

# Research and Practice on Examination Reform of Engineering Practice Courses

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**ABSTRACT:** Engineering and practicality are the main characteristics of electronic technology and application course. Engineering application ability and practical operation ability are the key contents of this kind of course assessment. The course assessment needs to closely follow the pace of curriculum reform, timely and dynamically reflect the teaching effect, and provide support for the formation of a closed loop in the teaching process. Firstly, this paper designs the overall idea of the examination of engineering practice courses. And taking electronic technology and application as an example, this paper adopts the combination of theory and practice, makes full use of the information conditions, emphasizes the breadth and depth of knowledge, pays attention to the examination of practical operation skills and application ability, increases the proportion of practical examination, and realizes the examination of the completion of teaching objectives; Secondly, it also gives the detailed design of the implementation of the theoretical content assessment scoring standard and the detailed design of the organization and implementation of the practical assessment based on non-standard answers. The practice results show that the integration of multiple assessment and evaluation, whole process assessment and evaluation, practical assessment and the implementation of online and offline, summative and procedural, standard and non-standard answer evaluation has improved the breadth and challenge of students' learning content, and the teaching effect has been significantly improved. This paper has certain reference significance for the examination reform of engineering practice courses.

## 1. INTRODUCTION

Electronic technology and application is a compulsory basic course for electronic communication majors, it is a bridge between basic electronic technology and professional courses, it is an important channel to consolidate professional basic knowledge and cultivate independent thinking and solve practical problems. Our curriculum implementation is divided into two semesters, 70 class hours in spring and 20 class hours in autumn, a total of 90 class hours. In 2018, the Ministry of Education issued the opinions on accelerating the construction of high-level undergraduate education and comprehensively improving talent training ability, which proposed to "reform the evaluation system, promote students to study hard, and vigorously promote the construction, use and learning of MOOC"[1]. In the same year, Wu Yan, director of the Higher Education Department of the Ministry of education, put forward the concept of "high-level, innovative and challenging" "GoldenCourse" for the first time. The essence of "GoldenCourse" is the unity of

knowledge and practice, practice, cognition, re-practice and re-cognition. In this regard, it is also proposed for the course assessment that "the course is difficult and needs to be obtained by jumping, and there are high requirements for teachers' lesson preparation and students after class"[2]. Based on the above background, the course of electronic technology and application puts forward four kinds of knowledge requirements in terms of knowledge, including sensor principle and application, typical analog circuit, digital circuit function and application, DC regulated power supply principle and application, combined with the requirements of the training outline and the talent training scheme of our college; In terms of ability, there are three requirements: circuit analysis, application testing and troubleshooting ability; In terms of quality, there are two requirements: rigorous and pragmatic, independent innovation and so on.

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## 2. SIGNIFICANCE OF EXAMINATION REFORM

### 2.1. Curriculum Reform

In order to achieve the above teaching objectives, this course has carried out curriculum reform to break the traditional basic curriculum system of electrical specialty. According to the composition and flow direction of electronic system, the content is set into 7 modules such as electronic system and DC regulated power supply, of which 30 class hours are theoretical and 60 class hours are practical class hours. In order to enhance the depth and breadth of teaching content, according to the needs of curriculum content, Timely push military and local excellent MOOC resources.

### 2.2. Significance of Curriculum Examination Reform

Examination is an important part of curriculum system construction. It is an important link to improve teaching quality and test teaching results [3]. It has the functions of evaluation, diagnosis, feedback, prediction and incentive. At present, the teaching reform of electronic technology and application curriculum has achieved initial results, but the curriculum assessment still uses the original assessment method, which is incompatible with the new curriculum reform and construction [4]. The curriculum assessment needs to closely follow the pace of curriculum reform, timely and dynamically reflect the teaching effect, and provide support for the formation of a closed loop in the teaching process. In addition, a scientific and reasonable assessment mechanism can effectively stimulate the enthusiasm of teachers and students to participate in teaching activities, so as to guide students to change their learning methods, boost their ability and continuously improve the quality of talent training[5],[8].

## 3. SPECIFIC MEASURES FOR EXAMINATION REFORM

Overall design: according to the setting of teaching content, the assessment of this course adopts the combination of theory and practice, makes full use of information conditions, realizes the examination of the completion of teaching objectives, emphasizes the breadth and depth of knowledge, increases the proportion of practical assessment, and pays attention to the assessment of practical operation skills and application ability.

### 3.1. Teaching Content of 70 Class Hours in Spring semester

Specific measures are: theoretical content online and offline mixed test, practical skills standard + non-standard combined test[6]. The proportion of theoretical assessment and practical assessment is 5:5.

