Research on the Teaching Effect Evaluation of Audit Experiment Course from the Perspective of "Research-Based Audit"

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Abstract: The development of research-based audit is the only way to achieve the high-quality development of audit career. Talents are the key to the development of research-based audit. In the exploration of the cultivation of research-oriented audit talents, Chinese scholars have done extensive research from various aspects. However, for the audit experiment course, how to help the training of "research-oriented audit" talents, the existing research is less involved. In order to respond to the call of the auditor General and the demand of the society for audit talents, the cultivation of "research-oriented audit" talents is implemented into the course construction. This paper attempts to apply fuzzy comprehensive evaluation technology to construct an observable evaluation index system for the teaching effect of experimental courses, which will expand and deepen the research on the cultivation of research-oriented audit talents. In practice, it may have reference value for the formulation of teaching effect evaluation scheme of experimental course.

Keywords: Research-Based Auditing; Auditing Laboratory Course; Evaluation of Teaching Effectiveness; Fuzzy Comprehensive Evaluation

1. Introduction

The high-quality development of audit work is indispensable in the new era, and research-based audit is the key way to achieve this goal. The development of the research of audit, talent is the key. Therefore, the training of research-oriented audit talents is particularly important. Research the audit talents training should be mainly based on the "study skills" and "audit professional knowledge" two aspects. In the research of audit, "research" is the spiritual kernel. "Research" requirement to have a problem oriented consciousness, and has the capability of information retrieval and analysis, aimed at the problems the corresponding effective conclusions. Therefore, the cultivation of research ability focus on "information gathering analysis" and "problem oriented consciousness". Nanjing Audit University, as the cradle of audit talents, should cultivate students' "research-oriented audit" thinking, including the application of "research-oriented audit" tools and the display of "research-oriented audit" results.

In experiment teaching, the teaching effect evaluation research audit can be done from multiple perspectives, multi-level, combining students' learning performance, and student feedback as well as the ascension of the levels of knowledge and ability, comprehensive evaluation of teaching effect, providing a reference for further improving the teaching quality. Some common guidelines include multidimensional evaluation, feedback, continuous improvement, student participation, fair and objective. In this paper, the training of research-based audit talents is implemented into the course construction, and the fuzzy comprehensive evaluation technology is used to construct an observable evaluation index system for the teaching effect of experimental course, which is used to evaluate the teaching effect of audit experimental course from the perspective of "researchbased audit", which has practical guiding significance.

2. Literature Review

2.1 Research-Based Auditor

Vasarhelyi (2010) suggests that companies are making rapid progress in digitisation of accounting and accordingly digitisation of auditing has become a research perspective. With the popularity of digital technology in auditing, the complexity of the work is climbing. Qi Zhendong and Zhang Zixuan

(2022) emphasised that conducting auditing work requires the use of research-based auditing thinking and methodology, which calls for audit professionals with higher education levels. Zheng Shiqiao and Liu Xingrui (2022) argued that the smooth operation of research-based auditing cannot be achieved without the corresponding technical competence of audit talents. Wang Fan et al. (2021) based on the vision of macro-analysis and data analysis, combined with the behavioural willingness to elaborate on the professional competence of research-oriented audit talents. Zhang Peng et al. (2022) believe that with the continuous iterative evolution of digital technology and the deep development of digital intelligence application, the digital technology application ability of research audit talents in colleges and universities should be improved.

2.2 Required Technology for Research-Oriented Audit Talents

For research-oriented audit talents, the required technology is issued as two categories of hard technology and soft technology. At the level of hard technology, Niu Yanfang et al. (2021) believe that audit talents should be able to give full play to the advantages of data integration, master the corresponding data analysis technology and the corresponding analysis methods and tools. As for the soft technology, Yan Weilong and Zhuang Shangwen (2022) emphasised that research-oriented auditing talents should be able to focus on summarising and grasping the essence and other aspects. Qiao Pengcheng et al. (2022) argued that in the context of financial digitisation, research audit talents should have higher soft skills, i.e., the qualities formed in the process of university education, which is conducive to adapt to the changes in the audit of the basic data environment.

