Construction of a Three-stage Progressive Teaching Model Guided by Learning Progression Theory: A Case Study of the Management Information Systems Course

Hualan Zhou, Ming Mo, Yanhua Sun
Hunan Agricultural University Business School, Hainan, China

Abstract: Guided by the learning progression theory, this research constructs a three-stage progressive practical teaching model covering traditional verification-based experiments, design-based experiments, and open design-based experiments. Through the empirical application results of the Management Information Systems course in Hunan Agricultural University Business School, it is evident that the proposed teaching model is capable of effectively improving students' system development competence. In this regard, the database design accuracy rate of students in the experimental group increases by 63%, with the innovation project conversion rate reaching 28%. Particularly, the proposed teaching model has influenced more than 1,000 students, providing a replicable teaching paradigm for the practical teaching reform of interdisciplinary courses.

Keywords: Management Information Systems Course; Experimental Teaching; Teaching Reform

1. Introduction

The learning progression theory was initially proposed by American scholars in 2004. Since then, this theory has gradually become an important hotspot within the field of global education research [1]. Essentially, the learning progression mainly describes the development process in which students' cognition and thinking evolve progressively and deepen step by step while engaging in learning and inquiry around a particular topic over a certain period of time. Conceptually, the application of learning progression theory in practical teaching activities is defined as constructing a teaching design system in which students' theoretical knowledge under a certain teaching theme is progressively transformed into practical application abilities through a staged and progressive development process [1]. In other words, the learning progression reflects the general knowledge learning process of students in specific situations, which conforms to the development law of students' cognitive ability. Of them, different progressions represent the learning objectives corresponding to various learning stages, embodying the learning mastery level of students at different stages. On the same note, different progressions can be used to describe the dynamic changes in students during the process of knowledge understanding and skill acquisition. Particularly, learning progressions can reflect the development process of learners from superficial understanding to deeper comprehension, thereby characterizing the cognitive development path of learners and the internal continuity of their learning process [2].

The Management Information Systems (MIS) is a course characterized by its interdisciplinary and cross-boundary nature, which requires learners to comprehensively apply the basic concepts and methods in diverse disciplines, such as management science, computer science, communication technology, and system science. Hence, this course presents a strong practical orientation. Furthermore, a myriad of basic concepts, methods, and theories in the MIS course require students to achieve a deeper understanding through practice-oriented learning methods, such as watching demonstrations, analyzing cases, and developing programs. In this research, the MIS serves as a core basic course for management-related majors at Hunan Agricultural University. Meanwhile, this course is currently offered in such majors as Business Administration, Accounting, Marketing, and International Economics and Trade [3]. This course consists of 48 class hours in total, including 24 hours of theoretical teaching and 24 hours of practical teaching. Practical teaching is not only an important teaching link for students to integrate theory with practice, but also a key pathway to cultivate students' practical skills, innovative abilities, and problem-analysis and problem-solving abilities [4]. Consequently, the reform and innovation of practical teaching play a significant role in cultivating students' comprehensive competencies.

In 2022, the Ministry of Education of the People's Republic of China explicitly proposed to encourage teachers to innovate teaching methods, further emphasizing that teachers should highlight the continuity and progression between the course content and learning objectives during the teaching process. Against this backdrop, it is of great significance to introduce the learning progression theory into MIS practical teaching. More specifically, the introduction of this theory helps to build a teaching process from theory, practice, to application, thus promoting students into a developmental, continuous, and progressive learning process. In practical teaching, this model can fully reflect the leading role of core concepts, thereby facilitating the structuring of teaching content and the layering of teaching objectives. Through the above structural optimization, this model is beneficial to promote students' in-depth understanding of core concepts and further enable the formation of their practical and application abilities, thus improving the overall teaching effectiveness.

2. Three-stage Progressive Practical Teaching Design Based on the Learning Progression Theory

The learning progression theory emphasizes the gradual transition of learning objectives from low to high, thus progressively realizing teaching objectives. According to the textbook content and talent cultivation objectives, the core teaching objective of this course is defined as enabling students to establish a deeper understanding of the theoretical knowledge and practical application of information systems through experiments. Meanwhile, based on the learning of theoretical courses, this course aims to enable students to systematically master various methods of information system development and endow them with the ability of system analysis, design, and development.

