Research on the Construction of a Value-Added Evaluation System for Vocational College Students Empowered by Big Data

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Abstract. Currently, there are prevalent issues in the evaluation of vocational college students, such as the emphasis on scores, a single evaluation subject, lack of process data, and delayed evaluation feedback, which make it difficult to adapt to the development needs of personalized training and comprehensive education for students. This paper proposes solutions from the aspects of formulating evaluation indicators, establishing student growth profiles, constructing evaluation models, and providing feedback on evaluation results by constructing a "two-subject, three-stage, four-dimensional" value-added evaluation system. Supported by big data and relying on digital platforms to achieve data collection, multi-dimensional analysis, and visual presentation, this system facilitates the transformation of students from standardized training to personalized training. It helps to realize the evaluation effectiveness of "promoting learning, teaching, and reform through evaluation", promotes the development of the student evaluation system towards a more scientific, fairer, and more efficient direction, and achieves the educational goal of promoting the comprehensive development of students and improving teaching quality.

Keywords: Value-Added Evaluation, Big Data, Digital Platforms, Personalized Training.

1 Introduction

In the field of education, student evaluation is the core of education and teaching, and also an important guarantee for cultivating high-quality talents. Education in the new era focuses on the comprehensive development and personalized growth of students. Traditional evaluation modes that are single-dimensional and result-oriented can hardly meet the demands of vocational education and talent cultivation. Seeking more scientific, comprehensive, and fair evaluation methods has become an urgent requirement of educational reform. Value-added evaluation centers on students' progress and growth increments, offering a new perspective to abandon the score-centric evaluation mindset; meanwhile, big data technology provides fundamental technical support for process data collection and real-time feedback. This paper deeply integrates big data technology

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with value-added evaluation, constructs a student evaluation mechanism that adapts to the requirements of the new era at the micro level, and facilitates the realization of the vocational education goal that "everyone can achieve success and give full play to their talents"[1].

2 Current Status and Problems of Student Evaluation

With the continuous advancement of educational evaluation reform, vocational colleges have generally shifted from summative evaluation to a composite model combining outcome evaluation and process evaluation. Compared to traditional single-score evaluation, they have made certain progress, but many still remain at the superficial level of formal renovation, with a focus on screening and selection rather than promoting individual growth and value-added development. They have not been able to break free from the score-oriented mindset.

The current student evaluation in vocational colleges mainly faces the following issues: First, the evaluation orientation is one-sided. Colleges and teachers use final written exam scores and daily homework scores as the core basis for student evaluation, with a low proportion of practical assessment and assessment content mostly focusing on basic operational training, which does not align with the competency standards of industry positions and cannot truly reflect students' comprehensive professional abilities. Second, the evaluation subject is single and rigid, highly dependent on teachers. Teachers evaluate students based on their classroom performance, homework completion, and final exam scores. The evaluation perspective is limited and subjective, making it difficult to comprehensively and objectively reflect students' overall quality. Third, the evaluation process is static, lacking accompanying and unobtrusive collection of students' daily learning behaviors. The lack of process data makes it impossible to accurately identify students' stage learning bottlenecks and support personalized teaching interventions. Fourth, the evaluation feedback mechanism is lagging and inefficient. Evaluation results are often summarized and outputted after the end of the course, missing the best intervention opportunity within the teaching cycle. Students cannot adjust their learning strategies in a timely manner, and teachers also find it difficult to optimize teaching content and methods based on real-time learning situations, resulting in the data value of process evaluation not being realized and the effectiveness of promoting teaching and learning through evaluation not being achieved[2].

3 Research Significance and Application Prospects

3.1 Comprehensive Development of Students

Value-added evaluation centers on student growth, emphasizing academic progress as the objective basis for assessment. Compared to using grades as the only criterion, it places greater emphasis on students' comprehensive qualities and abilities. This requires schools and teachers to value each student, pay attention to subtle changes in

their learning process, and provide timely, positive feedback accordingly. This approach strengthens students' positive traits and boosts their confidence in learning. At the same time, it guides students to focus on improving their abilities rather than just scores, enabling continuous growth in professional skills, cultural literacy, teamwork, and professional qualities, thereby achieving well-rounded development.

