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Research on the Construction of a Value-Added Evaluation System for College Students in the Context of "Five Educations" Integration

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Abstract: Value-added evaluation is an important model that focuses on students' progress and quantifies the net effect of educational interventions. It is crucial for breaking the limitations of traditional evaluation and promoting students' all-round development. However, in its current application in the field of "Five Educations," there are problems such as fragmented evaluation dimensions and difficulties in data integration. This paper focuses on the construction of a value-added evaluation system for college students under the integration of "Five Educations." It expounds on the connotation, origin, and development of value-added evaluation, and introduces main methods and their characteristics, such as the average value-added model. It discusses the necessity and logic of integrating the "Five Educations," and puts forward multi-dimensional data collection and integration mechanisms, analytical methods, and weight determination principles. Additionally, it constructs a "baseline diagnosis - process tracking - result application" closed-loop evaluation and illustrates it with cases. This research provides theories and schemes for colleges and universities to implement the integration of "Five Educations," and holds important practical significance for advancing the reform of higher education evaluation and promoting students' all-round development.

Keywords: Five educations, Value-added evaluation, Multi-dimensional data

1. Introduction

Value-added evaluation is a developmental assessment model that takes students' initial level as the benchmark and quantifies the "net effect" of educational interventions by longitudinally tracking their progress over a certain period. Its core lies in "focusing on progress rather than starting point, and emphasizing process rather than result". It is applicable not only to academic performance but also extendable to fields of comprehensive quality such as moral education and physical education [1–4].

Value-added evaluation originated from discussions on school effectiveness in the *Coleman Report* in the United States, with the Tennessee Value-Added Assessment System (TVAAS) being a typical early practice [4,5]. Domestically, from learning international experience to conducting localized explorations, it has gradually expanded from basic education to higher education. At the policy level, the *Overall Plan for Deepening the Reform of Educational Evaluation*

in the New Era explicitly proposes to "explore value-added evaluation" [2,6].

"The simultaneous development of Five Educations" serves as a core measure for implementing the fundamental task of fostering virtue through education. It requires breaking away from a single evaluation orientation and achieving coordinated integration of evaluations to promote the all-round development of morality, intelligence, physical education, aesthetics, and labor education. Traditional evaluations have limitations such as overemphasizing intellectual education at the expense of the other four aspects and focusing on outcomes rather than processes. It is therefore necessary to address the dilemma of "exclusive focus on scores" through the integration of the "Five Educations" and advance students' all-round development [7].

How to construct a university evaluation system that fits the "Five Educations" characteristics, leverages intelligent technology, reflects longitudinal value-added, and forms a "process tracking - multi-dimensional integration - precise feedback" loop? This necessitates enriching the theoretical framework of higher education value-added evaluation and providing colleges and universities with actionable plans for the integration of the "Five Educations." This paper conducts an in-depth exploration of the construction of a value-added evaluation system for college students under the integration of the "Five Educations." Chapter 2 will elaborate on the main methods and application characteristics of value-added evaluation. Chapter 3 will focus on expounding the construction path of the value-added evaluation system under the integration of the "Five Educations," along with specific implementation approaches and integration cases. Chapter 4 will summarize the paper.

2. Main methods and application characteristics of value-added evaluation

2.1 Classification of common evaluation methods

Common value-added evaluation methods can be categorized into two major types: basic models and advanced models, each with distinct characteristics in terms of principles and applicable scenarios.

Basic models primarily include the average value-added model and the multiple linear regression model. The average value-added model quantifies progress by calculating the difference between students' pre-test and post-test scores. This model is simple to operate, easy to understand and apply, and suitable for preliminary screening scenarios. The multiple linear regression model, an optimization of the average value-added model, incorporates covariates such as students' background information. It can effectively isolate the impact of non-educational factors on evaluation results, making it more suitable for academic value-added analysis.

