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A Study of Outcome-Based Education Development Pathways in Higher Education Based on Canvas (LMS)

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This study, based on the Canvas (LMS) at S University, explores the integration of online education with knowledge graphs and proposes an online learning-based OBE instructional framework that combines objectives (Outcome-Based Education) and structure (knowledge graph) to optimize instructional design. The study utilized the data collection and analysis functions of the platform to achieve accurate assessment of the achievement of course objectives, facilitating the shift from experience-driven to data-driven teaching. This study provides educators with a practical OBE teaching pathway that addresses the challenges of mismatched goals and outcomes and the difficulty of personalized instruction. A closed-loop system of "goal-path-evidence" was eventually established to promote the continuous improvement of talent cultivation quality.

Keywords: OBE, knowledge graph, Canvas (LMS), higher education

Introduction

Background and Context

Outcome-Based Education (OBE) is a teaching framework that focuses on the final learning outcomes of students. The concept was first developed in the 1950s by Spady, an American education expert, who defined OBE in his book *Outcome-Based Education: Critical Issues and Answers* as "clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences" (Spady, 1994, p. 1). OBE emphasizes what students need to be able to do upon graduation, and then designs curriculum and instruction to do the same. The key to this framework of education is that it focuses all instructional resources to help students acquire knowledge and competencies that are truly useful for future development (Kaliannan & Chandran, 2012). In other words, it is not just about how much content is taught, but what students can ultimately apply and what they can do.

However, the current traditional teaching evaluation system is difficult to meet the whole process and multi-dimensional monitoring needs on learning outcomes, resulting in a lack of data support for the analysis of course goal achievement. On the other hand, most of the classrooms are still in the teacher-centered knowledge transfer mode, and it is difficult to effectively implement the teaching methods advocated by OBE due to the lack of technical platform support. At the same time, the lack of personalized guidance in the large class teaching environment, the excessive reliance on experience judgment in teaching management, and other problems are

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constraining the real implementation of the OBE concept (Kohn, 2008).

OBE teaching based on online learning management system is an inevitable choice for the reform of higher education (Evans & King, 1994). The scientific nature of the professional talent cultivation program in universities needs to be realized through multi-dimensional evaluation such as the degree of achievement of course objectives and graduation requirements. Through the online platform, teachers can rely on digital tools to systematically plan teaching objectives, accurately anchor teaching priorities, and avoid the inertia of relying on experience or teaching materials (Asim, Vaz, Ahmed, & Sadiq, 2021). In addition, through the data collection and analysis functions of the platform, teachers can accurately assess the learning effect of students and provide an objective basis for the continuous improvement of teaching, thus promoting the transformation of college teaching from experience-driven to data-driven, and realizing the continuous improvement of the quality of talent cultivation.

In this context, it is of great practical significance to conduct research on OBE teaching based on online teaching platform. Based on the Canvas (LMS) used by S University, this study proposes a framework for OBE teaching based on the Canvas platform, explores the realization path of OBE teaching based on the platform among teachers and students, and provides guidance and design ideas for the whole S University to carry out OBE teaching using Canvas (LMS).

Research Objectives and Significance

OBE teaching concept is of great significance for deepening the teaching reform and improving the effect of teachers' education and teaching. On the contrary, the research on the application of OBE teaching mainly focuses on the analysis and improvement of traditional offline teaching, while there are fewer cases of application of online learning and online/offline blended learning. Along with the development of Digital Intelligence Education, the application of the OBE teaching concept to online teaching and the exploration of online/online/offline blended OBE teaching paths is a windfall for teaching reform, and also an important way to break the existing barriers of OBE research and to improve the professional education and teaching quality, and promote the development of higher education.

Based on this, the study takes OBE learning outcome-oriented as the basic perspective, takes constructing OBE teaching realization path based on Canvas (LMS) as the main content, explores the application of OBE teaching on Canvas (LMS) platform, and initially constructs the OBE teaching framework and realization path based on Canvas platform, highlights the learner-centered professional cultivation mode, promotes the professional cultivation objectives to be achieved. It also provides operable solutions and realization paths for all teachers and students to carry out relevant practices.

This study provides new ideas for the promotion of teacher education and teaching as well as the assessment of undergraduate teaching in colleges and universities at both the theoretical and practical levels. At the theoretical level, the study can develop the scientific practice of OBE teaching and seek the integration of OBE teaching in the online learning environment; at the practical level, it can provide teaching guidance and basis for the teachers of this university to use OBE teaching concepts in Canvas (LMS), so as to promote the students' professional ability and disciplinary quality, and to further push forward the reform of higher education teaching.

