Teaching reform and practice of database principle and application

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Abstract. Aiming at the characteristics that the content of database principles and applications is difficult to understand and master, this paper first analyzes the comprehensive and practical characteristics of database principle and application course, and then systematically introduces some innovative practices of the author in textbook construction, teaching content reform and design ability training, including the construction of systematic case teaching content system; The reform of curriculum content system keeping pace with the times; The construction of innovative design ability training system; The practice of curriculum design that is closely integrated with application; The introduction of typical entrepreneurial innovation cases; The guidance of famous sayings and aphorisms compatible with the curriculum. The author's beneficial attempts and innovative practices in the construction of database principle and application courses and the training of applied computer talents are expected to play a certain enlightening role in the teaching of computer majors, teachers and courses in relevant colleges and universities.

1 Introduction

Use Database technology is an important support and guarantee technology in the construction of national information infrastructure and information society. The research and development of various information system platform software based on database technology has become a necessary knowledge and basic skill for technology and management personnel in computer and related professional fields, therefore, database technology has become one of the core technologies that computer, electronic information and related to management students must master and apply flexibly.

As a required backbone professional course for undergraduates majoring in computer and related electronic information, database principles and applications cover relational operation, functional dependency theory and relational standardization theory, involving logical organization, physical organization, query strategy and control mechanism of databases; The design method should follow the phase division and design principles of the software life cycle; The design process requires strong programming ability; Designers should generally have some business knowledge or practical experience in the application field of user organizations, so the course of database principles and applications has always

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been difficult to learn, understand and master; The design of database based application software system (hereinafter referred to as database application system) has been a challenging problem for a long time\textsuperscript{[1]}. Therefore, it is very necessary to actively carry out the teaching reform of the database principle and application course, which is obviously of great practical significance for the training of application-oriented and innovative talents.

2 Comprehensive and practical characteristics of database course

The learning of the course of database principle and application needs discrete mathematics and program design as the basis. Although some of the contents of this course are highly theoretical, the essence of the course is a practical design technology. The core of the design technology is mainly the conceptual structure design, logical structure design, physical structure design of the database, and the manipulation and application of the database. It is the physical structure design of the database and the requirements for the operation and application of the database that make the design of the database application system and the programming ability of the designer and the ability to combine with the domain knowledge become the key to the success of the system design, which also makes the course of database principles and applications seem not only a professional course, but also a comprehensive design and practice course based on database principles and design methods\textsuperscript{[2-4]}. That is to say, if the course of database principle and application only explains the knowledge of database principle and the design method of database application system, most students may still not understand the operation mechanism of the database, and still cannot fully understand and master the design method of the database, but only truly guide and lead students to carry out the logical structure of a typical database application system through comprehensive and in-depth explanation. After the whole process of physical design and database application behavior programming design, it is possible for students to truly understand and master the basic principles, overall architecture and design methods of databases. This is the reason why the teaching organization system of database principles and application courses is difficult to build, and it is also the core and key that teachers have always felt that the course is difficult to teach and students have always believed that the course is difficult to learn.

3 Some teaching and practice methods of the course of database principle and application

After decades of teaching practice in the course of database principles and applications, the author has compiled and published database course textbooks in several publishing houses. In particular, the first to fourth editions of Database Principles and Applications (SQL Server) published in Tsinghua University Press have been adopted by dozens of universities across the country, and have been praised by many teachers and students. The course of database system principle and application, which the author is responsible for building, has also been selected as the national excellent course and national boutique resource sharing course. The following introduces some teaching practices and reform practices of the author around the database principle and application course.
3.1 The systematic case based teaching content system and teaching mode highlight the characteristics of the combination of theory and application

In the teaching process of database principles and applications, it is necessary to use real design cases and reliable experimental data to support the implementation of design methods and the verification of design results. Therefore, in the content organization of the textbook of the course of database principle and application, a case data set of the university teaching information management system is introduced, which is composed of seven database tables and their data, such as student information table, course information table, student course score table, etc., and based on the case data set of the university teaching information management system, in relation operation, SQL language and its query application, database integrity constraints, database (file) creation. The case course teaching content system is constructed in the contents of data table creation, data entry in the table, database application system design, etc. Based on the data set of teaching cases of the university teaching information management system, the teaching materials are organized with the teaching cases of the "university teaching information management system" as the main line; The discussion teaching is based on the teaching case of "University Teaching Information Management System"; The course experiment is organized and implemented around the relevant contents and design modules of the case of "University Teaching Information Management System"; The independent curriculum design is designed by students to select information management cases in their familiar application fields to design the database application system. The multi-level and multi link teaching case guidance and case based teaching mode highlight the distinctive characteristics of the combination of theory and application of database principles and application courses.

