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Digital Technology-Enhanced Evaluation of PBL Teaching Method

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Abstract: The integration of digital technology and teaching method has become an important part of teaching reform. In view of the current difficulties of insufficient digital technology integration, imperfect evaluation system, primeval teaching evaluation management and insufficient student participation, a framework of integration of digital technology and PBL teaching evaluation is proposed. Aim of digital technology, data, algorithm and computing power constitute the four core elements of the framework. Based on the four-level logic of the framework, a technical path is proposed to support the digital technology-enhanced PBL evaluation system.

1. Introduction

In 2022, 2023 and 2024, China National Education Work Conference respectively proposed to "implement the strategic action of education digitalization", "promote the digitalization of education as a whole" and "continuously open up a new track of education digitalization". The intensive introduction of policies on digital transformation of education shows that digital transformation is a new form of education. Education reform is the inevitable trend of education digital transformation. Project-base learning is an important practice of education reform.

In 2020, the Overall Plan for Deepening the Reform of Educational Evaluation in the New Era gave educational evaluation the strategic importance of "baton" leading the direction of educational development. At the same time, it demanded fully use of information technology to improve the scientific, professional and objective of educational evaluation, to guide students to learn to learn, promote personalized growth, and promote the effective cycle of teaching-learning-evaluation [1].

Project-based teaching (PBL) is a student-centered teaching method. It helps students learn knowledge and develop multiple skills in practice by engaging them in real, complex problems or projects. It emphasizes active exploration, cooperative learning and creative thinking in the process of solving practical problems, so as to gain deeper understanding and the ability to apply knowledge. PBL entered into China in the 1980s and it has become a major teaching method and has been widely used in many different fields. Its characteristics of "project-driven", "student-centered", "interdisciplinary learning" and "teamwork" pose higher challenges to the efficiency of teaching

evaluation, but it also leads to the integration of digital technology and PBL teaching.

2. The Dilemma of the Coupling of Digital technology and PBL

China has a strong lineup of information-based teaching platforms, such as the National Smart Education Platform for Primary and Secondary Schools, the National Vocational Education Smart Education Platform, Super Star Learning, Rain classroom, and so on. These platforms pay most attention to curriculum integration and teaching application, but coupling of digital technology and PBL is seldom noticed.

2.1. Insufficient technological integration and misplaced value orientation

The simple digitization of teaching resources cannot change the mode of knowledge "supply model". Since 2010, China's Ministry of Education has built 203 national vocational education teaching resource libraries, covering 19 major categories of higher vocational education, and the provincial project construction of professional resource libraries has reached 582 [2]. By February 2024, China has built 1,173 national and provincial professional teaching resource libraries, 6,757 high-quality online open courses, and 2,222 video open courses [3]. However, many teachers apply thseselearning platform to simple applications such as check-in, submission and homework correction. They fail to change the knowledge "supply model" with the "feedback" of procedural evaluation under information technology [4].

2.2. The inadequacy of evaluation system and the deficiency of multivariate heterogeneous data

Students' learning will produce a large amount of data, which together constitute the learning data, with the characteristics of large amount of data and diverse data. The theory of Educational Data Mining and Learning Analytics has brought about the upgrading of data collection and analysis technology, which can fully tap the value of data. Dong Yan [5], Wang Jing, Li Baoping et al. [6] pointed out that in the actual scenario of PBL, teachers only simply pay attention to the result data, but the process data, value-added data and comprehensive data are insufficient.

According to the research of Jiangsu Education Information Research Center, structured data generated by a student in the education system equals about 1.68PB, while unstructured data can read 35EB[7]. These data not only involve knowledge acquisition, ability cultivation, quality acquisition and other aspects, but also run through the whole learning process. According to Fu Yuting's survey on how teachers evaluate students, 87.5% of teachers would only draw conclusions based on quantitative data such as pre-test and post-test scores and homework accuracy [8].

2.3. The backwardness of evaluation and the heavy load of teachers

PBL emphasizes the development of students' comprehensive abilities in real projects, including critical thinking, creativity, and teamwork. In order to evaluate students' performance comprehensively, it is necessary to adopt a multi-dimensional evaluation system, including outcome evaluation, process evaluation, value-added evaluation and comprehensive evaluation. These four types of evaluation are interrelated and constitute a panoramic assessment of students' learning effect. However, due to the lack of advanced algorithm models to support intelligent evaluation methods, these complex evaluation tasks mostly rely on teachers' subjective judgment and manual operation, resulting in heavy evaluation load of teachers.

