Refinements on Teaching Methods for Data Analysis Course

Zi Ye

Wenzhou Vocational & Technology College, Wenzhou 325035, China.

45790269@qq.com

Abstract

Data Analysis is an important professional foundation course for students of information and computational science major. By combining characteristics of this course and the authors' teaching practice over the years, the author makes exploration on reform in the teaching content, motivation of students' interest in learning, application of multimedia-aided teaching and improvement of students' practical ability from the perspective of improving teaching quality and effectiveness.

Keywords

Data Analysis,Teaching Methods, Teaching Effectiveness.

1. Introduction

With the arrival of the era of information, data has been the carrier of information and a large amount of information has been displayed in the form of data. Therefore, it has been an issue of great significance how to collect useful information from complicated data, manage these data and get information that can help people make decisions through statistical analysis.

As an important professional foundation course in information and computer science, Data Analysis is highly practical, whose main task is to reveal various inherent laws, excavate useful information and eventually make scientific inferences and decisions from a large amount of data by adopting theories and methods on data analysis and processing.

With the continuous emergence of new data processing techniques and methods as well as further improvement of related software, teaching content and methods of Data Analysis must be adjusted accordingly to keep pace with the times. As a result, the author makes certain rough exploration on the teaching methods of the course based on characteristics of the course and the author's teaching practice from the following aspects.

2. Selecting Teaching Materials Carefully and Focusing on Cultivation of Abilities

Teaching content is one of the basic elements of teaching process and serves as intermediary and bond of the two-way communication between teachers and students. Therefore, the teaching content has a direct effect on the depth and breadth of knowledge accessible to students, thus affecting teaching quality and effect. Data Analysis comes with very rich teaching content, but limited teaching time. To this end, it is necessary to reasonably select teaching content according to the basic teaching requirements.

Teaching content is selected based on the following principles:

The first principle is to coordinate with other courses. The teaching content of Data Analysis intersects with other courses like Probability Theory and Mathematical Statistics, Stochastic Process, etc, so there is coordination of the teaching content of these courses under the coordination of professional leaders to guarantee no repetition, no omission and scientific and reasonable content when formulating basic teaching requirements and selecting teaching content.

The second principle is to focus on practicality. To be specific, there will be sufficient teaching period for teaching content with strong practicality as well as appropriate reduction for some unbiased or outdated methods and contents.

The third principle is to pay attention to the scientific nature of teaching content. We ensure that the teaching content of the course is accurate through reviews by experienced teachers and on this basis, fully consider the requirements of basic literacy and ability development for college students of information and computer science major.

3. Teaching with life examples, focusing on innovation and stimulating students' interest in learning

As Tolstoy once said, what is required for successful teaching is not coercion, but stimulating students' interest in learning. Although monotonous and boring, mathematic contains a wealth of factors to stimulate students' interest.

As a course with strong applicability, data analysis is commonly applied to daily life. Therefore, we make reasonable selection of relevant examples each year according to actual situation of current society and hot issues of social concerns, where lively and interesting content with rich characteristics of the times will be included to stimulate students' interest in learning. For example, we once predicted and analyzed SARS epidemics with regression analysis, made analysis on the rationality of college tuition with data processing methods and statistically analyzed the academic achievements of college students by means of principal component analysis and cluster analysis.

The purpose is to enable students to experience the fun of integrating theory with practice by solving these problems, fully mobilize students' enthusiasm, initiative and consciousness and cultivate their capacities of mastering basic knowledge, analyzing and solving practical problems.

4. Improving teaching methods and promoting teaching results with modern educational technology

Traditional teaching refers to the teaching methods where teachers play a dominate role, teaching with blackboards, chalks and teaching plans, while students sit still in their seats to listen and practice. However, multimedia teaching can be used to stimulate students through a variety of media technologies like sound, image, animation and video according to the characteristics of different disciplines and different content, which has increasingly become an important teaching method. Introducing multimedia into teaching can not only enrich teaching methods in the classroom, but also greatly reduce the heavy burden of blackboard-writing for teachers in the classroom.