Advanced models encompass the Hierarchical Linear Model (HLM) and the Student Growth Percentile (SGP) model. The Hierarchical Linear Model excels in handling nested data structures (e.g., student-class-school) and accurately quantifying impacts at different levels, thus being suitable for linkage analysis of group and individual value-added within the "Five Educations." The Student Growth Percentile model evaluates value-added by measuring changes in the relative position of student groups with the same starting point during the evaluation period. This approach can effectively avoid the "ceiling effect" and is more applicable to qualitative dimensions such as aesthetic education and labor education.

2.2 Characteristics and applicable scenarios of different methods

To more clearly illustrate the differences between common value-added evaluation methods—thereby facilitating the selection of appropriate methods based on practical needs—this section summarizes the characteristics of various evaluation methods, as presented in Table 1. The summary includes core Characteristics, applicable scenarios, and limitations of each method.

Table 1: Characteristics of different evaluation methods

Evaluation Method	Core Characteristics	Applicable Scenarios	Limitations
Average Value-Added Model	Calculates the difference between pre-test and post-test scores, simple to operate and easy to understand	Preliminary screening	Ignores students' basic differences and covariates
Multiple Linear Regression Model	Incorporates covariates and separates net effects	Academic value-added analysis of intellectual education	Unable to handle nested data
Hierarchical Linear Model (HLM)	Processes nested data and quantifies impacts at different levels	Linkage analysis of group and individual value-added in five educations integration	High requirements for data volume and technology, complex operation
Student Growth Percentile (SGP) Model	Evaluates value-added through changes in the relative position of groups with the same starting point, avoiding extreme values	Qualitative dimensions such as aesthetic education and labor education	Relies on large sample data, with large errors in small groups

3. The construction path of the value-added evaluation system under the integration of "five educations"

3.1 The necessity and evaluation logic of "five educations" integration

The evaluation logic of "Five Educations" integration lies in breaking through the fragmented state of single dimensions and emphasizing the mutual penetration and synergy among the dimensions of morality, intelligence, physical education, aesthetics, and labor education. For instance, the collaborative ability embodied in labor education actually reflects both the team literacy in moral education and the problem-solving ability in intellectual education. Furthermore, the teamwork (moral education) and innovative thinking (aesthetic education) demonstrated in the process of scientific research practice (intellectual education) also need to be incorporated into a unified evaluation framework for comprehensive consideration.

From the perspective of practical needs, the traditional evaluation model has an obvious tendency of "valuing intellectual education over the other four educations," making it difficult to comprehensively measure students' overall quality. Therefore, it is urgent to guide students toward all-round development through the integrated evaluation of "Five Educations," thereby addressing the predicament of the "five onlys" (only scores, only further study, only diplomas, only papers, only titles).

3.2 Multi-dimensional data collection and integration

The effective collection of multi-dimensional data constitutes the foundation for constructing a "Five Educations"-integrated value-added evaluation system, characterized by extensive sources and diverse types.

Quantitative data can be directly retrieved from existing campus management systems. For instance, intellectual education-related data (e.g., course scores and grade point averages) and physical education metrics (e.g., physical fitness test indicators) can be conveniently extracted via campus academic affairs systems and physical education management platforms.

Qualitative data, by contrast, requires transformation through technical means. This category includes moral education data (e.g., voluntary service records and ideological and political course practice reports), aesthetic education data (e.g., the creative process of artistic works), and labor education data (e.g., internship unit appraisal opinions). Such data must be converted into quantifiable "progress levels" using technologies like text analysis and image recognition.

Process-oriented data collection is enabled by intelligent technologies. Through tools such as Learning Pass and campus all-in-one cards, dynamic data can be captured—including classroom interaction frequency (intellectual education), physical exercise duration (physical education), and club activity participation (moral education).

To realize the effective utilization of such multi-dimensional data, a robust integration mechanism must be established. By constructing a "Five Educations Data Middle Platform," various types of data from different scenarios are interconnected via a unified identity identifier, thereby resolving the issue of "data silos." Additionally, blockchain technology ensures data authenticity and traceability, providing reliable data support for the "Five Educations"-integrated value-added evaluation.