2.4. The delay of evaluation result and the restriction of computing power boundary

Teaching evaluation itself should be growth-oriented. Through the feedback mechanism to connect students with teachers, evaluators and evaluators, it promotes continuous improvement of students. However, in fact, evaluation is often regarded as a final procedure or external requirement by all participants, and is subject to the boundary of computing power, resulting in insufficient timely and effective feedback mechanism, which limits the guiding function of evaluation and makes it difficult for feedback to play its due role in the teaching and learning process, thus affecting the adjustment of teaching strategies and personalized support for students' learning.

3. Digital technology and PBL teaching evaluation coupling theoretical framework

With the core purpose of promoting the comprehensive development and personalized growth of students, guided by the aim of digital technology and supported by the three core elements of modern information technology, data, algorithm and computing power, a “ADAC” framework is proposed, through which, the evaluation system of PBL teaching is empowered by perception, linking, calculation and feedback technology.

3.1. In the term of aim of evaluation

Educational participants should give full play to the value of numbers, and form a virtuous cycle of teaching-learning-evaluation. The aim of evaluation is a series of basic thoughts, principles and concepts that guide evaluation activities. It determines the value orientation and method selection of evaluation. The aim of evaluation mainly answers the question "why to evaluate?" In PBL, the application of digital technology is not only the digitization of curriculum resources, but also the full empowerment of teaching evaluation, and the in-depth mining of student learning data through digital technology to achieve evaluation goals, so as to build a virtuous cycle of teaching-learning-evaluation.

3.2. In the term of data

Educational participants should adhere to evidence-based evaluation, adhere to the comprehensiveness, objectivity and comprehensiveness of multivariate data to answer the question of "what to evaluate". If digital technology is a powerful machine, then data is its indispensable fuel, driving its continuous operation and evolution. Data is also the basis of PBL teaching evaluation. Through the introduction of multiple and heterogeneous data, including structured and unstructured data, students' learning process, interaction, thinking process, etc., can form a comprehensive evaluation perspective and provide a solid evidence base for evaluation.

3.3. In the term of algorithm

The analysis of algorithms needs to be deepened to promote the evaluation of application convenience. Algorithms are at the heart of artificial intelligence. It processes data and performs calculations to achieve specific functions. By deepening the algorithm analysis, the convenience of evaluation application in PBL teaching can be significantly promoted and the evaluation task of teachers can be greatly reduced. Algorithm enhancement is designed to answer the "how to rate" question. Automated data processing and precise analysis not only improve the efficiency and quality of evaluation, but also make the evaluation process more intelligent and easy to operate, so as to support the effective implementation and optimization of teachers in PBL teaching.

3.4. In the term of computing power

Computing power enables feedback to improve evaluation and application guidance. Computing power refers to the capability and performance of computing resources used to perform computing tasks. Enhancing computing power is designed to answer the question "what is the use of evaluation results?" The computing power realizes the output of analysis through the processing of data. In PBL teaching evaluation supported by digital technology, computing power plays a key role in data processing, model training, real-time feedback and improving evaluation accuracy. High computing power not only improves the accuracy and real-time performance of evaluation results, but also promotes personalized teaching and timely feedback, thus effectively improving the guidance and practicability of value-added evaluation.

4. The technology approach of digital technology coupled with PBL teaching evaluation

According to the technical logic of application concept → technical base layer → technical program layer → technical result layer under the visual threshold of PBL teaching evaluation, educational participants should set up correct evaluation aims and make good use of evaluation baton. In term of data collection, educational participants should enhance multi-modal integration and promote the construction of panoramic PBL teaching evaluation; A Convenient evaluation also should be constructed based on algorithm optimization. A benign ecology of teaching-learning-evaluation based on real-time visual feedback also should be formed on the basis of efficient computing power.

4.1. Serving the aim of evaluation and using the "baton" of evaluation

The teaching evaluation of PBL enhanced by digital technology should break the phenomenon of "only score" and fully reflect the actual performance of students. Evaluation should focus on promoting the overall development of students and guide their balanced progress in various aspects through feedback. On the whole, evaluation is not only a test of students' knowledge, but also an important tool to promote their growth.

Evaluation should not be limited to testing students' knowledge, its logical end point serves the purpose of "educating people", and should focus on promoting students' all-round development. The aim of "evaluation should be adhered to promote growth", and the feedback in the evaluation process should be used to help students find their potential and shortcomings. Through the dynamic evaluation system, students are encouraged to develop in a balanced manner in academic, practical and thinking aspects and cultivate their comprehensive quality, so that evaluation becomes an important driving force for students' growth, rather than just the end point.

