Research on the Teaching Reflection Model for Finance and Accounting Teachers Based on Learning Analytics

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Abstract: This study concentrates on the practical requirements of teaching reform for the accounting major in the context of educational digital transformation. It addresses the static and homogeneous issues of traditional experiential teaching reflections by exploring an innovative approach to a learning analysis technology-driven teaching reflection model. Through the integration of classroom behavior data, learning process data, academic performance data, and industry dynamic data using learning analysis techniques, a dual-cycle reflection model of "data iterative optimization— cognitive level transition" is established. Furthermore, a comprehensive implementation framework that encompasses data collection, visual diagnosis, and teaching decision transformation is proposed. Additionally, to ensure the effective implementation of data-driven teaching reflection, implementation strategies must be constructed from three perspectives: coordination mechanism, technical toolchain, and guarantee mechanism, considering the professionalism of accounting disciplines and the practicality of teachers' operations. This study broadens the theoretical boundary between learning analysis and teaching reflection and assists accounting education in meeting the needs of the industry's intelligent transformation at a practical level, offering a methodological reference for the cultivation of versatile accounting professionals.

Keywords: Learning Analytics; Teaching Reflection; Data Drive; Critical Reflection

1. Introduction

As an important means to promote teachers' professional development and improve teaching quality, teaching reflection has always been highly concerned by the education community. However, teaching reflection is not without challenges. Relying on experience, reflecting on experience and returning to experience are the concentrated embodiment of traditional teachers' teaching reflection experience review, but not all experience can give people reasonable guidance[1]. In addition, different disciplines will also lead to some differences in the mode of teaching reflection, mainly because the content, characteristics and teaching methods of each discipline are different. Therefore, the teaching reflection of each subject should be carried out according to the characteristics of the subject itself and the special needs of students, so as to maximize the teaching effect. Under the wave of digital transformation of education, accounting disciplines are facing practical challenges such as the high-frequency updating of accounting standards and the compounding of practical skills. However, the traditional teaching reflection model is difficult to accurately respond to the needs of industry change due to its dependence on subjective experience and lack of dynamic data support. Therefore, it is very necessary to construct a teaching reflection model for finance and accounting teachers.

2. Literature Review

The concept of teaching reflection was originally proposed by educator John Dewey. He believed that reflection involves an in-depth, sustained, and careful consideration of any belief or hypothetical knowledge[2]. Subsequently, Donald Schon, an American scholar, introduced the concept of reflective thinking into the field of vocational education and training. He posited that reflection is the process through which teachers engage in continuous learning and growth within their professional practice, resulting from the interplay between theory and practice, offering valuable insights for teachers' professional

development[3]. Chinese scholars also recognize the significance of teaching reflection and have conducted research in conjunction with China's educational practices. From a psychological perspective, researchers propose the teacher growth model of "excellent teacher= teaching process+ reflectio". Ye emphasizes that systematic and regular teacher reflection is fundamental to promoting teachers' professional self-development[4]. Li and Zhang introduced the three realms of teachers' reflection: the professional realm, which fosters career development; the career realm, which expands practical space; and the ambition realm, which encourages self-liberation. These realms are considered the pathways for teachers' development[5].

Although the importance of teaching reflection has been widely recognized, teachers still face many practical difficulties in practical teaching.

On the one hand, teachers' reflections often lack depth, critical analysis, systematic approach, and creativity[1,6]. This kind of experience retrospective reflection method is easy to lead to the error of "paying attention to one thing and losing the other" and "avoiding the important and taking the light", and can not fundamentally improve the teaching[7]. On the other hand, teaching reflection needs to spend a lot of time and energy, and teachers are often difficult to continue because of their busy work. In addition, the lack of effective teaching reflection tools and methods is also an important factor restricting the improvement of teaching reflection ability[8].

Considering the practical challenges of teaching reflection, the application of data-driven and artificial intelligence technologies offers new insights and avenues for enhancing this process. The data-driven teaching reflection model conceptualizes reflection as an ascending spiral that begins with teaching practice, progresses through "identifying problems→ discussing and analyzing→ solving problems", and ultimately circles back to teaching practice. Building on this concept, Lin et al. proposed a data-driven teacher reflection model. This model typically encompasses four stages: data-driven classroom teaching practice, data-driven identification of reflection problems, data-driven attribution analysis of problems, and data-driven design of improvement programs[1]. As a "new tool" for teachers' reflective practice, artificial intelligence technology can aggregate, analyze, mine, and present various educational data, enabling intelligent classroom diagnosis. It assists teachers in accurately pinpointing issues, analyzing them, and devising improvement strategies, thereby effectively enhancing teachers' reflective abilities and the quality of teaching[9].