Theoretical assessment. Set online pre test assessment for push resources; For the teaching module, the rain classroom stage test is set as the main element of formative assessment, and the offline closed book at the end of the course is taken as the final assessment result.

Practical assessment. The specific design is a combination of standard and non-standard tests[7],[9]. For confirmatory experiments, standard answers are used. A total of 10 experiments are selected, each accounting for 2% and a total of 20%; Three comprehensive experiments were set as non-standard answers, each accounting for 10% and a total of 30%.

Assessment method and organization and implementation method. See Table 1 for the detailed design of the implementation method of theoretical content assessment scoring standards.

Online push pre-test content: take the paperless closed book test in the rain classroom for four times and count it into the score, with a full score of 100 points each time. Half of the video viewing and answers are completed respectively. The test time is distributed in the whole teaching process, accounting for 4% of the total score.

**Table 1** Scoring standards for theoretical content assessment and organization and Implementation Measures

Items	Method	Scoring	Time	Percentage
Pre-Assessment	Closed book Rain class paperless	Draw 4 times and count them into the total score	During the course implementation	4%
Post-Assessment	Closed book Rain class paperless	According to the grading standard of Rain class	Mid term assessment of course progress	6%
Final test	Closed paper examination paper	Rated according to standard answers	Final assessment at the end of the course	40%

Offline teaching module: organize the online stage test by module, adopt the paperless closed book test in the rain classroom, score according to the standard answers in the rain class[10], and the test time is distributed in the middle of the course, accounting for 6% of the total score.

Final comprehensive examination: the offline paper closed book examination is adopted, and the scores are

scored according to the standard answers. The examination time is uniformly conducted at the end of the term after the end of the course, accounting for 40% of the total score.

The detailed design of practical assessment content and organization and implementation mode is shown in Table 2.

**Table 2** Practical skill assessment and organization implementation

Experimental content	Standard answer	Non standard answer
Sensor test, differential amplification, operation circuit, comparator experiment, DC regulated power supply experimented	2% each time, 10 times in total	
Signal processing experiment		√
Counter experiment		√
Alarm circuit		√

The practical skill assessment and the organization and implementation of the experimental assessment of standard answers are mainly for the experimental assessment of standard answers, mainly scoring from the aspects of component use, basic instrument operation, test process, etc.

Practical skill assessment and organize and implement the experimental assessment of standard answers. The experimental assessment of standard answers is mainly scored from the aspects of component use, basic instrument operation, test process, etc. the non-standard answer experiment is set as a highly comprehensive experiment, and students can adopt a variety of schemes, The specific implementation shall be carried out according to the steps of issuing tasks in advance-scoring classroom Exhibition-completing reports after class.

In the application of 555, the experimental tasks are issued one week in advance, and the students are required to find materials and use what they have learned to carry out scheme conception and circuit design; In this process, students can use the previous knowledge reserve, combination logic circuits and discrete components for scheme demonstration, and can also use the newly learned 555 timer to realize the core circuit; The intelligent technology can also be used to realize the circuit requirements, such as timing interruption of single chip microcomputer. The teachers can check the whole process and guide correctly in the design process.

In class presentation, the students build their own design circuit to complete the demonstration and defence. The teacher scores step by step according to the realization degree of the specific scheme. Finally, the teacher comprehensively evaluates and scores the weight value of the depth, breadth and practicability of knowledge and skills. For example, the weight is 0.7 for discrete components, and 0.8 for 555 timer, although it is difficult to use discrete components to realize the alarm circuit, it is less practical, so the weight value is low.

The scoring criteria for non-standard answers in the experimental assessment are as follows:

The standard answer score includes instrument use, experimental operation skills, data processing, experimental style, etc.

Skilled use of various instruments and equipment, improper use of instruments and equipment and wrong operation will be deducted by 1 point each time until it is deducted. If the instrument is damaged due to personal improper operation during the operation process, no score will be given.

Be able to correctly connect the positive and negative power supply; If the circuit connection is completed correctly within the specified time, 2 points will be obtained, and the experimental operation meets the specification requirements; If it can design by itself or measure and record in sequence according to the correct experimental steps, 2 points will be obtained; otherwise, 0.5 points will be deducted each time until all points are deducted.

If it can read and record correctly, 1 point will be obtained; otherwise, 0.5 points will be deducted.