4.2. Integrating technology and building panoramic value-added evaluation

Integrating multi-source heterogeneous data, using digital technology to build a data chain, build a panoramic evaluation ecosystem; Educators should make full use of the advantages of digital technology to collect multi-source heterogeneous data across scenarios, multi-types, and interoperability. Collecting and integrating various forms of data, such as text, images, videos, etc. can increase the breadth and depth of data. It is not only necessary to meet the expansion needs of students' learning data, but also to break the bottleneck of teachers' manual collection.

Breaking the "digital island" by integrating time-domain and spatial-domain data can achieve a comprehensive recording and three-dimensional analysis of the learning process. Constructing a panoramic evaluation ecosystem covering both time and space data is also required. Time domain

data, with time as the ordinate, runs through all stages of the learning process, including pre-class preparation, classroom learning and after-class review, and comprehensively records students' learning trajectory. Spatial data horizontally covers data in different learning scenarios and environments, including classrooms, libraries, families and social platforms, providing multi-dimensional learning environment data. By collecting and integrating these data, education participants can build a three-dimensional data system that runs through the learning time vertically and covers the learning space horizontally. Such a data system can not only provide a comprehensive evaluation basis, but also accurately identify students' learning needs and potential through multi-dimensional data analysis, providing strong support for personalized teaching and comprehensive development.

4.3. Optimization Algorithm and improving "four evaluations"

Based on the rich experience and existing difficulties of the existing information-based teaching platform, the construction of the value-added evaluation system for students should be achieved, and the quality of the teaching platform should be upgraded. By improving the algorithm model and optimizing the evaluation method, the burden of teachers can be reduced. Through the introduction of intelligent algorithm, the evaluation method in PBL teaching can be optimized. The algorithm not only automatically generates personalized results and procedural evaluation reports, but also accurately quantifies students' value-added effects, and integrates multi-dimensional data to generate comprehensive evaluation reports. It not only greatly reduces the evaluation burden of teachers, but also improves the scientificity and objectivity of evaluation, and effectively promotes the application of digital evaluation in teaching.

4.4. Improving computing power and supporting personalized learning and individualized teaching

Digital technology enhanced evaluation system for PBL teaching should provide real-time dynamic guidance. Education participants should give full play to the advantages of high computing power, improve the evaluation efficiency in PBL teaching, and equip the teaching platform with the ability to capture learning status, real-time analysis, timely feedback and dynamic guidance. Firstly, digital technology enhanced evaluation system for PBL teaching should provide feedback to students to help them understand their own performance in learning, to move away from rigid set standards and other references, and to focus on personal development. Through the "Zone of Proximal Development" theory, students can assess their existing knowledge and skills, set challenging goals, or use Scaffolding to help set phased goals, design learning paths, and achieve personalized growth and instant access to educational resources. Secondly, it should provide teachers, schools and parents with a clear dashboard of learning progress, showing students' growth trajectory information, and providing learner warning information to identify at-risk students. In this way, teachers can provide targeted teaching interventions, schools can adjust teaching plans, and parents can participate in the communication feedback mechanism of home-school co-parenting.

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References

[1] Central Government of the People's Republic of China. We will deepen reform of the new times education evaluation overall scheme [R/OL]. (2020-10-13) [2024-8-16]. https://www.gov.cn/zhengce/2020-10/13/content_5551032.htm

[2] Sun Shanxue. Some Problems on the Construction of modern Vocational Education System [J]. Journal of Beijing Vocational College of Economics and Management, 2023, 38(04):8-10.

[3] Ministry of Education of the People's Republic of China. Virtual simulation helps vocational education practice training! National vocational education digital strategy action obtained obvious progress [R/OL]. [the 2023-02-14 [2024-8-16]. http://www.moe.gov.cn/jyb_xwfb/xw_zt/moe_357/2023/2023_zt01/mtbd/202302/t20230214_1044627.html

[4] Huang Xun. Research on Improving Digital Learning Ability of vocational College students based on project-based learning [D]. Nanning normal university, 2020. DOI: 10.27037 /, dc nki. GGXSC. 2020.000064.

[5] Wang Jing, Li Baoping, Zhang Lishan. Problem analysis and Strategy Suggestion of PBL application in primary school curriculum [J]. Digital Education, 2021, 7(03):73-79. (in Chinese)

[6] Dong Yan, and Jing Yu. Application of PBL project-based learning in University teaching [J]. Modern Educational Technology, 2019, 29(09):53-58. (in Chinese)

[7] Xiao Jun. Big Data for Education [M]. Shanghai: Shanghai Science and Technology Press, 2020:292.

[8] Fu Yuting. Primary school teaching evaluation operation paradigm research [D]. Inner Mongolia normal university, 2022. The DOI: 10.27230 /, dc nki. Gnmsu. 2022.000850.