Research-based auditing is based on 'research', which should be carried out throughout the whole process of auditing, and be able to expand from specific projects to the industry level, and finally to the national policy level, so as to realise the transformation from details to the whole. This point-to-point approach helps to promote the progress of the industry and the national governance system, and enhance the depth and effectiveness of the audit work.

2.3 Teaching Effect Evaluation Index System

The methods of teaching effect evaluation include fuzzy comprehensive evaluation methods, assessment methods based on automatic clustering and integrated learning strategies, neural networks and multi-level Rasch models (Wen Mengfei et al., 2018; Liu Peng et al., 2020). According to Liu Guocheng et al. (2024), there are many methods to evaluate the effect of Civics in 'Auditing' course, such as expert survey method, entropy value method, etc., and the introduction of fuzzy comprehensive evaluation method can explore the teaching effect of Civics in 'Auditing' course. Cong Fangjie and Ma Feifei (2024) believe that the evaluation of online teaching effect is a typical fuzzy multi-attribute decision-making problem, and based on the fuzzy identification model of relative difference function, they constructed a satisfaction evaluation index system of online teaching effect which contains 4 secondary indicators and 12 tertiary indicators, and evaluated the target level indicators and element level indicators respectively. Sun Yuxia et al. (2024) combined literature search and expert consultation, based on the assessment model of 'structure-process-results', used the Delphi method to conduct expert correspondence, focused on medical-related professions in the selection of experts, and applied the hierarchical analysis method to determine the weights of evaluation indicators, and constructed a comprehensive evaluation index system. The evaluation indexes are determined by applying hierarchical analysis to determine the evaluation weights, and a comprehensive, scientific, systematic, reasonable and operational evaluation system for first-class undergraduate programmes in medical schools is constructed.

Based on the above analysis, it can be seen that for research-based auditing, the theoretical and practical circles have basically clarified its connotation and basic ideas. For the research on the cultivation of auditing talents, the research of scholars in China involves various aspects. But for the auditing experimental class, how to help achieve 'research-oriented audit' talent training, the existing research is less involved. In order to respond to the call of the Auditor General and the demand of society for

auditing talents, it is of practical significance to implement the cultivation of research-oriented auditing talents into the construction of the curriculum, and to construct an observable index system for evaluating the teaching effect of experimental courses, which can be used for evaluating the teaching effect of experimental courses in the perspective of 'research-oriented auditing'.

3. The Curriculum Objectives of the Experimental Course Guided by "Research-Oriented Audit"

3.1 The Curriculum Status of Audit Specialty

In order to better clarify the functions of audit experiment course, this paper divides audit-related courses into audit theory course and audit experiment course according to the audit professional training plan of Nanjing Audit University, as shown in Table 1. In order to increase the universality of the research, the audit experiment course in this paper refers to the course that requires students to operate, and the software use course related to big data audit technology is included in the list. Nanjing audit university based on project management and audit the provincial key engineering audit (college), audit simulation laboratory (experiment center), foster donations, such as laboratory, open audit technology and method, information systems and data audit, big data audit, such as experiment, designed to improve the special skills of students in the following key areas. On the one hand, how to efficiently conduct data query and information retrieval, and master the use of modern information technology to obtain professional literature. Focus in the field of auditing teaching and related disciplines, on the other hand, the application of data analysis tools and methods. In addition, emphasis is placed on cultivating students' ability to comprehensively use computer technology, Internet resources and related information technology tools in order to solve practical problems in audit practice.

3.2 Breakdown of the Objectives of the Auditing Laboratory Course

In this paper, we believe that the main solution to the audit laboratory course is the scientific research method and efficient analysis means, including hard and soft technology. Hard technology is the application of 'research-based auditing' tools, and soft technology is the cultivation of 'research-based auditing' thinking and the demonstration of 'research-based auditing' results, which complement each other.