3.2 Facilitation of Individualized Teaching

Value-added evaluation fully respects student differences and focuses on each student's starting point and progress. This helps to counteract the tendency to overly emphasize top-performing students, encouraging teachers to equally support the growth and improvement of underachievers, thereby creating balanced development opportunities for all students. Based on this, teachers can more accurately assess learning conditions, flexibly adjust teaching methods and content, design differentiated learning pathways, and implement tailored instruction.

3.3 Improvement of Teaching Quality

American educational evaluation expert Daniel Stufflebeam has pointed out: "The primary purpose of evaluation is not to prove but to improve." Through continuous tracking of student growth data, value-added evaluation can identify key factors affecting student progress, help students clearly recognize their weaknesses, define improvement directions, and adjust learning strategies under targeted teacher guidance, thereby achieving overall enhancement in teaching quality.

3.4 Promotion of Curriculum System Reform

Value-added evaluation reflects the actual contribution of different courses to competency development by tracking students' growth differences across various subjects. Schools can optimize curriculum design, enhance investment in high-quality course resources, adjust or replace inefficient course content, improve the efficiency of educational resource allocation, and promote deep alignment between the curriculum system and students' developmental needs as well as occupational requirements.

4 Construction Path of Value-Added Evaluation

In view of the deficiencies of the current student evaluation system in vocational colleges, this paper constructs a "two-subject, three-stage, four-dimensional" value-added evaluation system. The two-subject refers to the integration of teacher evaluation and student evaluation. This system covers the formulation of evaluation indicators, the establishment of student growth profiles, the construction of evaluation models, and the optimization of evaluation procedures. Supported by big data technology and digital platforms, it realizes automatic data collection, multi-dimensional analysis, and visual

presentation. This approach facilitates the shift from standardized cultivation to personalized training, promoting the all-round development of students, elevating teaching quality, and boosting curriculum reform. The specific construction path is as follows:

4.1 Formulation of Scientific Evaluation Indicators

Based on the guideline of "career demand-oriented and student development-centered," this paper reviews relevant theories of value-added evaluation and aligns them with curriculum objectives and characteristics to construct a four-dimensional evaluation framework, encompassing professional knowledge and skills, general vocational abilities, adaptability, and personal growth. By adopting the Analytic Hierarchy Process (AHP) and Principal Component Analysis (PCA), combined with feedback from industry experts, frontline teachers, and historical teaching data, this study determines the weights of each dimension and its sub-indicators, as shown in Table 1. Meanwhile, quantitative scoring criteria and qualitative rating scales are formulated to establish scientific and rational value-added evaluation indicators[3], which serve as practical guidance for data collection, analysis, and application in developing student growth profiles.

Table 1. Value-added evaluation indicators.

Four-dimensional indicators	Sub-indicators	Evaluation content	Corresponding training objectives
Professional knowledge and skills (40%)	Professional knowledge (15%) Operational skills (20%) Skills competition achievements (5%)	Assess theoretical knowledge, practical skills, and equipment proficiency	Knowledge objective, Ability objective
General vocational abilities (30%)	Teamwork(10%) Professional norms and literacy (12%) Problem-solving ability (8%)	Communication skills, operational norms and submission standardization of assignments during practical training	Ability objective, Quality objective
Adaptability (20%)	Learning stress resistance (7%) Environmental adaptability (6%) Self-regulated learning (7%)	Evaluate students' ability of knowledge transfer and skill iteration in practical training	Ability objective, Quality objective
Personal growth (10%)	Learning motivation (4%) Ideological and political quality (3%) Humanistic literacy (3%)	Assess students' personalized growth and comprehensive quality improvement	Quality objective, Ideological and political objective

4.2 Establishment of Student Growth Profiles

Before the course starts, preliminary assessments are conducted to measure students' prior knowledge, practical skills and learning attitudes. Comprehensive assessment results generate an initial course score for each student, with a personal growth profile built to set benchmarks for value-added evaluation.