3.3 Data analysis methods and determination of weight coefficients

After acquiring multi-dimensional data, the adoption of scientific analysis methods and reasonable determination of weight coefficients are critical to the effective implementation of the "Five Educations" integrated value-added evaluation.

In terms of analysis methods, a balance must be struck between longitudinal value-added calculation and horizontal integration analysis. For longitudinal value-added calculation, Formula (1) is employed in combination with the hierarchical linear model:

$$Value\text{-}added\ amplitude = \frac{Final\ level - Initial\ benchmark}{Initial\ benchmark} \times 100\% \quad (1)$$

This approach helps isolate interference from external factors (e.g., family background, school resources) and accurately extract the "net value-added" generated by educational interventions. For horizontal integration analysis, the structural equation model (SEM) is used to explore the mutual influence between dimensions of the "Five Educations." For example, it examines the correlation between research capabilities in intellectual education and practical abilities in labor education, thereby avoiding the isolation of individual dimensions.

The determination of weight coefficients must adhere to the principle of integrating dynamic adjustment and process-based correction. The dynamic adjustment principle necessitates tailoring weights to disciplinary characteristics: basic disciplines may prioritize intellectual education (e.g., 50% weight), while art disciplines may augment the weight of aesthetic education (e.g., 40%). Initial weight coefficients are determined through the integration of the Analytic Hierarchy Process (AHP) and the expert Delphi method. Process-based correction entails analyzing historical data via machine learning algorithms (e.g., random forests) to enable automatic weight calibration. For example, if progress in moral education is identified as a significant predictor of value-added in intellectual education, the weight assigned to moral education is adjusted upward accordingly.

3.4 Implementation path of value-added evaluation under the integration of "five educations"

The implementation of value-added evaluation under the integration of "Five Educations" requires constructing a complete closed-loop evaluation process and validating it with practical cases.

The closed-loop evaluation process comprises three core links: baseline diagnosis, process tracking, and result application. Baseline diagnosis involves establishing initial benchmarks for the "Five Educations" through standardized assessments upon students' enrollment, such as subject-specific foundational tests for intellectual education and value orientation questionnaires for moral education. Process tracking leverages intelligent platforms to collect diverse data in real time and generate periodic phased value-added reports, for example: "Student A demonstrated a 15% improvement in physical fitness this semester, though innovation in aesthetic creation remained insufficient." Result application entails utilizing value-added outcomes across multiple dimensions: providing personalized guidance for students (e.g., pushing labor education practice resources to those with underdeveloped labor literacy); assisting teachers in refining instruction (e.g., adjusting course designs to strengthen "Five Educations" integration); and supporting the optimization of university talent cultivation programs.

In terms of integration cases, a university incorporated, into its evaluation of engineering majors, team

collaboration (moral education) and the aesthetic awareness reflected in experimental device design (aesthetic education)—both observed in research projects (intellectual education)—as value-added indicators. Through multi-dimensional data integration, it calculated the comprehensive value-added amplitude, offering a practical reference for implementing value-added evaluation under "Five Educations" integration. [7]

Conclusions

This paper explores the construction of a value-added evaluation system for college students under the integration of "Five Educations." It clarifies the connotation of value-added evaluation and the requirements of "simultaneous development of Five Educations," introduces common evaluation methods and their applicable scenarios, and focuses on expounding the system construction path—including integration logic, data collection and integration, analytical methods, weight determination, and evaluation closed-loop. The research provides theoretical and practical support for colleges and universities to implement "Five Educations" integration. Future work should focus on three aspects: optimizing multi-dimensional data fusion algorithms to enhance integration efficiency; strengthening pilot projects across different colleges and universities to refine school-specific schemes; and deepening the application of evaluation results to form a more robust "evaluation-improvement" closed-loop.

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