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Research on the Current Situation, Problems, and Solution Paths of Value-Added Evaluation for Vocational College Students in the Context of Big Data

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Abstract: Value-added evaluation focuses on individual student growth by tracking changes in academic performance, skills, literacy, etc., at different time points. It weakens horizontal comparisons and emphasizes vertical progress to more fairly reflect educational effectiveness. This evaluation method is particularly suitable for vocational education, effectively motivating students' learning enthusiasm and enhancing their self-confidence. Foreign research is represented by the Tennessee Value-Added Assessment System (TVAAS), widely used in evaluating school quality and teacher performance. Domestic research currently focuses on the theoretical construction, model establishment, optimization, and practical application of value-added evaluation, still facing significant challenges in data collection comprehensiveness and model adaptability. Aiming at current issues, this study focuses on exploring the application of artificial intelligence large models in student value-added evaluation from an evidence-based perspective, committed to constructing an innovative evidence-based value-added evaluation system. It aims to achieve precise assessment of students' learning effect "net value-added" through multi-source data collection, intelligent analysis, and personalized feedback. The system integrates outcome evaluation, process evaluation, value-added evaluation, and comprehensive evaluation to form a "four-in-one" dynamic evaluation framework, considering students' starting points, process performance, and final achievements. In the future, value-added evaluation needs to further expand the assessment of non-academic dimensions (such as professional literacy and social-emotional skills) and explore the application of non-linear models to promote the deepening and innovation of educational evaluation reform.

Keywords: Evidence-based; Value-added evaluation; Artificial intelligence; Large model; Intelligent agent

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1. Introduction

Student value-added evaluation refers to continuously tracking data on students' professional performance, practical skills, and comprehensive literacy at different time nodes, analyzing the changes of each type of

data using statistical methods, focusing on students' self-development, weakening horizontal comparisons between students, and strengthening their vertical self-development. It evaluates the "amplitude" of progress, development, growth, and transformation based on their respective starting points or foundations after a certain period of education, and makes value judgments on the degree of individual student development [1]. It focuses on the value-added or progress students achieve in knowledge, skills, abilities, and physical and mental aspects through school education over a period. It emphasizes that evaluation should respect students' individual differences, pay attention to each student's unique growth trajectory, promote self-comparison, and avoid the low self-efficacy phenomenon in unified standardized evaluation [2].

Combined with the characteristics of vocational education and the actual situation of its students, it is not difficult to find that value-added evaluation is particularly suitable for student evaluation. The learning methods, further study paths, and development prospects of vocational college students show a diversified trend. If the traditional summative evaluation system is adopted, students will receive long-term negative evaluation feedback, seriously damaging their self-confidence and reducing their learning initiative. Value-added evaluation conducts vertical evaluation with students themselves as the reference, providing positive feedback on their growth and progress, playing an important role in motivating underachievers and promoting students' sound development.

2. Research status of student value-added evaluation

In recent years, domestic research on value-added evaluation has become increasingly extensive and in-depth, with many scholars discussing it from different perspectives.

In terms of defining value-added evaluation, scholars Li and Tan clarified its basic concepts, practical dilemmas, and optimization strategies, emphasizing its importance in focusing on individual growth and progress [3]. Xie and Fu designed a student-oriented value-added evaluation system from the perspective of vocational education students, based on the value and rational regression of value-added evaluation [4].

Regarding the rationality of value-added evaluation, scholars Qiu and Yue explored the impact of ability value-added on graduates' employment quality through empirical analysis, proving the effectiveness of value-added evaluation in improving employment matching and quality [5]. At the same time, Xu and Qian introduced the American value-added evaluation model for teacher effectiveness from a multi-evidence perspective, providing useful references for the reform of China's educational evaluation system [6].

In terms of specific implementation of value-added evaluation, domestic scholars mostly advocate adopting diversified evaluation models, emphasizing the importance of personalized evaluation and data-driven approaches. For example, Wang *et al.* proposed the concept of digital intelligence empowering evidence-based higher education evaluation, emphasizing the use of intelligent technology for precise evaluation [7]. Zhang and Liao designed a model and implementation path for intelligent technology empowering the value-added evaluation of curriculum ideological and political effects, further expanding the application field of value-added evaluation [8]. Kong *et al.* constructed a student learning value-added evaluation model based on knowledge graphs [9], while Wu *et al.* studied the contribution of higher education factor inputs to the value-added of undergraduates' core competencies in the AI era [10]. Scholars Li and Wei explored the motivation, transformation, and path of ChatGPT activating the reform of college student evaluation from the perspective of new productive forces [11], indicating that technology-driven educational evaluation reform is accelerating.

3. Current problems in student value-added evaluation

Although significant progress has been made in value-added evaluation research at home and abroad, many challenges remain. For example, how to ensure the accuracy and reliability of value-added evaluation models, how to avoid subjective biases in the evaluation process, and how to effectively apply value-added evaluation results to educational decision-making urgently need further research and discussion.

