Pathways for Big Data-based Process-based Evaluation of Computer Application Courses in Higher Education

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Abstract: The traditional evaluation models of Computer Application courses in universities mainly adopt the summative assessment method. They suffer from prominent problems such as monolithic evaluation dimensions, absence of process, and delayed feedback. This makes them fail to adapt to real demands of application-oriented talent cultivation in the digital era. Leveraging big data technology to conduct process-based evaluation provide effective solutions for the aforementioned issues. Big data technology can achieve data collection, analysis, and application throughout the whole learning process of students. This study focuses on the practical dilemmas in current evaluation practice, and constructs scientific and three-dimensional implementation pathways for process-based evaluation and corresponding optimization and safeguard mechanisms. The aim is to improve the evaluation systems of Computer Application courses, advance the shift of teaching evaluation from "consequentialism" toward "processualism", and provide theoretical reference for the digital teaching reform in higher education.

Keywords: Big Data; University Teaching; Computer Application Course; Process-based Evaluation; Teaching Reform

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1.Introduction

In the context of digital education transformation, the Computer Application courses in higher education are not only core general education courses but also professional foundation courses, and undertake important tasks of cultivating students' digital literacy, practical operational skills, and innovative thinking. As a crucial part of teaching activities, teaching evaluation directly influences the teaching orientation and the quality of talent cultivation. Big data technology has the advantages such as total-sample collection, dynamic analysis, and precise judgment. It can break through temporal-spatial limitations of traditional evaluation models, dismantle data silos, and achieve the whole-process tracking and multi-dimensional analysis of students' learning behavior. Based on this, this paper integrates the characteristics of the Computer Application courses in operability, renewal, applicability and other aspects to explore the improvement pathways for process-based evaluation empowered by big data in order to address the structural problems in the traditional evaluation systems.

2.The Core Essence of the Big Data-enabled Process-based Evaluation of Computer Application Courses in Higher Education

2.1 *The Core Essence of Process-based Evaluation*

Process-based evaluation differs from summative evaluation. Its essence lies in anchoring in the whole teaching process to conduct continuous, dynamic and diversified evaluation and analysis of students' learning status, learning progress and learning outcomes on the basis of student learning rather than merely make judgment based on the final learning results. Compared with the traditional evaluation models that focus on the summative assessment results and neglect the evaluation logic of the learning process, process-based evaluation pays more attention to implicit learning factors such as learning attitude, thinking changes, capability development, and growth trajectories and emphasizes the diagnostic, incentive, and guiding role of evaluations. Computer Application courses in higher education cover various teaching content such as theoretical cognition, software operations, programming, and comprehensive practical training. The practical operational skills, logical thinking ability, and problem-solving ability of students cannot be fully demonstrated through a final exam [1]. Process-based evaluation relies on the whole-process evaluation to conduct systematic observation of each stage (pre-class, in-class, and post-class). It can

accurately identify students' strengths and weaknesses in the process of knowledge acquisition, skill improvement, and thinking development.

2.2 *The Adaptation Logic of Big Data and Process-based Evaluation*

Big data technology features massive collection, real-time processing, deep mining and precise analysis. It is highly compatible with the implementation requirements of the process-based evaluation of Computer Application courses. It provides key technical support for the innovation of evaluation methods. The teaching of Computer Application courses is carried out based on digital teaching platforms. Students' online learning time, resource browsing history, classroom interaction, completion rate of practical operation tasks, exercise completion status, and after-class extended learning behavior can all be converted into structured data, thereby forming a relatively complete learning dataset. The traditional manual evaluation methods struggle to comprehensively collect and accurately analyze a large amount of fragmented learning data. They often rely on teachers' experience for vague judgment, resulting in deficient objectivity and comprehensiveness of evaluations [2]. By leveraging big data technology, it is possible to conduct automated acquisition, standardized processing and in-depth mining of multi-source learning data, reduce the deviation brought about by subjective evaluations, relatively accurately extract students' learning laws, knowledge deficiency and capability gap, shift the process-based evaluation from qualitative and subjective judgment to quantitative and precise analysis, promote evaluations to develop toward a scientific, refined and intelligent direction, and provide data support for personalized teaching intervention and differentiated cultivation.