The design of teaching objectives oriented to cultivating students' practical application ability can be roughly divided into three levels: knowledge, ability, and quality. Specifically, first of all, the knowledge-level objective is to enable students to master the basic theoretical knowledge related to MIS. Secondly, the ability-level objective is to enable students to address practical problems by using information technology, understand the basic ideas and methods of MIS, and acquire the ability of information system analysis, development, and management. Lastly, the quality-level objective is to enable students to form digital thinking ability and information system development ability, while cultivating their innovation and entrepreneurship spirit.

Based on the foregoing objectives, this research combines the content of teaching materials to implement modular selection for specific teaching content, including the conceptual section, the fundamental technology section, the application system section, and the system development and management section. Accordingly, this research further constructs a progression model oriented to the cultivation of students' practical application ability, as depicted in Figure 1.

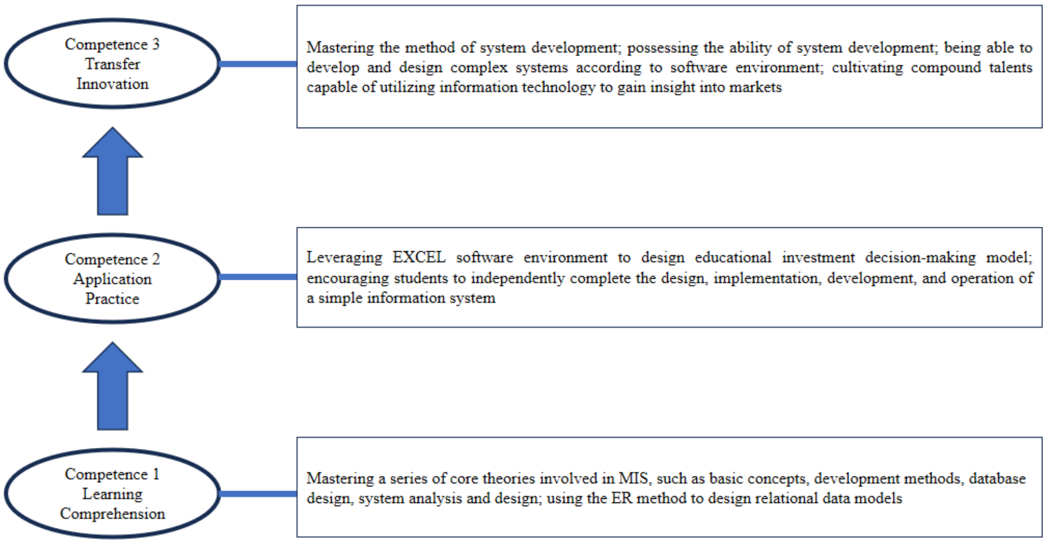

Figure 1: Correspondence Diagram between the Cultivation of Students' Practical Application Ability and the Progression Model.

As Figure 1 shows, students should possess the following abilities through the training during the learning-comprehension stage. First of all, students need to master the development methods of structured systems. Secondly, students should master the main work involved in the system development process, including the system analysis phase, the system design phase, the system implementation phase, and the system operation phase. Additionally, students should master system development methods based on functional division. On the other hand, students should be able to implement application practice in a simple EXCEL software environment through the training during the application-practice stage. Specifically, students need to design the functional modules of the educational investment decision-making model. Meanwhile, during this process, students are required to employ the relevant knowledge of system development to complete the overall design, implementation, and operation of the educational investment decision-making model system. Lastly, students should further master the system development methods and acquire relatively complete system development abilities through the training during the transfer-innovation stage. In this foundation, students are capable of developing and designing complex systems according to the specific software environment. Concurrently, this stage aims to cultivate students' abilities to use information technology for market insights, enabling them to form a compound professional quality with both theoretical and practical abilities of modern management, information science and technology, and information management science.

