students' comprehension of statistical problems. Research indicates that PBL designs significantly elevate students' statistical

understanding levels.[2]

As research deepens, scholars have begun to recognize the limitations of relying solely on either OBE or PBL models. While OBE sets high standards, many educators still resort to rote teaching in practice, resulting in students who excel academically but lack practical skills. Pure PBL, without clear objectives, risks students “losing focus,” resulting in projects that lack systematic coherence and struggle to align with national standards or industry certifications. In summary, OBE emphasizes goals but lacks sources of learning motivation, while PBL emphasizes process but has unclear objectives. Consequently, attempts to integrate OBE and PBL have emerged. OBE provides the goals, while PBL provides the motivation. This dual-drive model is particularly crucial because statistics demands both rigorous theory and flexible application.

Current literature increasingly focuses on the “dual-drive” model of OBE and PBL, integrating OBE's outcome orientation with PBL's process-driven approach. Research priorities shift toward designing tiered projects to meet diverse student needs while establishing dynamic, process-based evaluation systems. Studies demonstrate that OBE-based project-based learning significantly enhances learning effectiveness in statistical modeling courses.[3]

Therefore, emphasizing the “OBE-PBL dual-drive” approach aims to establish a teaching ecosystem that is both directional and dynamic, thereby achieving a genuine leap in statistics courses from “learning to calculate” to “telling stories with data.”

In terms of research evolution, early teaching models emphasized knowledge transmission and skill training—a “teacher-centered” approach. With the introduction of OBE-PBL, instructional design now prioritizes students' lifelong learning capabilities. OBE emphasizes “outcome-based education,” while PBL centers on the learner. Combined, these approaches shift the focus beyond merely mastering statistical methods to cultivating students' ability to apply statistical thinking to solve real-world problems.[4]

Second, traditional statistics course evaluations have relied excessively on final exams, making it difficult to provide timely feedback on student learning difficulties. Recent research has proposed the concept of “dynamic assessment,” advocating for the construction of a

multi-dimensional evaluation system through performance-based assessments during projects (e.g., project progress, report quality, teamwork) and formative assessments (e.g., self-assessment, peer assessment, immediate feedback). This approach focuses not only on students' final learning outcomes but also on knowledge construction and skill enhancement during the learning process.

In summary, the OBE-PBL dual-drive model exhibits a research trend progressing from superficial to profound and from singular to integrated approaches. Against the backdrop of accelerating convergence between new liberal arts and new engineering disciplines, coupled with the digital transformation of education, a systematic analysis of this research trajectory reveals that the dual-drive integration of OBE and PBL is not merely a superficial combination of pedagogical approaches. Rather, it represents a structural and systemic transformation tailored to the unique characteristics of the statistics discipline and contemporary talent demands. The empowering effects of this integration carry profound inevitability and urgency.[5]

3. The Necessity of Dual-Drive Empowerment Through OBE and PBL in Statistics Courses

Theoretically, the OBE approach begins with graduation requirements to conduct backward teaching design, establishing a clear and systematic framework of instructional objectives for statistics courses. PBL, guided by real-world projects, builds a platform for students to engage in active exploration and knowledge construction. During implementation, instructors observe student performance to identify gaps between learning objectives and actual outcomes, enabling timely adjustments to teaching strategies. The focus lies in how OBE establishes clear, measurable competency metrics for statistics courses through quantitative indicators, ensuring controllable teaching results and allowing instructors to determine whether students meet expected competency standards. PBL, meanwhile, emphasizes students' experiential learning through real-world project resolution, fostering comprehensive development of their integrated competencies. In terms of evaluation dimensions, OBE's multi-faceted assessment and PBL's project-based evaluation complement each other, providing a comprehensive evaluation of students across knowledge, skills, and

competencies. This approach not only reflects learning outcomes objectively and holistically but also provides robust evidence for instructional improvement.[6]