Table 1. Theoretical Courses and Experimental Courses of Audit Major in Nanjing Audit University

Theory courses	Lab classes
Fundamentals of Accounting,Fundamentals of Auditing, Intermediate Financial Accounting, Internal Controls, Managerial Accounting, Accounting for Governmental and Not-for-Profit Organisations, Internal Auditing, Introduction to Economic Law, Financial Management, Corporate Governance, Cases in Internal Auditing, and Auditing of Investments in Fixed Assets, Auditing Communication, Tax Law, Corporate Strategy and Risk Management, Financial Statement Analysis, Audit and Assurance, Fraud Audit, Financial Accountability Audit.	Outline of Frontiers of Modern Information Technology, Access Database Fundamentals and Applications, Comprehensive Accounting Lab, IT Auditing, Comprehensive Auditing Lab, Internal Auditing Computer Techniques, Big Data Auditing Theory and Practice, Applications of Statistical Analysis of Business Data - Based on Stata, and Applications of Python in Auditing'.

3.2.1 Ability to apply research-based auditing tools

(1) The practicality and cutting-edge nature of research-based auditing tools. In the auditing experimental course, cultivating students' hard power, that is, cultivating students' ability to apply research-based auditing tools, is the key to improving students' auditing professionalism and practical ability. This goal should run through the whole teaching process. In order to achieve this goal, we need to select research-based auditing tools that are closely related to auditing practice as the teaching content, such as data analysis software, audit management system and so on. These tools are practical and cutting-edge, can meet the needs of the current audit work and reflect the latest development trends in the field of auditing, to

avoid the embarrassing situation of teaching lagging behind the practice.

(2) In terms of teaching strategy, we integrate the dual methods of theoretical explanation and practical operation, so that students can understand the basic principles of research-based auditing tools and also master their practical operation skills. Using multimedia teaching tools such as PPT and video, we can vividly demonstrate the functions and operational processes of the tools to stimulate students' interest in learning. At the same time, we will also organise group experiments and project practice for students, so that they can use the tools they have learnt in a real auditing environment and enhance their practical ability. During the experiments, timely guidance and assistance will be given to students according to their actual operation to ensure that each student can master the use of the tools. In addition, we encourage students to actively participate in the internship opportunities provided by the audit organisations to experience first-hand the application of research-based auditing tools in practical work.

(3) Establish an assessment and feedback mechanism. Establish clear assessment criteria, including the ability to use research-based auditing tools, the completion of experimental projects and problem-solving ability. Through classroom tests, lab reports, project reports, etc., we can regularly assess students' learning progress and results. At the same time, we need to provide personalised feedback and guidance to students to help them improve their learning methods and skills. This evaluation and feedback process helps students to clearly define their learning goals and paths, which in turn promotes their learning motivation.

(4) Focus on cultivating students' independent learning ability and teamwork ability. Independent learning ability is the foundation of research-based auditing, which requires students to have the ability to actively acquire information, deeply analyse the acquired information, and apply appropriate methods and strategies to solve the corresponding problems. In the auditing laboratory class, teachers can guide students to learn auditing-related knowledge and technology independently by assigning tasks such as extracurricular reading and online learning. In addition, students can show the results and hot spots of relevant auditing experiments in small groups to cultivate their teamwork ability.

3.2.2 Demonstration of research-based auditing results

For the 'research-based auditing' results show, you can take a variety of forms and methods.

(1) Organise students to make classroom reports or speeches, so that they can show their research results and experience.

(2) Encourage students to write academic papers or research reports to systematise and standardise their research results.

(3) Activities such as audit case competitions and audit technology innovation competitions can also be organised to allow students to demonstrate their research-based auditing abilities in practice.

4. Evaluation of the Teaching Effect of Experimental Courses Oriented to 'Research-Oriented Auditing'

4.1 Optimisation of Evaluation Dimensions, Evaluation Principles and Evaluation System

4.1.1Evaluation dimension of the teaching effect of auditing experimental course

According to the literature review and the actual teaching operation, this paper considers that the evaluation of teaching effect of the experimental class can be carried out from the following dimensions: (1) Evaluation by student performance. Observe the students' participation, interaction and performance in the experimental class; check the students' mastery of the experimental content through homework, group discussion, classroom interaction, etc.; (2) Evaluate with students' feedback. Conduct anonymous questionnaires to collect students' insights, recognition and suggestions on the laboratory class; conduct individual interviews to gain insights into students' feelings and opinions on the laboratory class; (3) Assessment by students' knowledge level and ability enhancement. Design pre- and post-tests to assess the improvement of students' knowledge level in the content of the experimental course; compare the performance of students' abilities before and after the experimental course, such as problem-solving ability, analytical ability and so on.