3. Three-stage Learning Progression Practical Teaching Scheme Covering Traditional

Verification-based Experiments, Design-based Experiments, and Open Design-based Experiments

3.1 Teaching Objectives and Requirements

The main purpose of the proposed three-stage progressive practical teaching model can be summarized as cultivating students' abilities to apply information system theory to practice. More precisely, through the course design, the proposed teaching model aims at: a) cultivating students' abilities to analyze and solve problems independently; b) further training and improving students' system development abilities; and c) cultivating students' team spirit. moreover, this model focuses on the cultivation of students' scientific attitudes of objectivity, diligence, and rigor, as well as a persevering scientific spirit in the face of difficulties, thereby gradually fostering students' scientific and sound experimental quality and habits.

The three-stage progressive practical teaching, on the other hand, requires students to systematically master various methods of information processing as well as the functions and effects of information systems, and to understand diverse forms of MIS. Simultaneously, students need to master the correct methods of information system development. On this basis, students should further master the key points of MIS development and be familiar with its application-related issues. Through learning, students need to master the knowledge of organizing, storing, processing, and leveraging management data by computers, and possess the ability to develop MIS and apply computers in management practice, thus gradually forming system analysis and design abilities.

3.2 Teaching Content and Schedule

In accordance with the characteristics of the MIS course, the knowledge chain, and the training objectives and requirements of students' application skills, this research formulates the corresponding teaching content and schedule, as shown in Table 1.

Table 1: Experimental Projects.

Serial Number	Experimental Project Name	Experiment Type	Difficulty Level	Applicable Majors	Competency Requirements	Class Hours
First-stage Experiment	Personnel Records Management System Design	**Traditional Verification-based Experiment**	Easy	Management-related Majors	Basic Practical Competence	12 In-class Hours
Second-stage Experiment	Educational Investment Decision-Making Model Design	**Design-based Experiment**	Moderately Difficult	Management-related Majors	Comprehensive Practical Competence	6 In-class + Extracurricular Hours
Third-stage Experiment	Logical Model Design for MIS	**Open Design-based Experiment**	Difficult	Management-related Majors	Innovative Practical Competence	6 In-class + Extracurricular Hours

The first-stage experiment is the personnel records management system design. The experiment at this stage requires students to learn the system development method and master the specific system development steps. Through the experiment at this stage, students are capable of understanding the main work contents of each stage of system development and mastering the system design method based on functional division. Meanwhile, students can master appropriate system analysis methods and design a relational data model by using the entity-relationship (ER) method. In terms of types, the experiment at this stage can be classified as a traditional verification-based experiment. The experimental contents mainly include system analysis, system menu compilation, design and creation of database and data table, realization of various modules (e.g., opening personnel file module, adding or modifying personnel records module, query module, statistics module, and printing report module), and system debugging. Through the experiment at this stage, students can master a series of basic steps involved in the information system development, as well as the method of developing an information system with Visual FoxPro. Upon completion of the experiment, students will be required to submit an operational personnel records management system. Notably, teachers are mainly responsible for providing the experimental scheme and steps, while setting the experimental type as the traditional verification-based experiment.

The second-stage experiment is the educational investment decision-making model design. The experiment at this stage requires students to further develop a certain system development ability. Through the second-stage experiment, students can make reasonable financial planning as per the set financial situation in the familiar and relatively simple EXCEL software environment, while participating in investment activities appropriately. Typologically, the experiment at the second stage can be classified as a design-based experiment. The EXCEL software platform that students are familiar with is selected for the experiment, with teachers being responsible for formulating the purpose and requirements of the experiment. On the other hand, students need to independently design the functional modules of the educational investment decision-making model according to the system development methods and steps mastered in the first stage, and use the relevant knowledge of system development to build an educational investment decision-making system. In this stage of the experiment, the experimental scheme and steps are mainly designed by students independently, whereas the experimental environment is preset by teachers, who mainly play a guiding role during the experimental process.