For example, multiple equations are involved in the explanation of the derivation process of the least squares solution of multiple regression analysis. With traditional methods, not only does it end with consumption of time and energy but little effect, but also it is not conducive to students mastering its essence. Therefore, by adopting the various functions of modern teaching equipment as well as their intuitive, vivid and novel pictures, their virtual contents are turned into real contents to help teachers effectively teach, better train the thinking ability of students and improve teaching efficiency. For another example, practical examples of data analysis involve a large amount of multi-dimensional data, which is usually expressed in tables and almost impossible to write on the blackboard, so multimedia is adopted. However, the application of modern teaching methods does not represent a substitute for computer thinking of students, and some of the basic core principles still require that students should think and explore under the guidance of teachers.

Therefore, the author suggests using traditional teaching methods should be taken as principle and modern multimedia methods should be adopted as supplement. In this case, we should make CAI courseware for those teaching content that is abstract in content, complicated in process, difficult to express verbally, hard for students to understand, suitable for CAI form and expected to have obvious effects. Through an organic combination of traditional teaching methods and multimedia in the course

of teaching, the leading role of teachers in teaching activities can be given full play and the teaching effect will be further improved.

5. Focusing on Experiments and developing operational ability

As an applied course, Data Analysis extremely emphasizes the organic combination of theory and practice and experimental teaching is an important part of this course, whose basic task is to enable students to deeply understand various basic concepts and basic theories of data analysis by analyzing and processing data with actual background, to process multidimensional data with skilled application of data analysis methods, to improve students' ability to observe and analyze practical problems and improve students and to promote their capacities of solving practical problems by means of mathematical methods and modern computing methods

5.1 An Organic Combination between Data Analysis Method and SAS Software

In the teaching process, the introduction of statistical methods is combined with the statistical software SAS (Statistical Analysis System) so that students can not only learn the theoretical knowledge of statistical methods, but also know how to solve practical problems.

The SAS software is one of the most widely used data analysis software. The SAS system is a huge data analysis system which provides data steps and proc steps for data processing and analysis. However, It takes a lot of time and effort for beginners to learn. In order to make sure students has quick access to SAS without feeling too difficult to learn, we simply introduce some necessary SAS statements and certain some SAS procedures and sentences related to this course during teaching, so that students will have a preliminary understanding SAS system and can use SAS software to make a basic analysis of some data analysis methods, which will lay a foundation for further comprehensive and in-depth data analysis using this software.

5.2 Training students' ability to rationally explain results obtained

In the Data Analysis class, the ultimate purpose of the teaching of theoretical knowledge and cultivation of experimental ability is to solve practical problems. However, the output of all kinds of software can only be numbers or charts, so students have to analyze and interpret outputs to solve practical problems, which therefore make it necessary to develop students' ability to reasonably explain the results obtained.

In the teaching course, we will start from the following points.

1. The data source used by students must be reliable. Only by ensuring the accuracy and reliability of data, our analysis and interpretation make sense.

2. The results should be interpreted in combination of the political and economic background of data. For example, when analyzing the numerical characteristics of those data as China's per capita GDP in 1952-1997, we find that the data distribution is significantly right-sided, that there are many extreme values at the right end of data distribution and that the standard deviation of the data even exceeds the mean. In this case, the analysis of this result requires a combination with the data background. The reason is that there has been a rapid increase in the gross output of people since the reform and opening up, which leads to the characteristics of the above data distribution.

The purpose of combining theory with experiment is to deepen students' understanding of basic theories of data analysis methods (regression analysis, cluster analysis, principal component analysis, discriminant analysis and analysis of variance), master various methods of statistical software and give a reasonable explanation of calculation results in combination of specific circumstance and related knowledge.

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