4.1.2Principles of Evaluation of Teaching Effect of Auditing Experimental Courses

In order to make the evaluation index system practical and credible, the evaluation of the teaching effect of the experimental course should follow the following guiding principles: (1)multi-dimensional evaluation. Comprehensive use of a variety of evaluation methods, such as quantitative and qualitative combination, in order to fully understand the teaching effect; (2) timely feedback. Evaluation results should be fed back to students and teachers in a timely manner to help students improve their learning methods and guide teachers to optimise their teaching strategies. (3) Continuous improvement. Adjust the teaching design and teaching methods according to the evaluation results, and continuously improve the quality and effect of the experimental class. (4) Student participation. Encourage students to participate in the evaluation process, understand their needs and expectations, and make the evaluation more targeted and effective. (5) Fairness and objectivity. Evaluation should be fair and objective to ensure that the evaluation results are true and reliable. Through the above methods and guiding principles, the teaching effect of the experimental class can be better evaluated to provide useful reference and guidance for improving the quality of teaching and students' learning effect.

4.1.3Optimisation of the evaluation system of the teaching effect of the auditing experimental course

In order to have a more in-depth understanding of the effect of the auditing laboratory class and whether the selection of course evaluation indicators is objective and fair. The following methods can be used to optimise: (1) classroom observation, to understand whether the use of experimental teaching mode can achieve the expected results, and analyse the differences with the expected differences and think about the corresponding improvement measures; (2) questionnaire survey, through the design of the questionnaire to understand the students' feelings and satisfaction with the different experimental teaching modes, as well as the corresponding comments and suggestions, in order to improve the experimental teaching mode in the future; (3) file research method, the data obtained from the tracking survey of graduated students were analysed by samples to understand students' feedback on different experimental courses, different experimental software and teaching methods; (4) structured interviews. Interviews with students of different grades, counsellors, teachers, teaching supervisors, students' parents, students' internship units and students' employment units were conducted to optimize the experimental teaching evaluation model.

4.2 Establishment of Evaluation Index System

For the evaluation of the effectiveness of the auditing experimental class, there are more methods available, such as the expert survey method, entropy weight method, grey correlation analysis method and so on. This study introduces a fuzzy comprehensive evaluation technique that is concise and has the potential for continuous improvement, and takes it as the basic framework for evaluation, aiming to provide guidance and reference for the actual evaluation work.

4.2.1Introduction of Methods

In the context of this study, the set of fuzzy comprehensive evaluation indicators is defined as E, and the set of possible evaluation results of specific indicators is defined as F. E={e1,e2,...,en},F={f1,f2,...,fm}. According to the evaluation index ei=E, a fuzzy set is now introduced based on the fuzzy set defined by the set of evaluation results F, i.e., (gi1/b1, gi2/b1,..., gim/bm), 0≤gij≤1, i=1, 2,..., n; j=1, 2,..., m, and an evaluation matrix is established P.

$$P=\begin{bmatrix} G_{11} & G_{12} & \ldots & G_{1m} \\ G_{21} & G_{22} & \ldots & G_{2m} \\ \ldots & \ldots & \ldots & \ldots \\ G_{n1} & G_{n2} & \ldots & G_{nm} \end{bmatrix}$$

For the weight of specific evaluation indicators in all evaluation indicators, it is expressed by vector W: W={w1, w2,..., wn}, wi≥0 (i=1,2,..., n),$\sum_{i=1}^{n} W_i = 1$.