The third-stage experiment is the logical model design for MIS. Compared with the first two stages, the experimental difficulty in this stage is further improved. The experiment at this stage requires students to conceive and design a complete system framework model based on the theoretical knowledge of MIS development, the system development methods and steps mastered in the first stage, as well as the system development ability formed in the second stage. During the implementation of the experiment, students are required to conduct a systematic investigation independently or in the form of group-based cooperation. Meanwhile, students need to implement a feasibility study according to the survey results and write a feasibility study report. Subsequently, according to the results of the feasibility study, students will conduct further detailed investigations. During the investigation, students are required to use a standardized graph instrument to record the survey results. In this foundation, students need to complete the logical structure design of the system and write a system analysis report. Moreover, students need to combine the practical ability and related theoretical knowledge obtained in the first two stages to complete the development and design of the system. The topic selection of the experiment at this stage, coupled with the experimental schemes and results, presents an open-ended nature.

Through the third-stage experiment, students need to conceive and design a complete system framework model according to the relevant theoretical knowledge concerning MIS development in theoretical courses, as well as the system development and design ability acquired in the previous experimental stages. In the course of the experiment, students complete the experimental task in the form of group-based cooperation, implementing systematic analysis and design in strict accordance with the general steps of the systems development life cycle (SDLC) method. In this regard, the specific contents include: a) drawing the organizational structure diagram and functional structure diagram of the department or college, as well as the flow chart or data processing flow chart of selected businesses; b) drawing a simple ER diagram; c) compiling relational data model and main data structure of the system; and d) forming a detailed and feasible system development and design scheme.

The experimental schemes, steps, and experimental environment at this stage present an open-ended nature, which further enhances the experimental difficulty and puts forward higher requirements for students' practical application abilities. Simultaneously, this stage aims at further improving students' practical application abilities acquired in the second stage.

3.3 Teaching Methods

This course is roughly divided into four levels according to teaching content and requirements, including basic concepts, technical basis, application system, and system development. During the practical teaching, the course is designed as a progressive learning mode covering three stages. With regard to different teaching objectives, this course adopts various teaching methods. Specifically, in the first-stage experiment, the learning objective is set as learning and comprehension. The first stage, therefore, mainly introduces teaching methods, such as lecture, demonstration, and students' exercises. During the second-stage experiment, the learning objective is set as application and practice. Accordingly, the second stage mainly adopts the problem-oriented teaching method and the heuristic teaching method. In other words, teachers guide students to use what they have learned in the first stage by asking questions, thereby completing teaching tasks through group discussion and active problem solving. During the third-stage experiment, the learning objective is set as knowledge transfer and innovation. Hence, the third stage mainly adopts group discussion, case observation, and a task-driven teaching method. Throughout the teaching process, the implementation of teaching activities gradually changes from a teacher-centered model in the first stage to a new model characterized by teacher guidance and support, with students serving as its core. By this progressive process, this course gradually guides students to realize a transition from passive learning to self-directed learning.

In summary, from the perspective of knowledge system construction, this teaching process effectively integrates the pre-class basic knowledge points with the key and difficult points in classroom teaching and further realizes the application of knowledge points in practical teaching, thus strengthening students' mastery of relevant knowledge. From the perspective of ability training, on the other hand, this teaching process comprehensively uses mathematics, computer science, information science, economics, and management science to realize the progressive transformation from theoretical study to practical application, thereby cultivating high-quality talents with comprehensive abilities.

4. Features of the Three-stage Learning Progression Practical Teaching Model

4.1 Comprehensiveness

The comprehensiveness of the proposed three-stage progressive MIS practical teaching reform is mainly reflected in the following three aspects.

First and foremost, the proposed practical teaching reform integrates the knowledge system of students' prerequisite courses. MIS is a marginal, comprehensive, and systematic discipline formed by the cross-development of diverse disciplines, such as management science, system science, computer science, and communication technology. During the process of practical teaching, therefore, students need to comprehensively apply the theories and methods of such disciplines as economic management theory, information theory, system theory, computer science, and financial management. In this connection, the first-stage experiment applies the knowledge of Visual FoxPro-related courses, basic knowledge of computer applications, and knowledge of computer networks and digital communication, with the experiment involving the comprehensive application of extensive knowledge points (e.g., computer hardware, software, database, communication, and network). Furthermore, the second-stage experiment introduces the knowledge of various courses, such as financial management and Excel. The third-stage experiment comprehensively employs the relevant knowledge of prerequisite courses and theoretical courses to facilitate practical teaching tasks.