3.2 The continuous reform of the curriculum content system has realized the characteristics of keeping pace with the times in the reform of the teaching content

Although the basic content system of the database course has been basically formed, from the perspective of deepening students' understanding of the course content, the presentation methods and teaching methods of the relevant content of the course will never end. Therefore, in the evolution from the first edition to the fourth edition, the textbook "Principles and Applications of Database (SQL Server)" has reformed and improved the expression and organization methods of related contents in many aspects. For example, in order to enable students to intuitively understand the core knowledge point of the overall architecture of the database management system, which is the mapping of the logical mode to the external mode in the three-level model of the database system, the textbook uses the definition sentence of the external mode (user view):

CREATE VIEW CG
AS SELECT S.S#, SNAME, C#, CNAME, CLASSH, GRADE
FROM S, SC, C
WHERE S.S# = SC.S# AND SC.C# = C.C#

It explains that the values of the table (external mode) CG are queried (SELECT) from the three tables S, SC, and C. Then, by constructing the "Mapping Example of Table S, SC, and C External Mode CG" as shown in Figure 1, it intuitively illustrates the association between the values in the data records "S256, Wang, C5, Database, 50, 80" queried from the table CG and the tables S, SC, and C. That is, the complete data record "S256, Wang, C5, database, 50, 80" does not exist in the database. The values in the data record are queried from three tables S, SC, and C, and are spliced together. There are many examples
of such novel expressions of relevant contents in the content of the textbook, such as the addition of the design method of "combined E-R diagram" in the content of database conceptual structure design. This novel expression method and the supplement and improvement of teaching content that keep pace with the times have not been seen in other existing database textbooks.

3.4 The supporting curriculum design practice and organization links have improved the students' design innovation ability

As the training of database design ability involves the analysis ability of management information requirements in certain fields, a certain high-level language programming ability, the comprehensive application and experience of database design knowledge, etc., the general listing and explanation of some design steps and design methods obviously fail to meet the needs of improving students' comprehensive design ability [6]. For this reason,
in the textbook "Database Principle and Application (SQL Server)", the author first gives detailed system function analysis, database creation based on SQL Server, data table structure design and table creation method based on SQL Server around the design and implementation of university teaching information management database application system, and then gives a new project method based on Visual Studio programming development environment according to the system and programming needs, Then from the aspects of function description, interface layout and object and attribute setting, related control and attribute design, program code and its design ideas and programming methods, program module debugging and running, and based on SQL Server database management system development environment and Visual Studio VB NET programming language. The design steps and methods of login module, student information addition module, student information query module, score information query module, score information maintenance module and main interface module are given in detail and systematically, It enables students to understand and learn the design process and design and programming methods of a practical database application system in an immersive way, and then through the design process experience of relevant course experiments, it not only enables students to understand and basically master the relevant design technology and design methods, but also improves their practice and design ability.

3.5 The integration of typical entrepreneurship and innovation cases has improved students’ confidence in design innovation

The integration of typical entrepreneurship and innovation cases has improved students' confidence in design and innovation. The main teaching goal of the course Database Principle and Application is to cultivate the practical design ability of database based information systems. The cultivation of practical design ability not only requires students to master the basic design technology and design methods of the database, but also requires students to have strong programming and application ability for a high-level language, The latter is where many students' weaknesses and deficiencies lie, so it is inevitable that there is a fear of difficulties among students. For this reason, the author not only inspires and enhances students' interest in learning through the explanation of some programming cases in the course teaching, but also inspires students' enthusiasm and initiative in curriculum practice design through relevant typical cases and the employment annual salary and success path of some excellent graduates with strong design ability of the college. In addition, students are also actively encouraged to take part in the annual examination of software designers and database engineers organized by the Ministry of Personnel of the People's Republic of China. The number of students taking part in the examination of software designers and database engineers is not only increasing every year, but even some students have obtained certificates of senior software designers, which has greatly improved the students' confidence in practical design and innovation.

3.6 The introduction of famous sayings and aphorisms integrated with classroom teaching meets the classroom teaching requirements of ideological and political education

In the process of students' four years of learning and the formation of their life values and aspirations, course teaching plays a crucial role. Course teaching not only teaches students knowledge, but also involves the cultivation of their life values and aspirations [7]. For this reason, in addition to introducing some ideological and political elements of the course in real time in the teaching of database principles and applications, the author mainly gives one or two famous aphorisms around a certain theme in the classroom every week to shape
students' value orientation related to the characteristics of the course and enlighten them on the way of life. For example, in view of the characteristics of database courses that are difficult to learn and understand, we give famous aphorisms that are determined to tackle difficulties and dare to climb; According to the characteristics of the overall structure required by the course content, the famous aphorisms of the importance of establishing the grand ideal and goal of life are given; In view of the characteristics that curriculum design and programming should start from the big and focus on the small, the famous aphorism of realizing the relationship between grand goals and small goals is given; In view of the situation that individual students play with their mobile phones instead of attending classes in class, the famous aphorism of the relationship between self-discipline and career success is given. Through the natural integration of these targeted aphorisms in classroom teaching, it has played a certain role in inspiring, guiding, encouraging and demanding students.

4 Conclusion

The database principle and application course plays an important role in the training of new engineering applied talents. The improvement of the content system of the database principle and application course, the innovation of the practical teaching content system, the training of the design innovation ability, and the ideological and political exploration of the course of teaching and educating people are always on the way. We look forward to the author's practice of organizing teaching materials and teaching contents around case based teaching, building a teaching material content system of Database Principles and Applications (SQL Server) (4th Edition) that integrates theory and design ability training, and the exploration in course teaching and practice can be used for reference by peers in improving database course teaching methods and improving practical design ability, And then it plays a positive role in promoting the teaching quality of computer specialty and training applied talents to adapt to the information society.

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