The fuzzy set of the evaluation result set F is established as (z1/f1,z2/f2,...,zm/fm),or represented by the vector Z={z1,z2,...zm}, where Z=W·P, which is deduced as the following equation:

Zj=$\sum_{i-1}^{n} \left(W_i \times G_{ij}\right)$,j=1,2,...,m

Quantifying the above results, the evaluation value calculation formula T is obtained, i.e., T=Z·F^T

4.2.2Application of the method

The evaluation of the effectiveness of the auditing experimental class at Nanjing

Auditing University can be carried out with the help of on-campus auditing-related resources and professors in related fields as well as the audience of the 'auditing experimental class' teaching, and complete the following tasks, specifically: (1) For the evaluation indexes in the table, give the ideal standard Hi (i=1,2,.....13), and elaborate the ideal standard for Hi (i=1,2,.....13), and then give the ideal standard for Hi. 13), and elaborate clearly on Hi. The ideal standard represents the optimal level that should be available in the auditing laboratory class; (2) following the 5-point scoring guideline, the perfection standard is set to 5 points. In this framework, the assessment result Fi of a single indicator Ei relative to the perfection criterion is categorised into five levels. Specifically, when Fi scores 5, it means that the actual performance of Ei after the 'auditing laboratory class' is exactly the same as the ideal performance; when it scores 4, it means that the performance is closer to the ideal; when it scores 3, it means that the performance is average; when it scores 2, it means that the performance is below the ideal; and when it scores 1, it means that the performance is far from the ideal standard. A score of 1 indicates that the performance is far from ideal.

Combined with Table 2, the set of indicators for evaluating the teaching effectiveness of the 'auditing laboratory class' is generated as E={e1,e2,...,e13}. In this formula, e1 indicates that the teaching effect of the 'audit laboratory class' to meet the student evaluation results, e2 indicates that the teaching effect of the 'audit laboratory class' to meet the peer evaluation results, and so on. The scoring result F is evaluated according to a 5-point scale, i.e., the set F contains {f1, f2, f3, f4, f5}, and the corresponding scores are {1, 2, 3, 4, 5}. In this scoring system, the F value reflects the consistency of the actual performance of the evaluation indexes with the preset ideal standard.

The corresponding professors were invited to assign values to Fi for the teaching evaluation modelling of 'Auditing Laboratory Class' and counted. For example, for ei, 10% of the experts assigned 3 points, and 90% of the experts assigned 4 points, then the evaluation vector of ei is constructed (0, 0, 0.1, 0.9, 0). Thus, the corresponding evaluation matrix P is generated.

For the evaluation index ei, its corresponding weights and the corresponding vectors are determined and given, e.g., W = {0.07, 0.08, ...}. The fuzzy set corresponding to the set of evaluation results F is calculated by the formula Z=W·P. The actual values of the above vectors W and matrix P are substituted into the arithmetic system defined by the Z formula to obtain the results of Z. Again, according to the formula $T = Z \cdot F^T$ calculate the corresponding 'auditing experimental course' teaching effectiveness evaluation of the value of T.

In the comprehensive evaluation of the numerical value of T level division work, Nanjing Audit University can be used as the evaluation standard of 5 points. When T=5, it means that the teaching effect of 'auditing experimental class' is in full compliance with the fuzzy comprehensive evaluation modelling system constructed in the centre of Table 2; when 4≤E<5, it means high support; when 3≤E<4, it means general support; when 1≤E<3, it means weak support; when 0<E<1, it means extremely unsupportive. When the evaluation result T is between 4 and 5, it is defined that the implementation of teaching activities related to the auditing laboratory class meets the common approval of the auditing experts in the university to a large extent. In addition, the evaluation results should not be limited to the data of the semester. Horizontal and vertical comparisons can be made to continuously improve the evaluation index system and the teaching of the auditing laboratory course.