Constructing an OBE Teaching Framework Based on Canvas (LMS)

It has been found that knowledge mapping can present the logical relationship between knowledge points,

teaching objectives, and competency goals through a visualized and structured knowledge network, which helps teachers to systematically decompose OBE teaching goals, ensure the precise alignment of course content and goals, and help OBE teaching to land. We accessed the knowledge mapping tool in Canvas (LMS) and made a deep connection with Canvas (LMS) to provide more comprehensive support for teachers to carry out OBE teaching based on Canvas (LMS). Through the OBE teaching and knowledge mapping related functions based on Canvas (LMS), we propose a teaching framework for teachers to carry out OBE teaching based on Canvas (LMS) online teaching platform, so that teachers can better understand the implementation path of OBE teaching, as shown in Figure 1.

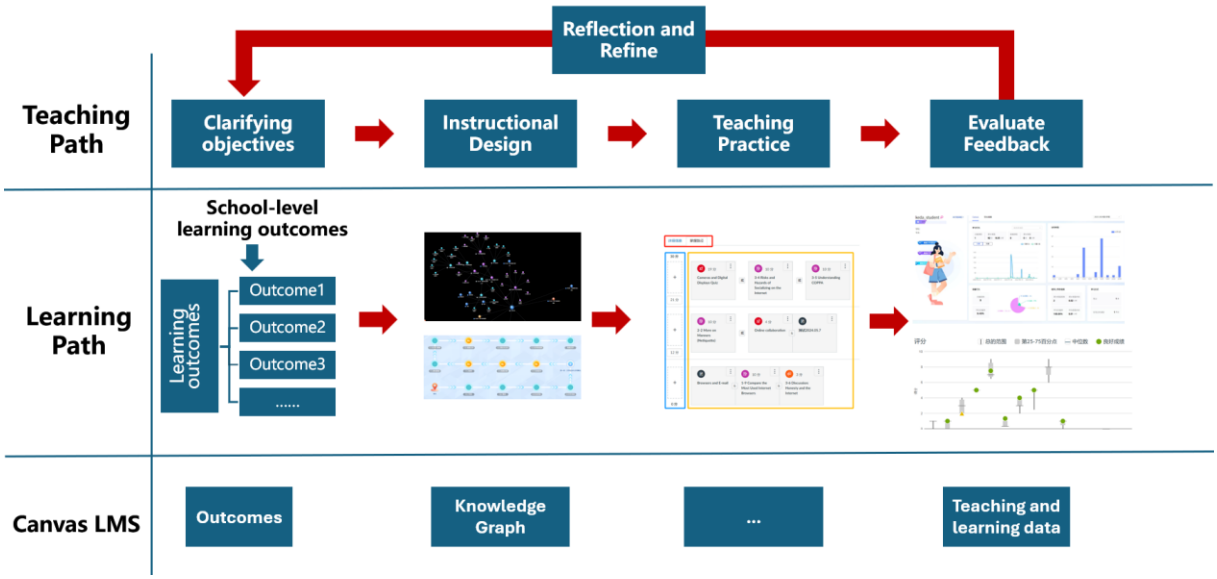

Figure 1. OBE teaching framework.

The OBE education concept emphasizes taking students' ultimate learning goals as the starting point, and decomposing the macro cultivation goals into measurable and assessable specific competence indexes step by step through the reverse design method (Davis, 2003); while the knowledge mapping technology clearly presents the logical connection and hierarchical relationship between various knowledge elements by constructing a visualized and structured knowledge network. The organic combination of the two ensures both the clarity of the teaching direction and the systematic nature of the knowledge system.

Among them, the teaching goal design based on the concept of OBE is centered on the ultimate goal of "the core competencies that students should ultimately possess", and then the reverse derivation and formulation of specific, quantifiable, and hierarchically progressive learning goals. On this basis, relying on the structured semantic relationship network support provided by the knowledge graph, a comprehensive curriculum network can be systematically constructed with competency needs as the traction, knowledge points as the nodes, and teaching resources and assessment data as the related elements. Ultimately, by integrating the real-time, multi-dimensional learning process data (such as participation, homework performance, assessment scores, etc.) collected by learning management systems (LMS) such as Canvas, dynamic closed-loop teaching feedback is formed. The key to this closed-loop mechanism is to continuously use the results of learning data analysis to review and adjust the initial teaching objectives and optimize the match and fit between them and the knowledge

structure defined by the knowledge map, so as to achieve continuous improvement of teaching effectiveness (Budiyanto, Hartati, & Azhari, 2018).