Regarding the integration of social practice: First, it enhances students' ability to solve real-world problems. In statistics education for business and economics majors, statistical principles often remain disconnected from economic expertise, and statistical analysis methods are poorly aligned with pressing economic issues. This disconnect hinders students' grasp of key statistical concepts and their ability to flexibly apply statistical methods to economic problems. The integration of OBE and PBL addresses this by introducing authentic project cases, enabling students to learn statistical knowledge and skills through practical application. Second, it closely aligns with industry talent demand standards. Currently, diverse industries seek statistics professionals with multifaceted competencies. Employers expect such talent to possess not only solid expertise and skills but also strong communication, teamwork, innovation, and problem-solving abilities. The OBE-PBL integrated teaching model fosters students' teamwork and communication skills, cultivates independent thinking and solution exploration processes, and hones their problem-solving and innovation capabilities. Third, it develops students' interdisciplinary competencies. In the era of big data, statistics increasingly intersects with other disciplines, and solving many practical problems requires integrating knowledge across fields. The OBE-PBL integration provides students with opportunities for interdisciplinary learning, enhancing their cross-disciplinary competencies.[7]

4. OBE-PBL Dual-Drive Model for Tiered Project Design in Statistics Courses

The tiered project design under the OBE-PBL dual-drive model is grounded in a contemporary understanding of learning's essence: learning is a social process where learners actively construct meaning and develop practical abilities within specific contexts. The integration logic of this model manifests as a three-tiered progressive closed-loop system.

The first tier is the OBE goal-oriented layer. Courses must first clearly define the ultimate outcomes students should achieve upon completing their statistics studies. These outcomes should transcend mere memorization

of knowledge points like “descriptive statistics, inferential statistics, regression analysis,” focusing instead on observable, evaluable “competency demonstrations.” For example, competency outcomes might be articulated as: “The ability to independently design data collection plans for a given business and management problem, apply appropriate statistical methods for exploratory analysis and modeling, provide professionally contextualized interpretations and visualizations of analytical results, and ultimately formulate actionable recommendations supporting decision-making.” This overarching goal is further decomposed into sub-objectives across cognitive dimensions—knowledge comprehension, skill application, analytical synthesis, and value judgment—forming a clear competency indicator matrix. This matrix serves as a calibrated “compass” for all subsequent teaching activities, particularly project design.

The second layer is the project-based learning (PBL) implementation layer. Projects serve as the primary vehicle for driving students to actively construct knowledge and develop competencies. Within the OBE framework, projects are no longer supplementary exercises but form the core structure and central thread of the curriculum. Project design must directly align with OBE competency indicators, with scenarios drawn from real or highly simulated contexts in finance, trade, management, and information systems. For instance, a project on “Consumer Behavior Analysis” can integrate multiple course components: data collection, graphical representation, summary statistics, hypothesis testing, and regression analysis. The PBL process—from problem definition, solution design, data collection and processing, analytical modeling, to final presentation and reflection—perfectly simulates the complete workflow of applying statistical methods to solve real-world problems. This activates, connects, and applies abstract theoretical knowledge within concrete contexts.

The third layer is the differentiated adaptation layer of tiered design. This serves as the bridge connecting OBE's unified objectives, PBL's unified methodology, and individual student differences. Recognizing the diversity in students' entry-level foundations, cognitive styles, professional interests, and learning paces is the starting point for educational equity and efficiency. Tiered design does not involve

labeling or ranking students, but rather involves modifying projects themselves through gradient and modular approaches. Its core principle is to design multiple pathways to achieve the same core competency goal. These tiered project tasks exhibit systematic differences in aspects such as “clarity of problem structure,” “complexity and cleanliness of data sources,” “degree of predefined methodological tools,” “format and depth requirements for deliverables,” and “intensity of instructor support.” For instance, targeting the competency of parameter estimation and hypothesis testing: - A foundational-level project might provide a pre-cleaned dataset with clear variable relationships for a product user group, requiring students to perform interval estimation for specified parameters and conduct several predefined hypothesis tests. - An applied-level project might present a real e-commerce sales dataset containing missing and outlier values, demanding students formulate and test 2-3 business hypotheses about user behavior or sales performance. Innovation-level projects might present only a broad topic, requiring students to independently define specific research questions, design survey protocols, collect raw data, and conduct comprehensive statistical inference. This design ensures all students engage in authentic project practice while facing varying cognitive demands and challenge dimensions, thereby maximizing growth within each student's Zone of Proximal Development.

These three layers of logic are nested within each other, forming a dynamic cycle: OBE objectives guide PBL project design; PBL projects provide contextual pathways to achieve OBE objectives; and the tiered design ensures these PBL pathways can be personalized to fit each student, ultimately converging to enable all students to achieve the course's core learning outcomes.