3.Practical Dilemmas in the Traditional Evaluation Systems of Computer Application Courses in Higher Education

3.1 *Monolithic and Rigid Evaluation Dimensions*

Current evaluation of Computer Application courses in higher education still mostly adopts the traditional assessment methods, focusing mainly on the final written tests, computer-based unified exams, courses' practical training reports, and other summative outcomes. The evaluation dimensions are relatively monolithic, struggling to comprehensively reflect students' learning process and comprehensive capabilities. The course evaluation overly emphasizes the memorization of theoretical knowledge and the repetitive training of fixed operational procedures, and pays less attention to students' core competencies such as autonomous learning ability, innovative practical ability, problem-solving ability, and teamwork ability. The core educational objectives of the Computer Application courses are to enhance students' digital application skills and practical operation innovation capabilities. The implicit indicators, such as students' operational proficiency, thinking flexibility, and initiative in independent exploration, are important criteria for evaluating teaching quality. However, it is difficult for the traditional evaluation systems to conduct effective quantitative assessment on them.

3.2 *Fragmented Evaluation Process*

The traditional course evaluation lacks a complete whole-process closed loop. The evaluation behavior exhibits fragmented and phased characteristics, which makes it difficult to establish a continuous learning and growth monitoring mechanism. In most teaching scenarios, teachers only conduct evaluations at fixed nodes such as random classroom questioning, periodic assignments, and final exams, but lack effective monitoring and judgment during the learning process in between. As a result, they cannot record the dynamic learning trajectories of students integrally. There is a seamless transition between knowledge points in the Computer Application courses. Operational skills require continuous training. Learning problems often occur in daily scattered stages of learning. Fragmented evaluation methods are challenging to promptly identify students' learning difficulties at different stages. Fragmented evaluations struggle to reveal the development laws of students, fail to accurately distinguish the differences in students' basic knowledge, learning attitude, and learning advancement extent, hinder the implementation of precision-tailored education and weaken the diagnostic function and teaching improvement

efficacy of evaluations.

3.3 *Lagging Evaluative Feedback Mechanisms*

Evaluative feedback plays a crucial role in promoting the optimization of teaching and the growth of students. However, in traditional evaluation of Computer Application courses, there are common problems such as delayed feedback, general feedback, and deficiency in feedback. The summative assessment results are usually announced concentratedly at the end of courses. By this time, teaching activities have largely been finished. It is difficult for students to make up for their deficiencies based on the evaluation results and for teachers to adjust the teaching content and pace to address common problems in their classes too. The evaluation merely serves the functions of assessment and identification, but fails to give full play to the role of diagnosis, improvement and enhancement [3]. Concurrently, the traditional evaluative feedback mostly adopts a uniform result announcement model, merely presents general information such as scores and grades, and lacks concrete analysis of students' individual gapes of knowledge, practical operational deficiencies, and learning misconceptions, resulting in feedback with deficient targeted relevance and guidance.

4.Implementation Pathways for the Big Data-enabled Process-based Evaluation of Computer Application Courses in Higher Education

4.1 *Establishing an All-dimensional Data Collection System*

Establishing an all-dimensional, standardized and dynamic learning data collection system based on big data technology is the fundamental condition for the effective implementation of process-based evaluation. It can conduct systematic collection of various learning data in the whole teaching process of Computer Application courses. Collected data covers three main parts: pre-class preparation data, in-class learning data, and post-class extension data. This achieves the whole-process tracking of learning behavior. Before class, the system mainly collects data on students' browsing history of course resources, completion rate of pre-class tasks, answers to pre-class exercises, autonomous questioning and interaction in order to understand students' knowledge preparation status and pre-class preparation effects. In class, it mainly collects data on classroom attendance, real-time classroom interaction, completion of in-class exercises, completion of practical training, group discussions, and completion of classroom tasks to record students' classroom learning performance and immediate learning outcomes. After class, it mainly collects data on homework, practical operation projects, extended learning, review of errors, consultation of answers, and periodic tests to comprehensively cover students' learning trajectories of after-class consolidation and enhancement. By establishing unified data collection standards, it can collect and integrate structured and semi-structured learning data, eliminate redundant and invalid information, provide complete, accurate and effective data foundations for subsequent analysis and evaluation to form data foundations for process-based evaluation.