Canvas (LMS) plays a key digital education hub role in this educational transformation, and its theoretical positioning is mainly reflected in three important functions. Firstly, as the hub of goal management, Canvas (LMS) realizes the fine decomposition and systematic integration of OBE goals through its unique Outcomes module, which disassembles macro educational goals into operable and measurable micro competency units, and at the same time ensures the logical consistency between goals at all levels. Secondly, the platform serves as a structure mapping carrier, using the modularized curriculum design framework and knowledge mapping tools to present the course knowledge points and their complex logical relationships in an intuitive way, so that the abstract knowledge network can be transformed into a concrete form of teaching organization. Finally, Canvas (LMS) can systematically collect, organize, and analyze all kinds of data in the process of students' learning, forming a complete data chain of competence attainment and providing an objective basis for teaching evaluation and improvement (Bezhovski & Poorani, 2016). These three aspects of the function of mutual support, organic unity, together constitute the Canvas (LMS) to support the OBE and knowledge mapping integration of the application of the core competence system.

OBE Teaching Path Based on Canvas (LMS)

Based on the above framework, the study summarizes the path for teachers to carry out OBE teaching based on Canvas (LMS) by combining the characteristics of OBE teaching and the principles of instructional design, which is divided into the following five stages: Clarifying Objectives, Instructional Design, Teaching Practice, Evaluate Feedback, Reflection and Refine.

Clarifying Objectives

The first stage is clarifying teaching objectives and designing assessment plans. Teachers need to use the Outcomes tool of the Canvas (LMS) to establish a three-level goal system at the course level, module level, and knowledge point level, which should comply with the SMART principle to ensure that the goals are specific, measurable, achievable, relevant, and time-bound. At the same time, the Rubrics tool is used to translate these objectives into observable evaluation criteria, such as "the instructional design plan should include at least three technology integration strategies". The result of this phase is an Objective-Assessment Matrix, which clearly shows the relationship between the course objectives, corresponding modules, assessment tasks, and the knowledge graph nodes.

Instructional Design

The second stage is developing instructional designs and optimizing curriculum systems, in which teachers need to choose the right tools to build course knowledge maps (as structured knowledge networks) and Canvas (LMS) modules. In the initial attempt, teachers can use lightweight tools such as XMind or Miro to draw preliminary static maps of knowledge structures. In the design process, the principle of vertical layering and horizontal linkage should be followed: vertically reflecting the cognitive progression from basic concepts to comprehensive applications, and utilizing the hierarchical structural properties of the knowledge map to clearly show this progression; horizontally labeling the knowledge associations across modules and courses, and constructing semantic relationships (e.g., prerequisite, successor, related, contained, etc.) in the knowledge map.

Teaching Practice

The third stage is course activity organization and strategies dynamical adjustment, where teachers need to design instructional activities based on the structure of the knowledge graph and its embedded knowledge relationships. The main strategies include: controlling the granularity of tasks, based on the atomic knowledge points or competency nodes defined in the knowledge graph, ensuring that each learning activity corresponds to one or two learning outcomes, and avoiding cognitive overload (Bryson & Hand, 2007); designing diversified learning paths, utilizing the path-planning capability of the knowledge graph to plan for both the mainline tasks covering the core knowledge (i.e., the critical paths in the graph), and the branching tasks based on the association of knowledge graph nodes and student profiles, automatically adjusted according to students' ability differences. Specific operations on Canvas (LMS) include: using the module function to map the modular division of the knowledge graph to organize the course content, and setting prerequisites to clearly mark the graph nodes involved and the learning outcomes corresponding to each task in the assignments to help students understand the purpose and value of the learning activities, the purpose and value of learning activities.

Evaluate Feedback

The fourth stage is teaching feedback evaluation and dynamic monitoring, where teachers need to establish a data-driven instructional feedback mechanism. Two types of key data are collected through the Canvas (LMS): process data such as page visit length and discussion board participation, which are used to mark student engagement; and outcome data such as quiz scores and assignment ratings, which are used to identify weaknesses in knowledge acquisition (Wardoyo & Yuniarti, 2020). Based on these data, two intervention mechanisms can be implemented: one is to provide automated personality feedback through tools such as Learning Mastery Path, which directly references the relevant materials to give suggestions for improvement. The Learning Mastery Gradebook feature automatically generates a report on each student's achievement of learning goals. Teachers can accurately analyze the achievement of learning goals and locate the shortcomings of teaching in combination with knowledge mapping to help students check for gaps and fill in gaps in their knowledge; the other is to use the Analytics feature to identify groups of people with learning difficulties, and organize targeted tutoring activities.