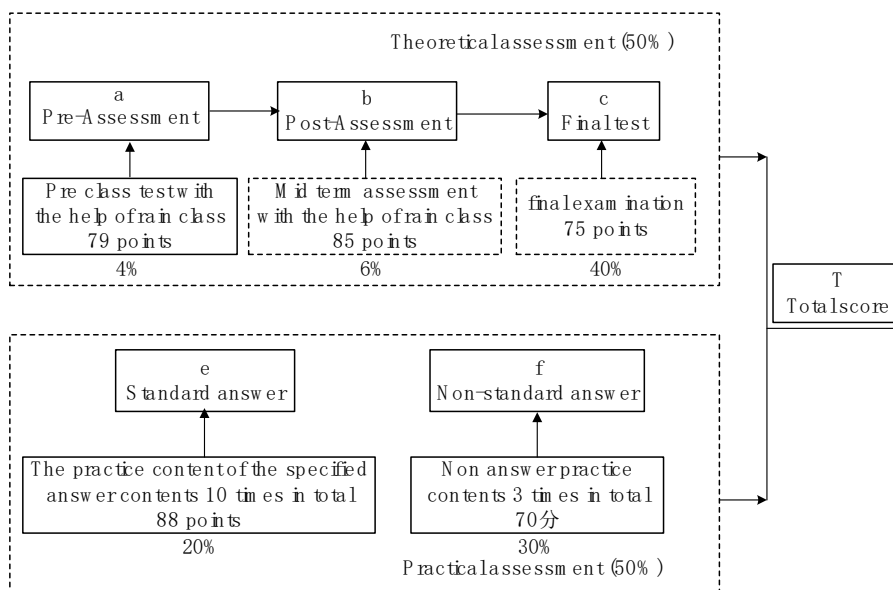
Take a student as an example, Figure 1 shows the process of obtaining the total score of 70 class hours of courses and the composition of the total score. T stands for total score, L stands for theoretical score, S stands for practice score. Other letters are defined in the Figure1. The scores of each part are shown in Figure 1 too. All scores was scored according to the hundred point system.

$$T = (L + S) \times 0.5 \tag{1}$$

$$L = a \times 40\% + b \times 12\% + c \times 80\% \tag{2}$$

$$S = e \times 40\% + f \times 60\% \tag{3}$$

Substitute the relevant data in Figure 1 into the equation (1)~ equation (3),then T=76.9.



**Figure 1** Assessment process and score composition

### 3.2. Project-based 20 Class Hour Practice Content for Autumn Semester

assessment, emphasizing the improvement of practical innovation ability. The specific process is shown in the Table 3.

All are set as practical assessment and whole process

**Table 3** Scoring standard of project practice content and organization and implementation method

Project Practice				
Step Name	Examination Mode	Assessment Criteria	Assessment time	Percentage of Achievements
Counter display	Experimental field demonstration	The function is normal and the layout is reasonable. According to the fastest completion efficiency, the full score is * 60%. For those who fail to complete, the score is between "0 ~ Full Score * 60%. The overall circuit layout is reasonable, accounting for 20%. The installation process is horizontal and vertical, avoiding crossing, beautiful circuit and reliable connection, accounting for 80% of the full score. (non standard answer)	Process assessment	20
AD conversion and display				15
Signal conditioning				15
Overall function test				5
Circuit technology				10
Experimental circuit analysis	Experimental report statement	If the principle description is correct, 1 point will be deducted for each mistake until it is completed		10
Schematic drawing		If the circuit is complete, 1 point will be deducted for each place until it is completely deducted		5
Fault handling	Experimental field demonstration	The test process setting is reasonable, the test method is correct, the fault phenomenon description is accurate, and the treatment methods and steps are clear		10
Maintenance style	Scene record	Classroom discipline: 2 points will be deducted for each violation of discipline Experimental style and habit: the instruments and meters are used safely, and the maintenance order of the experimental table is poor. 3 points will be deducted for each occurrence until all points are deducted		10

## 4. CONCLUSIONS

Multiple assessment and evaluation can make students

“busy”, focus on stimulating students' learning motivation and knowledge application, conduct whole process assessment and evaluation, implement online and offline, summative and procedural, standard and non-standard answer evaluation, strengthen the investigation of reading

volume, and improve the breadth and challenge of learning content.

Improve the assessment rules can make teachers “strong”, take improving the assessment rules as the goal, learn the latest teaching concepts and methods, use high-quality classrooms and attractive teaching resources to enhance students' interest in learning, and improve teachers' own teaching ability. Since the pilot work of examination reform was carried out, teachers have achieved excellent results in various teaching competitions, Won the national first prize and second prize in the national Electro technical and electronic experiment case design competition, one national first prize and one second prize in the National Youth electronic circuit teaching competition. Since the practice of the examination reform, more than 2000 students have been trained from point to surface in the teaching classes of electronic technology or related majors in the autumn semester of 2020 and the spring semester of 2021. In addition, through the investigation of students entering the follow-up professional learning, the professional teaching and research office and students generally reflect that this reform has played a good supporting role in students' after-school learning. The specific measures of examination reform have important reference significance for similar courses.

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