4.2 *Establishing a Tiered Evaluation Indicator System*

Higher education institutions should integrate the knowledge structure, skill requirements and educational objectives of Computer Application courses and leverage the multi-dimensional learning data collected to establish a tiered and classified, scientific and diversified process-based evaluation indicator system and break the traditional one-dimensional evaluation methods. The indicator system is divided into three tiers: foundational literacy, operational capabilities, and innovative development. The three tiers progress step by step and comprehensively cover different aspects of students' academic growth. The foundational literacy tier focuses on examining learning attitude and basic cognition, including learning engagement, task completion rate, knowledge mastery, compliance with learning specifications, and other indicators. It is mainly used to assess students' accumulation of basic knowledge and daily learning status [4]. The operational capability tier takes the core skills requirements of courses as the starting point to set indicators around software operations, programming, problem diagnosis, project practice, and task completion quality in order to accurately measure students' professional skills and problem-solving ability. The innovative development tier focuses on the cultivation of advanced capabilities, covering indicators such as

independent exploration, extended creation, scheme optimization, innovative design, and cooperation & exchange. It mainly examines students' innovative thinking and comprehensive application capabilities. All the above indicators are quantitated based on big data. They not only focus on basic norms but also attach importance to development and innovation. And they can conduct comprehensive and three-dimensional evaluation of students' growth process.

4.3 *Establishing a Dynamic Evaluative Feedback Mechanism*

Higher education institutions should establish a dynamic, precise and closed-loop evaluative feedback system based on real-time analysis technology of big data to achieve rapid generation, accurate transmission and effective application of evaluation results. Big data analysis models are leveraged to process daily, weekly and phased learning data, and generate students' individual learning status reports and classes' holistic teaching situation analysis reports so as to enable the normalized operation of process-based evaluation. For individual students, the system precisely feeds personalized learning feedback, clearly marks phased knowledge deficiency, practical operation shortcomings and Learning misconceptions, and simultaneously pushes relevant exercise resources, practical operation cases and learning guidance plans to guide students to independently identify and fill gaps, and improve their learning methods. For teachers, the system automatically summarizes the common problems in class teaching, students' mastery of key and difficult points, as well as the tiered differences students to provide data support for teachers to adjust the teaching pace, improve teaching methods, and design stratified teaching schemes. The real-time dynamic feedback mechanism can help solve the problem of delayed feedback of traditional evaluation effectively, and form a complete teaching cycle of "data collection → intelligent evaluation → precise feedback → teaching improvement → capability enhancement" to enable process-based evaluation to continuously optimize both teaching and learning.

5.Safeguard Strategies for the Big Data-enabled Process-based Evaluation of Computer Application Courses in Higher Education

5.1 *Improving the Digital Teaching Support Environment*

Stable digital teaching environment is the hardware foundation for the effective implementation of big data-enabled process-based evaluation. This requires that higher education institutions must comprehensively promote the upgrading of teaching platforms and the construction of digital resources. Higher education institutions should enhance the functions of the integrated smart teaching platforms, improve the modules for data collection, storage, analysis, and feedback, and dismantle data silos among pre-class preparation, classroom teaching, post-class practice, and evaluation to achieve the interconnection & intercommunication and centralized management of varying learning data. In addition, they should integrate the operational characteristics of Computer Application courses, and optimize the practical training equipment and the digital practical operating systems in computer rooms to ensure that the data on students' online and offline learning behavior can be fully collected and accurately stored. Concurrently, they should establish a standardized course resource library to integrate various types of resources such as micro-lesson videos, practical operation tutorials, exercise banks, project cases, and extended materials and provide sufficient resource support for the normalized implementation of process-based evaluation.