Reflection and Refine

The fifth stage is iterative optimization. At this stage, it is necessary to strengthen reflection, improve the teaching management process, and enhance the efficiency of teaching. Improvement mainly focuses on two aspects: first, to amend the goal system and remove redundant goals; second, to reorganize the knowledge structure based on students' actual learning path data, comparative analysis. Such as adjusting the strength of association between nodes, adding or deleting nodes or relationships, optimizing the weight distribution of graph nodes, and reflecting changes in the importance or mastery priority of knowledge points. For this purpose, Canvas (LMS) provides a series of auxiliary functions, such as using the course replication function to retain historical teaching versions for comparative analysis, and also collecting feedback on students' experiences with the knowledge graph through course evaluation questionnaires. The learning behavior data collected by Canvas, such as access frequency, stay time, homework completion, discussion participation, etc., are analyzed in depth, combined with the comparative analysis of the data and the knowledge graph nodes to reveal the relevance of the association between the graph structure and the actual learning effect, and to make timely adjustments to provide a data-driven basis for the optimization of the knowledge graph. These five stages constitute a complete closed

loop of teaching practice, which promotes the deepening and enhancement of the integration of online education and knowledge mapping.

Conclusion

This study explores the implementation path of Outcomes-Based Education (OBE) on the Canvas (LMS), which based on its own functions and embedded with knowledge mapping functions, realizes the visual presentation and organic integration of OBE paths.

The study first takes Outcomes and Rubrics tools as the starting point to construct the basic framework of OBE, realizes the systematic decomposition of teaching objectives and the clarification of assessment standards through these two core functional modules, and at the same time initiates the drawing of the course knowledge map to lay a double foundation for the subsequent teaching implementation. The research focuses on building a core cycle mechanism of dynamic optimization, driven by the evaluation data generated during the learning process, guiding the iterative updating of the knowledge map through the continuous analysis of the data, which in turn feeds the adjustment of the course structure on the Canvas (LMS), forming a virtuous cycle of "data-optimization-implementation".

On the basis of achieving the basic goals, the study further explores the construction and application of knowledge graphs, promotes the cultivation of students' comprehensive abilities through the integration of multidisciplinary knowledge networks, and makes full use of Canvas (LMS) features such as learning mastery gradebook and collaborative tools, so that students' learning outcomes can be explicitly displayed and assessed.

Practice shows that through the systematic implementation of the above strategies, Canvas (LMS) can not only effectively support the implementation of the OBE teaching concept, but also upgrade to an intelligent "education navigation system" with the help of knowledge mapping technology, thus significantly improving the overall level of online education in the three dimensions of scientific, personalized, and teaching efficiency. This integration framework provides a replicable and scalable practical solution for teaching reform in the context of education informatization.

Limitations

While this study describes an Outcomes-Based Education (OBE) instructional framework implemented through the Canvas platform, there are a number of practical challenges associated with school-wide adoption of this framework. Designing OBE-aligned learning objectives and constructing corresponding knowledge maps requires more lead time than traditional curriculum development, so transitioning to this model requires a significant time investment. In addition, these materials need to be updated regularly to reflect evolving subject matter knowledge, which places additional demands on faculty workload.

The application effectiveness varies considerably across different academic disciplines due to fundamental variations in knowledge structures and teaching methodologies. STEM fields such as computer science and engineering naturally accommodate knowledge graph approaches with their hierarchical and logically progressive knowledge systems. In contrast, humanities disciplines like literature and philosophy present greater implementation challenges as their knowledge domains often emphasize open interpretation and multidimensional perspectives which may not align well with rigid node-based frameworks.

Successful implementation further depends on stakeholders adapting to new roles and technologies. Faculty members need to transform from traditional knowledge providers to learning facilitators while simultaneously

mastering the technical aspects of the Canvas platform. Students similarly face a learning curve in navigating this new educational environment.

To address these challenges a multi-faceted support system should be established including tiered training programs and ongoing technical assistance. Developing discipline-specific template libraries could reduce faculty workload by providing pre-structured knowledge graph frameworks. Institutional policy support through recognition and incentives for innovative teaching practices would further encourage faculty engagement with this pedagogical transformation. These coordinated measures would facilitate smoother adoption while preserving the educational integrity of diverse academic disciplines.

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