Digital platforms are adopted to automatically collect and analyze learning data covering pre-class, in-class, and post-class stages. Pre-class metrics cover course resource browsing time, learning progress and pretest results to assess students' independent preview performance. In-class data records students' active questioning frequency, group participation, classroom task completion and peer evaluation results. Post-class indicators include proactive inquiries about difficult points, reflections on practical training setbacks, and self-study duration of extended resources.

The platform updates profiles and integrates evaluation data from students and teachers. It guarantees real, up-to-date learning records, laying a data foundation for calculating academic value-added scores, analyzing student growth trends and offering personalized academic guidance.

4.3 Construction of Value-Added Evaluation Model

Adhering to the core principles of respecting differences, valuing starting points, focusing on processes, and emphasizing development, this study centers on student development, comprehensively utilizes methods such as statistics and educational measurement, constructs a value-added evaluation model, analyzes the collected data, and calculates the growth increment of students. By employing analytical tools such as the Analytic Hierarchy Process and maximum likelihood estimation, the evaluation model eliminates students' original foundations, innate ability differences, and other interfering variables, and assesses students' stage growth value-added scores[4].

During the implementation of the course, students' comprehensive scores are assessed in stages. The current score is compared with the initial baseline score of the course and the score from the previous stage to derive the incremental score for that stage, as shown in Fig. 1. A positive incremental score indicates that the student has made progress; a negative score indicates a decline in the student's learning effectiveness during that stage.

Fig. 1. Calculation of students' stage value-added scores.

4.4 Visual Presentation of Evaluation Results

With the support of big data visualization tools, comparative charts and stage trend charts of students' stage-based value-added evaluations are generated to intuitively display students' learning fluctuations and growth trajectories across all learning stages, as shown in Fig. 2. In-depth analysis of evaluation results helps identify key factors influencing students' progress, including teaching approaches, learning environment and students' learning initiative, on the basis of which individual growth reports can be compiled. Stage-based evaluation data and analytical results are fed back to students to help them clarify their strengths and deficiencies. Meanwhile, these data and analytical findings are also delivered to teachers to support the optimization of teaching content and instructional strategies[5].

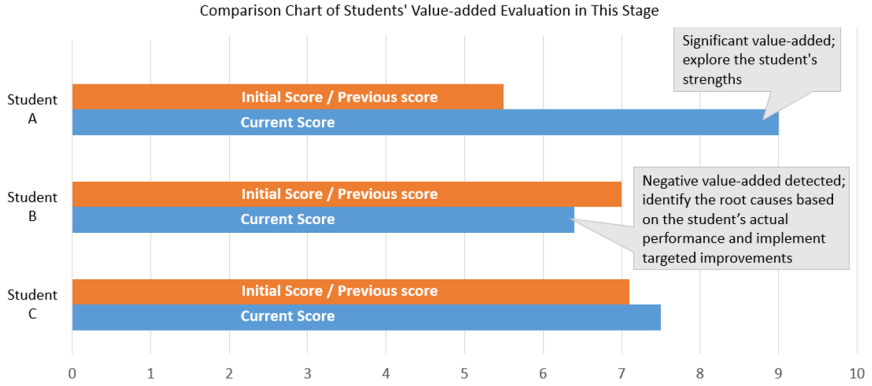

Fig. 2. Visualization of evaluation results.

5 Conclusion

In the context of improving the quality and excellence of vocational education, constructing a scientific student evaluation system is a crucial path to improve the quality of talent cultivation in vocational colleges and cultivate all-round skilled talents. Supported by big data technology, this paper has established a value-added evaluation system tailored for vocational college students. Through the organic integration of "two-subject, three-stage, four-dimensional," the concept of value-added evaluation is incorporated into the student evaluation system. This system can overcome the drawbacks of traditional evaluation systems, such as the sole reliance on scores, a single evaluation subject, and the absence of practical ability assessment. It helps achieve the goal of "promoting learning, teaching, and reform through evaluation," driving student evaluation towards a scientific, fair, and efficient direction. It can mobilize students' learning initiative, build their confidence in learning, and promote the simultaneous improvement of students' comprehensive abilities, including professional skills, innovative thinking, and professional ethics. It facilitates the transformation from standardized training to personalized training, laying a solid foundation for the high-quality development of vocational education.

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