Secondly, the proposed practical teaching reform integrates the knowledge system of the MIS course. At this point, the practical teaching involves the application of a variety of core theoretical knowledge, such as the basic theory of MIS in teaching materials, database technology, structured system development methods in system development, system data analysis methods, and relational data model design based on the ER method.

Finally, the practical teaching comprehensively uses diversified experimental methods, thus effectively cultivating students' abilities to comprehensively analyze and solve problems by using different thinking modes and experimental methods. In particular, during the third-stage experiment concerning the logical model design for MIS, students determine the topic through investigation, implement the scheme design through experimental exploration, clarify the scheme through group discussion, and complete the system development and design through the project-based production. The overall experimental methodology presents significant diversity and comprehensiveness.

4.2 Openness

The openness of the three-stage progressive MIS practical teaching reform is mainly reflected in the open-ended nature of experimental content, environment, and results. More exactly, the open-ended nature of experimental content is mainly reflected in the emphasis on students' autonomous learning and comprehensive application abilities. In practice, for instance, students need to flexibly use the knowledge points in various prerequisite courses and comprehensively apply the theoretical knowledge of the courses. During the progressive process from design-based experiment to open design-based experiment, a series of contents, including experimental steps, schemes, initial data, and system function division, are designed and selected by students independently within the prescribed scope according to their understanding ability and interest. In the third-stage experiment settings, the course further guides students to highlight the agricultural and commercial characteristics during the process of topic selection. The students, for example, are encouraged to design the system around a rural revitalization information system, an agricultural product supply chain MIS, and an agricultural decision support system. With regard to partial students with outstanding computer skills, the course further guides them to build a tea quality traceability information system in combination with the actual demands of the Tea Research Center of Hunan

Agricultural University Business School, thereby improving the quick response code traceability of the whole process of tea planting, processing, and sales.

4.3 Bidirectional Competence Mapping Mechanism

During the teaching implementation, the course demonstrates an effective dynamic interaction of forward mapping and reverse feedback, which promotes the deep integration of theoretical teaching and practical innovation, further forming a bidirectional competence mapping mechanism. This mechanism's core lies in constructing a bidirectional transformation channel between knowledge points and experimental projects. To be specific, forward mapping is mainly to concretize abstract theories into operational experimental tasks. For instance, by transforming the E-R diagram theory in ER model into a database entity relationship modeling experiment, the course enables students to naturally understand the correlation between data during the process of completing modular experimental projects. By contrast, reverse feedback mainly optimizes the theoretical teaching content by analyzing the common problems exposed in students' experiments. For example, regarding the frequent data redundancy in the course selection system developed by students, teachers further strengthen the relevant topics of paradigm design in subsequent teaching. Through the above mechanism, the course progressively forms a closed-loop structure characterized by theory guiding practice and practice feeding back theory, thus effectively addressing the pain point of the disconnection between theory and application in traditional teaching.

4.4 Teaching Evaluation

The evaluation acts as the last key link in the learning progression process. Evaluation indices mainly cover three dimensions: students' participation attitude, activity ability, and literacy development. Specifically, the evaluation content includes students' participation in the experiment, team cooperation performance, team task completion, and students' abilities to find and solve problems. In terms of evaluation methods, the course adopts a comprehensive evaluation method combining self-evaluation, intra-group mutual evaluation, and teacher evaluation.