5. Implementation of Tiered Projects in Statistics Courses Under the OBE-PBL Dual-Drive Model

Exquisite design requires meticulous implementation to take root. The execution of tiered project design under the OBE-PBL dual-drive model constitutes a dynamic cycle encompassing diagnosis, selection, execution, support, evaluation, and iteration.

The first phase involves diagnosis and orientation. At the semester's outset, pre-tests,

major interest questionnaires, and faculty-student interviews provide an initial understanding of students' foundational statistics knowledge, software proficiency, professional focus areas, and learning expectations. Based on this information and the three-tier project task descriptions, instructors provide each student with an initial tier recommendation. It is crucial to emphasize that tiering applies to tasks, not individuals, and that tiers are fluid. Students are encouraged to make autonomous choices based on self-awareness and willingness to challenge themselves, with the option to request adjustments after one project cycle.

The second phase involves project initiation and dynamic grouping. Several thematic project clusters spanning different professional directions are released, such as “Financial Market Analysis,” “International Trade Competitiveness Assessment,” “Corporate Operational Efficiency Diagnosis,” and “Information System User Behavior Research.” Each theme includes project proposals at three tiers: Basic, Applied, and Innovative. Students select a theme based on interest and then choose a tier within that theme according to their capabilities. Grouping employs a hybrid strategy combining “heterogeneous stratification” and “homogeneous stratification.” For high-complexity projects in the applied and innovative tiers, cross-disciplinary heterogeneous teams are encouraged to foster complementary perspectives. For foundational tiers or specialized skill training, homogeneous grouping is permitted to facilitate targeted instructor guidance. Team compositions may be dynamically adjusted throughout the project cycle based on task progress and member performance.

The third phase involves differentiated teaching processes and support, which is crucial for ensuring the effectiveness of stratification. Instruction shifts from uniform classroom lectures to a blended model of “micro-lectures + workshops + group collaboration + personalized coaching.” Micro-lectures target all students, concisely covering core statistical principles and key concepts to establish a knowledge baseline. Skill workshops are tiered. For example: - Foundational tier: “SPSS Descriptive Statistics & Basic Testing Workshop” - Applied tier: “R/Python Data Cleaning & Regression Modeling Workshop” - Innovation tier: “Research Design & Social Survey Methods

Workshop” Group Collaboration and Faculty Guidance: Faculty transition into “coaches” and “advisors.” Differentiated support is provided for groups at each tier: foundational groups receive detailed task lists, code templates, and step-by-step checkpoints; applied groups undergo regular progress reviews focusing on methodological soundness and interpretive depth; innovation groups receive strategic direction, resource recommendations, and support for overcoming challenges, while being encouraged to pursue independent exploration. Resource repository development involves constructing a tiered online resource library, including foundational tutorials, classic case studies, domain-specific datasets, and advanced methodology literature, accessible to students as needed.

The fourth phase is a diversified evaluation and feedback loop. Evaluation runs throughout the project, encompassing both formative and summative assessments. Formative assessment focuses on group discussion records, data cleaning logs, and interim analysis reports; summative assessment evaluates final project deliverables—such as analytical reports, visual dashboards, and oral defenses—using tiered rubrics. Additionally, peer review and domain-specific evaluations (e.g., involving faculty or industry experts as project judges) enrich assessment perspectives. Evaluation outcomes are not merely scores but critical inputs for subsequent learning cycles. Upon project completion, students engage in individual and group reflections to summarize gains and gaps in knowledge, skills, and collaboration. These insights inform tier selection and competency development for the next project cycle. Instructors, in turn, reflect on project design effectiveness based on student performance, dynamically adjusting task difficulty and support strategies across tiers to achieve continuous iteration of instructional design.

6. Conclusion

The OBE-PBL dual-drive model and tiered project system established in this study represent a systematic innovation in the teaching paradigm of statistics courses. By organically integrating goal-oriented guidance with process-driven implementation, and through the precise execution of tiered design and dynamic evaluation, it effectively bridges statistical

theory with business and management practice, transforming the course from “knowledge transmission” to “capability development.” This reform pathway offers an actionable solution for cultivating applied talents equipped with robust data literacy and complex problem-solving skills—essential for meeting the demands of the digital economy era. It holds clear practical value for advancing the development of new liberal arts disciplines and enhancing course quality in higher education institutions.

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