Learning analytics is a hot topic in the field of educational technology research in recent years. Since 2011, the research hotspots in the field of learning analysis in China mainly include "learning analysis", "big data", "data mining", "online learning", "learning behavior", "artificial intelligence", "learning engagement", "collaborative learning", "visualization", "online courses", "machine learning", "learning environment", "intelligent education", "learners", which are reflected in the field of learning analysis. Based on the exploration of big data, data mining, artificial intelligence and machine learning algorithms, domestic scholars mainly measure and collect various learning behavior data of learners in online courses, analyze the learning engagement and collaborative learning of learners in online learning, output the results in a visual way, study the construction and optimization of intelligent learning environment, and promote intelligent education[10]. Artificial intelligence-based learning analytics technology plays a crucial role in achieving precise teaching and enhancing the quality of education[10]. For instance, Zhou and Ye assert that the integration of learning analytics with artificial intelligence holds significant potential for advancing computational pedagogy, fostering data-driven thinking, establishing a lifelong learning service system, and elevating the standard of educational governance[11].

Therefore, this study focuses on the innovation of teaching reflection mode empowered by learning analytics technology, which not only promotes the transformation of teachers from experience judgment to evidence decision-making, but also provides a theoretical reference for the innovation of accounting talent training mode in the digital era.

3. The Construction of Teaching Reflection Model of Finance and Accounting Teachers Based on Learning Analytics

3.1 The Design Logic of the Teaching Reflection Model

The teaching reflection model for finance and accounting teachers developed in this study centers on the "double circulation drive" as its core logic. It closely integrates the dynamic, practical, and ethical attributes of the accounting discipline, achieving the dynamic evolution of teaching reflection via the synergistic effect of iterative data optimization and cognitive level transitions.

The first cycle is the data iterative optimization cycle. The cycle is supported by learning analysis technology, forming a closed-loop process of “data acquisition→ analysis and diagnosis→ teaching improvement→ new data generation”. Teachers need to integrate multi-source data of accounting courses, covering students' cognition, behavior, emotion and other dimensions, and then use descriptive analysis and predictive model to locate teaching pain points. The teacher adjusts the teaching strategy according to the diagnosis result, and the improved teaching behavior generates a new data flow and enters the next round of cycle to verify the effect.

The second cycle is the cognitive cycle of deep reflection. On the basis of data iteration, it promotes the transition of teachers from “technical reflection” to “critical reflection”. Technical reflection to solve surface problems is mainly reflected in the revision of teaching methods, such as optimizing questioning strategies through classroom activity data. Critical reflection is combined with industry trends (such as intelligent finance) to re-examine whether the curriculum objectives match the needs of professional competence, such as the need to add “financial robot application” teaching content.

The data cycle provides evidence support for the cognitive cycle, and the cognitive cycle guides the focus of data collection. The two form a spiraling synergy mechanism. In addition, the design of this model also needs to deeply couple the characteristics of the accounting discipline, and ensure that the reflection process not only responds to the technical logic of the digital transformation of education, but also takes root in the real demands of the accounting professional scene through the professional modules such as the real-time synchronization of the criterion update library, the mapping matrix of practical ability and the evaluation of ethical sensitivity, and finally realizes the spiral rise of teaching behavior improvement and educational concept innovation.

3.2 The Core Element Framework of the Teaching Reflection Model

The teaching reflection mode of accounting teachers based on learning analysis is composed of three core elements: data layer, analysis layer and reflection layer. The three layers are progressive and dynamic interaction, forming a complete chain from data collection to teaching decision-making.

3.2.1 Data layer: integration and governance of multi-source heterogeneous data

The data layer is the underlying support of teaching reflection. It is necessary to solve the two major problems of “what data to collect” and “how to standardize management data”, and it is also necessary to closely meet the practical needs of accounting teaching.