5.2 *Enhancing Teachers' Digital Evaluation Capabilities*

Teachers are the direct executors of process-based evaluation. Their digital literacy and data application capabilities directly affect the implementation effect of evaluations. Therefore, special capability training and teaching empowerment should be carried out for them on a regular basis. Higher education institutions should establish a systematic faculty training system, and conduct special training on the big data-based teaching philosophy, the operations of intelligent teaching platforms, learning data analysis methods, the design of process-based evaluation indicators, the improvement of personalized teaching, etc. to help teachers update their traditional evaluation views and develop the data-driven teaching evaluation mindset [5]. In addition, they should establish teaching exchange platforms for teachers, and organize process-based evaluation teaching seminars, case sharing and experience exchange meeting to explore data-driven evaluation implementation plans suitable for different learning

situations and different teaching stages. Concurrently, they should guide teachers to actively use the analysis results to diagnose teaching problems, optimize teaching designs, and implement stratified teaching so as to enable big data evaluation technology to deeply integrate with daily teaching, and comprehensively enhance teachers' ability to conduct precision teaching and scientific evaluation based on data.

5.3 *Refining the Evaluation Management Standard Systems*

To guarantee the standardization, objectivity and fairness of big data-enabled process-based evaluation, it is necessary to establish and improve management systems and operational norms to prevent problems such as data abuse, inaccurate evaluation and disorderly management. Higher education institutions should make detailed rules for big data-driven teaching evaluation and management to clearly define the scope of data collection, usage specifications and confidentiality requirements so as to strictly protect students' personal learning data information and prevent data leakage and improper use. Concurrently, they should standardize the implementation process, score standards and data verification mechanisms of process-based evaluation, and establish a dual verification system integrating manual review and intelligent evaluation to prevent data deviation and algorithm flaws and ensure the objectivity and fairness of evaluation results. In addition, they should establish a normalized evaluation supervision mechanism to comprehensively supervise the implementation of process-based evaluation, data quality, feedback effects, and the effectiveness of teaching improvement in order to promptly identify and correct problems in the execution process, and continuously optimize the evaluation systems and operation procedures and ensure the long-term stable operation of the big data-enabled process-based evaluation model.

6.Conclusion

The reform of teaching evaluation serves as an important lever for the digital transformation of Computer Application courses in higher education. The innovative implementation of process-based evaluation is the key path to make up for the deficiencies of traditional teaching evaluation and improve the quality of application-oriented talent cultivation. Big data technology provides new idea and technical support for the reform of course evaluation, and advances the shift of teaching evaluation from outcome judgment toward process empowerment, from subjective and ambiguous to precise and quantitative, and from one-dimensional to diversified and stereoscopic. In the future, higher education institutions should continuously deepen the data-driven teaching evaluation reform, continuously improve evaluation models and implementation mechanisms, and promote the improvement of teaching quality and educational effectiveness of Computer Application courses to provide strong support for the cultivation of digital application-oriented talents in higher education in the new era.

References:

[1] *Hao Zhang,Li Sun.(2025)Reform and Practice of Application-oriented Computer Talent Cultivation in Local Universities[J].Journal of Jilin Agricultural Science and Technology University,34(4),30-33.*

[2] *Xiangdong Qin,Jing Wang,Danfeng Xiao,et al.(2025)Application of Situational Teaching Method in Computer Courses of Universities[J].Intelligence,21,77-80.*

[3] *Weiling Li.(2025)Computer Talent Cultivation Methods in Local Universities in the Era of Large Language Models[J].China Computer&Communication,37(11),233-235.*

[4] *Bo Zhang,Dazhou Li.(2024)Construction of Big Data Practice Course Materials for Computer Programs in Local Universities Oriented towards First-Class Disciplines[J].Computer Knowledge and Technology,20(33),149-151.*

[5] *Kenan Zhai,Shuyue Wu,Kai Zhang.(2024)Strategies for High-Quality Employment of Graduates from Computer Programs in Higher Education from the Perspective of Full-time Teachers[J].Western China Quality Education,10(21),107-110+189.*