First, in terms of evaluation content, since value-added evaluation requires statistical models to calculate value-added results, it must rely on data of a certain scale. The data sources for value-added evaluation are diverse, but in practical applications, most models are implemented in two main ways. One is to track students' academic performance over many years to longitudinally analyze their academic value-added, intermittently collecting their test results at different time points and comparing pre- and post-test results. The other is to focus on the gap between students' expected and actual results, measuring whether the actual progress made by students through education and teaching is higher than the progress they might have achieved at their starting level. Both approaches limit evaluation content to standard tests of knowledge, lacking data support for skills, professional literacy, learning processes, and other aspects. The main reasons are the difficulty of collecting process data and the inconsistency of evaluation indicators, which need to be continuously explored and solved in future research.

Second, in terms of model selection, current value-added evaluation models include those based on individual average score rankings, individual percentile rankings, mean value-added evaluation, simple value-added evaluation models, the Tennessee Value-Added Assessment Model (TVAAS), models based on scores and grades, ladder-type value-added evaluation models based on scores and grades, data collection, and analysis methods, which can be categorized into five types: simple difference models, multiple regression models, multilevel models, growth percentage models, and combined models. Meanwhile, to construct more flexible, efficient, accurate, and reliable value-added evaluation models, researchers have successively proposed model variants based on different estimation methods. Although these variants solve some of the limitations of the original models, no perfect model has emerged so far. With the widespread application of value-added evaluation in China, value-added models suitable for evaluating students' professional literacy, social emotions, mental health, etc., urgently need to be researched [12]. Compared with traditional linear models that use grades as dependent variables, value-added modeling for discipline core literacy and other aspects may involve non-linear and complex data category issues. The key to solving these problems lies in expanding the inclusiveness and adaptability of existing value-added models, which can be achieved by introducing non-parametric models and intelligent models, i.e., the application of large models in value-added evaluation.

4. Solution paths for existing problems in student value-added evaluation

Aiming at the above problems, a large amount of data generated in students' learning processes can be collected and transformed into evidence. From an evidence-based perspective, artificial intelligence large models can be used to achieve student value-added evaluation, mainly involving the following three aspects.

4.1. Collecting and processing omnidirectional multi-source heterogeneous data to provide data support for evidence-based value-added evaluation

Collect and analyze multi-source heterogeneous data, transforming various process learning data into evidence to provide evidentiary support for value-added evaluation. Vocational college students have diversified student sources and uneven levels, so value-added evaluation should fully consider the differences in students' starting

points and reflect the value of value-added by paying attention to individual differences [13]. The research mainly collects data closely related to student value-added evaluation from the smart classroom teaching platform vigorously promoted by the college in recent years, including various student data recorded by the platform before, during, and after class. The platform is used by all teachers in the college, with diverse data types, large quantities, and consistent data structures across multiple courses, facilitating collection. The collected data are sorted, classified, and integrated for subsequent analysis and application. Errors, duplicates, or missing data in the collected data are processed to ensure accuracy and completeness. In the process of data collection and processing, attention should also be paid to protecting students' privacy and ensuring the security and confidentiality of student data.

4.2. Developing an evidence-based value-added evaluation agent to assess students' periodic "net value-added"

Centering on students and taking the comprehensive improvement of their professional literacy as the basis for selecting model indicators, a suitable artificial intelligence large model is selected for customized development. Based on value-added evaluation evidence, the agent conducts deductive analysis of the evaluation objects' explicit states and implicit characteristics, generates evaluation results according to the preset evaluation system, assesses students' "net value-added" in a certain stage, and provides targeted guidance and support for their personal development [14].

4.3. Constructing an evidence-based value-added evaluation system that considers starting points, processes, and endpoints, focusing on "individual value-added"

Construct a "four-in-one evidence-based value-added" evaluation system (**Figure 1**). Outcome evaluation, process evaluation, value-added evaluation, and comprehensive evaluation are both an integral whole and interrelated, all being key paths to promoting the scientific effectiveness of the educational evaluation system. The evaluation content of process evaluation and outcome evaluation is based on teaching objectives, focusing on comprehensive evaluation combining students' professional abilities and basic professional literacy [15]. Based on the principles of development, unity and difference, and scientificity, an evidence-based value-added evaluation system based on artificial intelligence large models is established. With the help of the evidence-based value-added evaluation system, starting points, processes, and endpoints are considered, and "individual value-added" is focused on, allowing students to timely understand their personal progress through data, ensuring the comprehensiveness and timeliness of evaluation data while considering differences.