Table 2. Teaching Effect Evaluation Index System for Auditing Laboratory Courses

Tier 1 indicators	Tier 2 indicators	Scientific nature of indicators
Improvement in the effectiveness of teaching assessment in student assessment of teaching;	e1. Excellent performance in student assessment of teaching; e2. peer assessment of teaching performance is excellent; e3. Teachers' teaching results are presented to the school and peers.	Multi-dimensional evaluation, student participation, continuous

		improvement
Increased sense of student access e4. Increased rates of student project work scores;	e5. a decrease in the sense of boredom in student data analysis, including an increase in attendance, an increase in front row rates, and an increase in classroom lab completion rates; e6. an increase in student participation in class, including an increase in head-up rates, an increase in the frequency of raising their hands to answer questions, and an increase in the frequency of initiating communication with the instructor. e7. students are exposed to a variety of teaching methods, including case-based teaching methods, flipped classrooms, and scenario-based presentations.	Student engagement, objectivity and fairness, observability, timely feedback
Increase in the use of data analysis tools in 'Research Audit' e. Increase in the frequency of use of statistical analysis software in students' summer practice survey reports;	e9. Increase in the frequency of using quantitative analysis methods in 'Challenge Cup', 'Internet+' and Da Chuang projects; e10. Increase in the ranking of students in mathematical modelling and data prediction competitions. Assessment by students' knowledge level and ability enhancement	Cultivation of research-oriented thinking and demonstration of research-oriented results

5.Research Conclusions

For the cultivation of auditing talents, scholars in China have done a more comprehensive study. However, how to help realise the 'research-oriented auditing' talent cultivation in the auditing experimental course is less involved in the existing research. In response to the call of the Auditor General and the demand of the society for audit talents, and to implement the 'research-oriented audit' talent cultivation into the course construction, this paper tries to build an observable teaching effect evaluation index system for experimental courses, which will expand and deepen the research on research-oriented audit talent cultivation, and may have a reference value in practice for the development of classroom teaching effect evaluation programme for experimental courses. It may be of reference value for the development of teaching effect evaluation programme of experimental class.

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References

[1] Zheng S.Q., Liu X.R..(2022). Research-based Auditing: Connotation, Types and Conditions of Application[J]. Journal of Nanjing Auditing University,19(1): 18-25.

[2] Qi Z.D., Zhang Z.X..(2022). Research-based auditing: a theoretical analysis framework[J]. Friends of Accounting,(06):118-124.

[3] Wang F., Zhang L., Ma Z.Z.(2022). Does the Degree of Audit Informatisation Influence the Auditor's Ethical Decision-Making Process [J]. Accounting Research, (1):173-186.

[4] YAN W.L., L. M..(2022) .Research on the talent effect of research-based auditing[J]. Auditing and Economic Research, 37(1): 11-18.

[5] Zhang P..(2024) .Digital Transformation of Chinese Listed Companies: Causes, Trends and Realisation Paths[J]. Journal of Jianghan University,41(04):116-128.

[6] YAN W.,ZHONG S.W.. (2022).Experimental study on the national governance effectiveness of research-based auditing[J]. Auditing Research,(01):13-19.

[7] QIAO P.C.,ZHANG M.Q.,JIN M.Q.. (2022).Research on the innovation of training research audit talents in universities under the perspective of financial digitalisation[J]. China Internal Audit,(10):32-36.

[8] WEN M.F.,LIU W.R.,YE Z.. (2018).Formative evaluation method for online teaching based on automatic clustering and integrated learning[J]. China Electrochemical Education,(03):74-82.

[9] LIU G.C.,CHEN J.Y.,CHEN Y.Z.. (2024).The construction concept, practice path and effect evaluation of 'auditing' programme[J]. Journal of Finance and Accounting,(05):160-165.

[10] Cong F.J., Ma F..(2024). Fuzzy Comprehensive Evaluation of Network Teaching Effect Satisfaction in Higher Education[J]. China Modern Education Equipment,(09):5-8.

[11]SUN Y.,Z B.,HU L.Z.. (2024).Construction and application of teaching effect evaluation system for first-class undergraduate courses in medical schools[J]. Continuing Medical Education,38(05):103-106.

[12] Dai J.M.,Li H..(2024). Reconstruction and Optimisation of Auditing Simulation Laboratory Course Construction under the Perspective of Auditing Strategic Positioning in the New Era[J]. Finance and Economics,(07):170-172.