The model constructs the exclusive evidence chain base of accounting teaching by integrating multi-source heterogeneous data. Classroom behavior data rely on smart classroom systems and interactive tools (such as barrages and voting) to capture students' feedback on the interpretation of the guidelines in real time (such as the frequency of questions on the new revenue recognition rules) and case discussion participation. The learning process data is extracted from the online platform and the virtual simulation training system (such as yongyou U8), and the operation trajectory of the practical module is tracked (such as the length of financial statement preparation and the wrong steps of the tax declaration process), and the connection between theoretical teaching and practical training is accurately mapped. The academic performance data integrates the operating system and competition results, and quantifies the application ability of criteria and the level of professional judgment. The industry dynamic data captures the policy database of the Ministry of Finance, the financial statements of listed companies and the cases of accounting firms through crawlers, and

anchors the update of standards and industry hotspots in real time to form a practical reference system for teaching reflection. All the above data are standardized through standardized coding and hierarchical authority management (such as group analysis data opening, individual data anonymization) to achieve standardized governance. At the same time, desensitization technology is used to process sensitive information (such as the blurring of real financial report data of enterprises), and a data resource pool with professionalism, timeliness and ethical compliance is constructed.

3.2.2 Analysis layer: accurate diagnosis of pain points in accounting teaching

The analysis layer transforms the original data into an operable reflection basis through multi-dimensional data analysis technology. The core tasks are "identifying problems" and "attribution analysis".

The model helps locate students' knowledge blind spots through student participation analysis and cognitive load identification. First, social network analysis constructs a classroom discussion relationship map to identify "marginalized students". Secondly, through eye tracking or click stream data analysis, students understand difficulties (such as abnormal length of stay on the courseware page of "Recognition and Measurement of Financial Instruments"). Thirdly, association rule mining finds the weak links of knowledge point relevance. In addition, according to the characteristics of the subject, the model also needs to compare the keyword matching degree between the teaching content and the latest criterion database, generate the "criterion lag early warning report", and construct the "theoretical knowledge point-practical ability" mapping matrix, and calculate the deviation index through the training system data, so as to provide teachers with accurate reflection basis rooted in the accounting professional scene.

3.2.3 Reflection layer: the transformation from data insight to teaching decision-making

The reflection layer is the value realization link of the model. It is necessary to transform the analysis results into specific teaching improvement strategies and promote the upgrading of teachers' reflection level.

Reflection dimensions and strategies. According to the results of dynamic data analysis of the industry, adjust the course objectives, such as adding the "financial robot process automation (RPA)" teaching module to respond to the needs of intelligent financial transformation. Based on the data of classroom behavior, the teaching process is reconstructed. For example, in view of the high cognitive load knowledge point of "cost calculation", the mixed teaching of "step-by-step animation demonstration + virtual simulation training" is adopted. Combined with the analysis of learning participation, this paper designs immersive ideological and political scenes, such as text sentiment analysis of financial fraud cases of listed companies, to guide students to discuss the "gray zone" dilemma of accounting professional ethics.

Reflect on hierarchical progression. The process of reflection is characterized by step-by-step deepening. From technical reflection to critical reflection, it promotes teachers to leap from surface strategy adjustment to deep education concept innovation, and finally forms a closed loop of "data diagnosis→ action optimization→ effect tracking", so as to realize the deep fit between accounting teaching and professional ability demand.

4. The Implementation Path of Finance and Accounting Teachers' Teaching Reflection Based on Learning Analysis

4.1 Data-Driven Reflection Process

The data-driven reflection process is the core link of the implementation path. Supported by learning analysis technology, through the closed-loop chain of "multi-source data acquisition→ visual diagnosis→ reflection decision generation", the accurate transformation from data to teaching improvement is realized.

4.1.1 Data acquisition phase

In the data collection stage, as mentioned above, accounting teachers need to build a multi-source data ecology covering the whole scene of teaching, including classroom behavior data, learning process data, academic performance data and industry dynamic data. All data are standardized and desensitized to construct a base of reflective evidence chain with professionalism, timeliness and ethical compliance.

4.1.2 Visual diagnosis stage

In the visual diagnosis stage, accounting

teachers transform heterogeneous data into actionable teaching insights through multi-dimensional analysis tools. Based on the knowledge graph technology, the subject knowledge association network is constructed to intuitively present the students' cognitive breakpoints (such as the logical weak connection between "long-term equity investment" and "consolidated statements"). Using cluster analysis to identify abnormal learning paths, for example, it is detected that some students stay too short in the "tax planning" module but the correct rate is falsely high, suggesting shallow learning risks. Combined with Tableau and other tools to generate a dynamic dashboard, the heat map is used to present the class ability distribution (such as the "financial instrument measurement" knowledge point mastery gradient), and the criterion synchronization rate early warning system (based on the text similarity algorithm) automatically compares the courseware content with the latest criterion library of the Ministry of Finance to mark the lagging content. At the same time, a "theory-practice" two-dimensional matrix is constructed to quantify the teaching disconnection points (such as students are familiar with the internal control theory but unable to design and simulate the risk control process of the enterprise), and finally a visual diagnosis report including group feature portrait, criterion timeliness evaluation and ability fault location is formed, which provides teachers with a reflection basis with both subject depth and technical interpretability.

