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Engineering Education Accreditation: Exploring and Practicing the Analysis Method for Course Objective Achievement in "Digital Electronic Technology"

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Abstract

Based on the concept of engineering education accreditation, the analysis of course objective achievement is a key approach to evaluating student learning outcomes. The traditional assessment method for the "Digital Electronic Technology" course is relatively simplistic. This paper takes the "Digital Electronic Technology" course at Guilin University of Technology as a reform pilot, reconstructing the course evaluation system and objective achievement analysis method. By combining qualitative and quantitative approaches, a questionnaire survey was conducted, focusing on students' comprehensive practical weaknesses from the perspective of student learning autonomy. The study outlines methods for continuous improvement in course teaching, laying a solid foundation for further cultivating applied talents.

Subject Areas

Educational Technology

Keywords

Engineering Education Accreditation, "Digital Electronic Technology" Course, Assessment Methods, Target Achievement Value

1. Introduction

The certification of engineering education majors is gradually gaining widespread recognition from universities. Guided by the engineering education philosophy of "student-centered, outcome oriented, and continuous improvement", various

universities actively carry out reform and exploration in the fields of professional talent training mode, curriculum teaching mode, and curriculum construction [1]-[4]. The analysis of the achievement value of course objectives helps teachers grasp the overall quality of course teaching, discover potential weak links in teaching, and optimize teaching design and implementation strategies accordingly, thereby improving students' learning effectiveness and ability achievement. At the same time, based on the evaluation results of the achievement of course objectives, the rationality and support of the curriculum system can be reverse verified, effectively promoting the formation of a closed-loop quality assurance mechanism of "evaluation feedback improvement".

This article takes the "Digital Electronic Technology" course at Guilin University of Technology as a reform pilot, reconstructing the course assessment method and target achievement value analysis method; Using a combination of qualitative and quantitative methods to conduct a questionnaire survey, starting from the subjectivity of student learning, focusing on the weak links in students' comprehensive practice, sorting out methods for continuous improvement of course teaching, and laying a solid foundation for further cultivating applied talents.

2. The Current Status of Assessment Teaching in the Course of Digital Electronic Technology

As an important foundational course in the field of digital electronic technology, its overall objectives are set as follows: 1) to accurately explain the basic concepts, core theories, formulas, and theorems of digital electronic technology; At the same time, digital circuit models can be established for complex engineering problems in the field of automation, and problem solving can be completed through simplification and verification of logic functions. 2) Ability to systematically analyze the functional characteristics and working principles of various gate circuits, flip flops, combinational logic circuits, sequential logic circuits, as well as A/D and D/A conversion circuits; Based on the knowledge learned and literature research results, able to analyze the advantages and disadvantages of complex digital circuits, and make reasonable replacements for circuit structures and devices. 3) Through theoretical learning in the course, cultivate students' ability to carry out digital electronic circuit engineering design and application; At the same time, various factors that affect design goals and technical solutions can be comprehensively considered in the design and application process.

At present, there are problems with course assessment: 1) The assessment method is relatively single: traditionally, the final closed book written test is the main evaluation form, and the proportion of regular grades is often less than 30%. Moreover, it relies heavily on homework submission and classroom attendance, which makes it difficult to fully reflect students' comprehensive knowledge application ability and practical operation level. 2) The assessment focuses more on the memorization and simple application of theoretical knowledge, such as logic function simplification and circuit analysis, with a higher proportion of basic

question types. However, there is less emphasis on the assessment of complex engineering problem modeling ability, circuit design innovation ability, and engineering ethics awareness required by the course objectives, which is significantly different from the achievement oriented evaluation requirements emphasized by engineering education certification. 3) The process evaluation link is weak, and the standardization of experimental operations, collaborative performance of group projects, and the integration effect of ideological and political elements in the curriculum have not been included in the systematic evaluation system, resulting in teachers being unable to timely identify teaching shortcomings and provide targeted guidance and feedback to students.

In summary, it is imperative to promote the reform of the course "Digital Electronic Technology", especially the reform of the course objective analysis method.

3. Case Study on Achievement Value Analysis of Course Objectives in Digital Electronic Technology

Take the scores of all students in this course for each assessment segment. If the total number of students is N, the achievement value of the i-th course objective based on the score assessment method is represented as the weighted average calculated by assigning weights to the scores of each component. The total score is 100%, with classroom performance (including student note taking, classroom discussions, answering questions, etc.) accounting for 25% (course target 1 accounts for 12%, course target 2 accounts for 13%), homework accounting for 25% (course target 1 accounts for 9%, course target 2 accounts for 10%, course target 3 accounts for 6%), and final exam accounting for 50% (course target 1 accounts for 18%, course target 2 accounts for 17%, course target 3 accounts for 15%). An analysis was conducted on the quantitative evaluation results of 118 students from the 2023 automation majors' classes 1 - 3 for this course, with a comparative bar chart of the three course objectives shown in Figure 1.