5. Experiences from the Three-stage Learning Progression Practical Teaching Reform

5.1 Stimulation of Students' Learning Interest by Three-stage Learning Progression Practical Teaching

Interest is the best teacher. In practical teaching, the top priority is to design the corresponding practical content according to the teaching characteristics of each class to effectively stimulate students' learning motivation and interest. Only when students are interested in learning will they further form the internal driving force of exploration. Therefore, in the first-stage traditional verification-based experiment concerning the personnel records management system design, the teaching process is appropriately set with certain experimental difficulty to drive students to complete the experimental tasks through independent exploration under the experimental guidance of teachers. Finally, students build a practical information system (IS) software system. This process is capable of making students gain a sense of accomplishment at the psychological level and further stimulating their curiosity, thus arousing their interest in the second-stage independent development of simple systems in the Excel environment. Also, this stage lays a solid foundation for the smooth development of the third-stage open design-based experiment.

5.2 Construction of an Effective Bidirectional Interactive Teaching Model by Three-stage Learning Progression Practical Teaching

In the three-stage learning progression practical teaching environment, teachers and students persistently maintain an effective two-way interaction. In the first-stage experiment, teachers mainly implement teaching through operational demonstration. In the second-stage experiment, according to the progress of students' experiments, teachers adopt the method of combining students' demonstration with teachers' guidance. In the third-stage experiment, teachers mainly guide students to present their achievements and organize students to conduct cross-comments among groups, while conducting multi-evaluation combined with teachers' comments. Finally, teachers conclude and summarize the whole experiment process based on students' feedback.

5.3 Full Mobilization of Students' Learning Initiative by Three-stage Learning Progression Practical Teaching

In practical teaching, it is imperative to fully highlight students' dominant position and guide students to carry out deep learning by setting different levels of difficulty. Deep learning is not only reflected in the progressive progress of knowledge difficulty but also in the meticulous design of problem situations and inquiry activities, thus stimulating students' intrinsic motivation for active inquiry. In the first-stage experiment, teachers guide students to leverage the knowledge points of the prerequisite courses to conduct inquiry learning with the help of existing knowledge and experience. In the second-stage and third-stage experiments, teachers further guide students to design experimental schemes and complete the learning process independently with a more active and positive learning attitude. The aforementioned teaching design helps students to gradually transform into subjects and participants in classroom practice, thus achieving the improvement of students' comprehensive competencies.

5.4 Optimization of Teaching Process by Three-stage Learning Progression Practical Teaching

The three-stage learning progression practical teaching first defines the teaching objectives. Moreover, it selects the corresponding teaching materials based on the teaching objectives and integrates theoretical knowledge points into practical application, thus effectively stimulating students' learning motivation. Concurrently, through the application of knowledge in practice, it enables students to understand the core knowledge points in the textbook more deeply. The three-stage learning progression teaching model makes students' ability development gradually transition from learning and comprehension to application and practice, thus building a learning path that is convenient for knowledge consolidation and experience accumulation. The third-stage practice, oriented by knowledge transfer and innovation, further effectively verifies the teaching effect. Simply put, the foregoing three stages are interrelated and progressively structured, jointly forming a complete and efficient teaching process.

Funding

This research was supported by the Research on the Construction of a First-class Marketing Major with Agricultural and Commercial Characteristics (Grant No. HNJG-2022-0101), a 2022 Provincial Key Teaching Reform Project for Higher Education Institutions in Hunan Province, as well as the Research on the Practical Competence Training System of Marketing Major under the Double First-class Initiative (Grant No. HNJG-2021-0503), a 2021 Provincial Key Teaching Reform Project for

Higher Education Institutions in Hunan Province.

References

[1] Chen Y. Research on Reverse Instructional Design for Programming Based on the Learning Progression Theory. Yangzhou University, 2023.

[2] Zhu H. S., Zhou S. Y., & Pan F. H. Exploration of Practical Teaching System of Human Geography under the Background of First-class Major Construction. Heilongjiang Education (Higher Educational Research and Evaluation), 2022(11): 56-59.

[3] Hu H. Y. Design and Teaching of the Teaching Practice Ability Learning Progression of Chemistry Normal College Students. Chinese Journal of Chemical Education, 2023, 44(20): 60-65.

[4] Zhou H. L., Tang W. Y., & Zhou L. Analysis of Blended Teaching Reform Concerning Customer Relationship Management. Heilongjiang Education (Higher Educational Research and Evaluation), 2020(02): 21-23.