4.1.3 Reflect on the decision-making generation stage

In the stage of reflective decision-making, accounting teachers transform data insights into targeted teaching improvement strategies based on visual diagnostic reports. According to the criterion lag warning, the teaching content is dynamically updated, and the immersive professional ethics discussion scene is designed to strengthen the ideological and political integration. To implement hierarchical intervention for students' ability faults, strengthen entry training for "accounting" groups, and add financial robot simulation tasks for "analytical" groups. To reconstruct the teaching evaluation system, improve the performance of virtual simulation training, and simultaneously establish an "improvement-tracking" closed-loop mechanism. For example, after adjusting the income recognition teaching strategy, the follow-up classroom interaction data and the correct rate of homework are continuously monitored to ensure that the reflective decision-making not only accurately responds to the frontier dynamics of the discipline, but also deeply meets the needs of vocational ability training, forming a data-driven teaching optimization closed-loop.

4.2 Key Implementation Strategies

In order to ensure the effective implementation of data-driven teaching reflection, it is necessary to construct implementation strategies from three aspects: coordination mechanism, technical tool chain and guarantee system, taking into account the professionalism of accounting disciplines and the operability of teachers' practice.

4.2.1 Collaborative reflection mechanism

In the collaborative reflection mechanism, accounting teachers realize the deepening of teaching reflection through the linkage mode of "individual accurate diagnosis and collective wisdom co-creation". Based on the learning analysis platform, individual teachers focus on class-specific problems and formulate targeted intervention programs. At the same time, the teaching and research group gathers multi-class data to identify common pain points and jointly develops standardized resource packages. The data sharing mechanism breaks the information island, and the anonymized academic data supports cross-teacher horizontal comparison and drives experience transfer. In addition, industry experts are introduced to participate in the target calibration, and lightweight tools are customized by the technical team to form a three-dimensional reflection ecology of "individual reflection and anchoring problems, collective cooperation to overcome difficulties, and industry linkage and forward-looking layout", so as to ensure that teaching improvement not only accurately responds to the differences in learning conditions, but also closely connects with the frontier needs of the accounting profession.

4.2.2 Construction of a technical tool chain

In the construction of technical tool chain, accounting teaching reflection realizes the organic balance between low threshold and

high adaptation through “lightweight design and scene embedding”. Based on the preset template library and drag-and-drop visualization tools, teachers can complete professional analysis without complex programming. The technical adaptation of the deep coupling subject scene is reflected in the embedding of data burial points in the virtual simulation training system, tracking the operation trajectory of students and generating the growth curve of practical ability, as well as the real-time feedback tool of the mobile terminal to realize the data penetration of the whole process of teaching ecology. It not only reduces the threshold of use through standardized templates, but also ensures that the tool accurately responds to the specific criteria timeliness, practical complexity and ethical sensitivity requirements of accounting teaching with the help of industry customization design.

4.2.3 Guarantee mechanism design

In the design of the guarantee mechanism, the teaching reflection of accounting teachers realizes sustainable development through “step-by-step ability training and ethical constraints”. Colleges and universities empower teachers' data literacy through a hierarchical training system. Basic workshops teach teachers Excel data perspective and Tableau dashboard construction skills. High-level seminars focus on deep applications such as social network analysis to optimize grouping strategies and logistic regression to predict the teaching effects of new guidelines. The construction of ethical framework runs through the whole process, ensuring that the application of technology not only responds to the dynamic update of standards and the cultivation of practical ability, but also abides by the bottom line of educational equity and privacy protection, forming a guarantee ecology of “ability upgrading to support practical innovation and ethical compliance to escort healthy development”.

5. Summarized and Prospected

This study constructs a data-driven dual-circulation framework for accounting teachers' teaching reflection, and embeds discipline elements such as dynamic tracking of criteria, mapping of practical ability and evaluation of ethical sensitivity, forming a reflection path with both theoretical innovation and practical operability. However, in promoting the practice of teaching reflection, it is necessary to face multiple challenges, such as data privacy and ethical risks, the risk of disconnection between industry dynamic tracking and teaching landing. Future research can further explore the potential of generative artificial intelligence to enable deep reflection, promote the construction of evaluation index system of teachers' reflective ability from an interdisciplinary perspective, and formulate risk response strategies to provide continuous evolutionary methodological support for the cultivation of compound accounting talents in the era of digital economy.

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