The combined use of value-added evaluation with other teaching evaluation results is the key to truly engaging in the "four evaluations." Therefore, integrating value-added evaluation into the "four evaluations" system should not be dominated by single value-added evaluation results. The comprehensive application of value-added evaluation results should promote the "four evaluations" to form an overall synergy to advance educational evaluation reform.

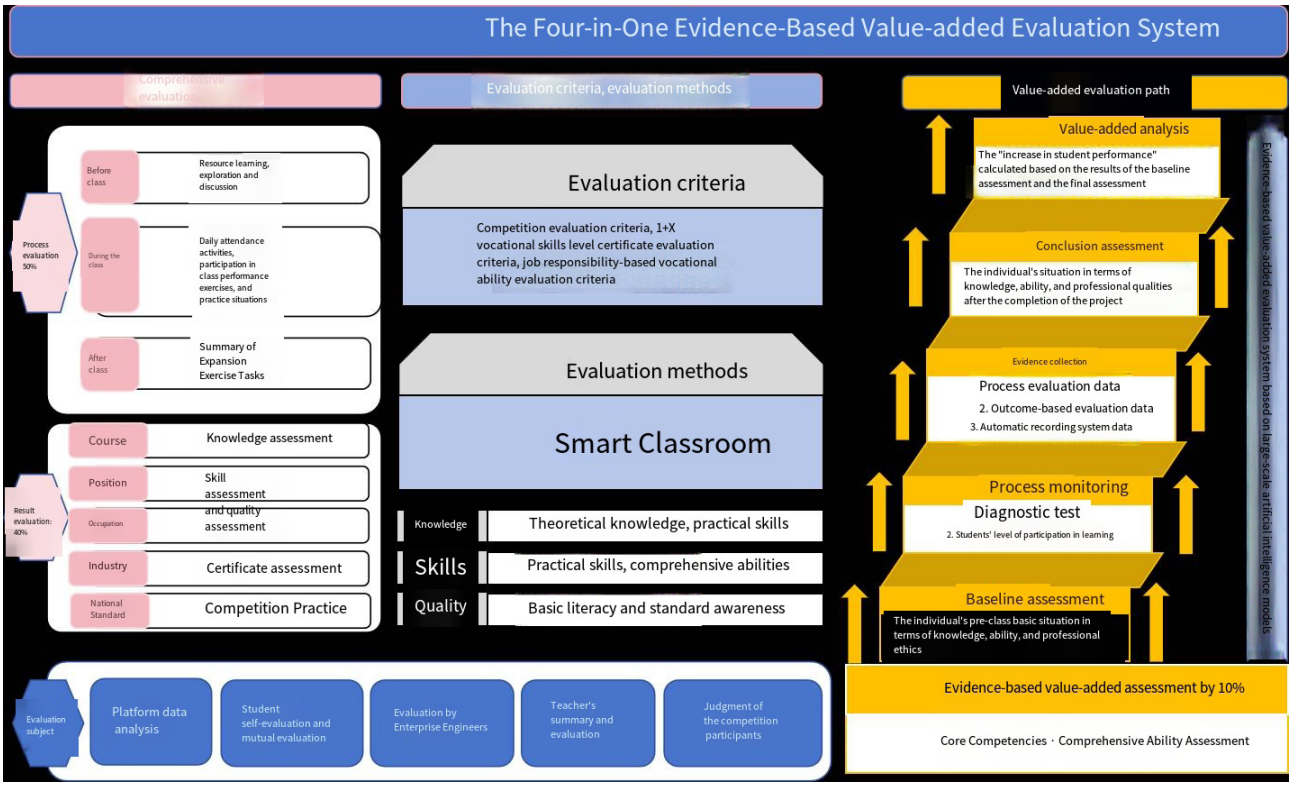

Figure 1. The "four-in-one" evidence-based value-added evaluation system

5. Conclusion

Value-added evaluation mainly focuses on students' progress, weakening the evaluation of their absolute grades or rankings. This evaluation method helps identify students who originally had poor foundations but made significant progress, as well as those who had high starting points but made little progress, thus evaluating students' learning outcomes more fairly. Meanwhile, large-scale online education, smart classrooms, and other teaching methods have gathered a large amount of process and outcome data in students' learning processes, providing a good data foundation for the implementation of value-added evaluation. The goal of this study is to find reasonable solutions by analyzing the current situation and existing problems of value-added evaluation. The research attaches importance to "individual" factors, considers individuals' starting points, processes, and endpoints, focuses on "value-added," and relies on artificial intelligence technologies such as large models for logical deduction and optimized feedback using process and outcome data from teaching activities. By constructing an evidence-based value-added evaluation system that integrates outcome evaluation, process evaluation, value-added evaluation, and comprehensive evaluation (i.e., the "four evaluations"), real-time tracking and evaluation of students' learning processes are achieved to more accurately assess their learning effects and ability development, promoting the transformation of evaluation towards scientific and systematic unity.

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