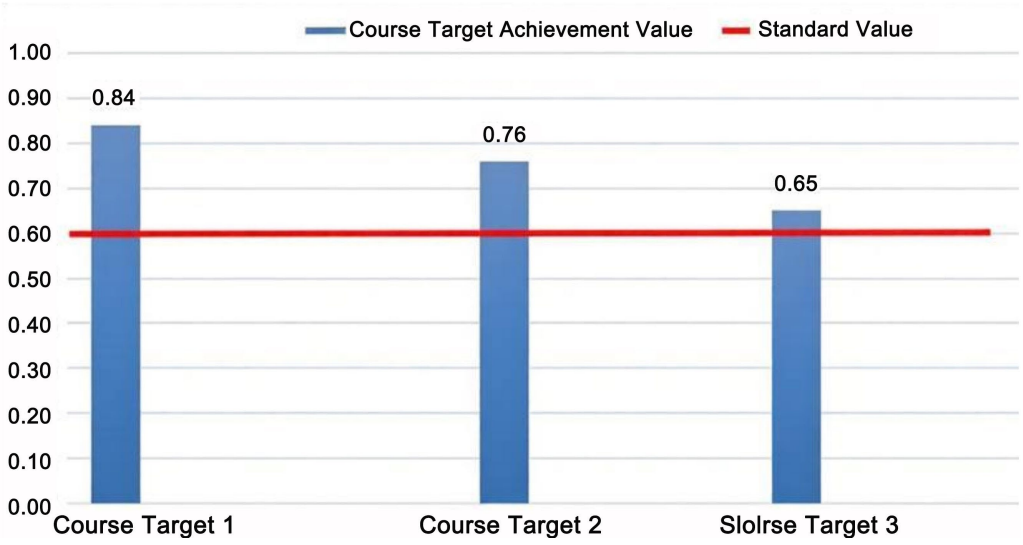

Figure 1. Achievement value of course objectives.

Conduct an accounting of the achievement of the three objectives of the course "Digital Electronic Technology": the achievement of objectives 1 and 2 is detailed in the above figure. All three objectives have been successfully achieved, and the achievement values have exceeded the standard value by more than 20 percentage points. Comparing the achievement performance of three objectives: Although the course objective 3 is relatively poor, it has improved compared to the achievement value of the same objective by previous students; The achievement of course objectives 1 and 2 is the most outstanding. Among them, course objective 2 focuses on testing students' ability to analyze digital circuit systems, achieving good results. Especially the achievement values of course objectives 1 is 0.84.

The questionnaire mainly involves the evaluation of the achievement of the course objectives. Each course objective is divided into five levels, corresponding to the distribution of achievement quality from low to high. The survey results of the achievement values of course objectives for all students in this course are shown in Table 1.

Table 1. Survey results on the achievement of course objectives.

Course target	5 point	4 point	3 point	2 point	1 point	Achievement Value of Course Objectives
1	62	54	12	5	0	0.87
2	56	60	11	6	0	0.86
3	21	39	46	25	1	0.68

After in-depth analysis of students' daily learning performance, homework completion quality, and final exam scores, it was found that there is a general lack of depth and systematic understanding of the core working principles of digital electronic technology among current students, especially in the practical application of knowledge and engineering transformation ability, which is relatively weak. Specifically, it is difficult to effectively integrate scattered knowledge points into circuit function design, and when facing practical engineering problems, the analysis ideas are not clear enough and the design methods are not firmly grasped. Therefore, it is planned to focus on strengthening the following aspects in the second semester of teaching: firstly, deepening teacher-student interaction, timely grasping students' learning difficulties through classroom communication, post class Q&A, and individual tutoring, and providing targeted guidance; The second is to strictly manage the learning process, by refining daily homework evaluation standards, increasing the frequency of in class questioning and periodic tests, and urging students to maintain sustained and solid learning engagement; The third is the independent practice section of system design, which attaches great importance to the cultivation of practical abilities. By setting up hierarchical experimental tasks and open design projects, students are guided to deepen their theoretical understanding through hands-on practice, gradually build a complete ability chain from principle analysis, functional implementation to system debugging,

effectively improve their proficiency in knowledge application, and ensure that students truly master the comprehensive ability to use digital electronic technology to solve practical engineering problems.

Based on the above calculation results, Students generally have low achievement values for Goal 3. A continuous improvement plan is formulated as follows: in order to systematically enhance students' analytical and design literacy in the field of digital circuits, high-quality extracurricular reading materials will be introduced in the teaching process, covering cutting-edge developments in digital electronic technology, classic design cases, and engineering practice methodologies, in order to expand students' theoretical horizons and stimulate innovative thinking. At the same time, by scientifically designing and arranging hierarchical learning reports, phased assignments, and comprehensive experimental reports, improving effective collection and feedback mechanisms, continuously tracking and recording students' mastery of various knowledge modules of digital electronic technology and the development trajectory of their application abilities, teachers can accurately diagnose weak teaching links, dynamically adjust teaching strategies, and ultimately promote students to gradually transform theoretical knowledge into solid abilities to solve practical engineering problems, achieving comprehensive improvement in three dimensions: knowledge understanding, method application, and engineering literacy.

4. Conclusion

This article focuses on the practical exploration of the reform of ideological and political teaching mode in the course of "Digital Electronic Technology". Based on the core concept of "student centeredness, outcome orientation, and continuous improvement" in engineering education certification, this course at Guilin University of Technology is used as a practical pilot to reconstruct the course assessment system and target achievement analysis method, achieving an organic integration of quantitative and qualitative evaluation. After the reform, the achievement of course objectives has significantly improved, with course objective 3 particularly outstanding in the dimension of comprehensive practical ability cultivation, forming a closed-loop quality assurance mechanism of "evaluation feedback improvement". The above practice not only effectively strengthens students' grasp of theoretical knowledge of digital electronic technology and enhances their engineering application ability, but also provides solid support for professional engineering education certification.

Fund Project

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Conflicts of Interest

The author declares no conflicts of interest.

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