

# Practice on Construction of Linear Algebra Question Bank Based on ChaoXing Fanya Platform

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**Abstract:** In recent years, in all kinds of colleges and universities in our country, the ChaoXing Fanya platform has been widely used in informationize teaching of the courses. Relying on the ChaoXing Fanya platform, closely focusing on the linear algebra curriculum standards, the teaching team established a linear algebra question bank, adopted online and offline mixed teaching, combined paperless testing with process evaluation, which better reflects the goal of examination separated from teaching

**Keywords:** ChaoXing Fanya platform; Paperless testing; Examination separated from teaching

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## 1. Introduction

ChaoXing Fanya platform is an educational product of ChaoXing Group, which can meet the needs of college teachers to carry out online and offline mixed teaching to a large extent, and also provide important technical support for students' independent learning, participation in various classroom activities and evaluation. In recent years, it has been widely used in many colleges and universities in China.

Linear Algebra is a School Management Platform Compulsory Course offered for various majors in our school, including engineering major, economics and management major, science major, medical major, and agricultural and forestry major. It mainly discusses theories such as determinants, matrices, linear equations, vector systems, linear transformations, and quadratic forms. It focuses on training students' ability of calculation, abstract thinking and logical reasoning, which plays a very important role in the cultivation of students' comprehensive mathematical quality. However, for freshmen, the knowledge content and way of thinking of linear algebra are completely different from the mathematics knowledge they learned in high school. Its many concepts are directly elaborated in the order of definition, theorem, proof and example, and the proof methods have their own characteristics. In the questionnaire survey conducted in the early stage, 83.55% of the students think that the main difficulty in learning linear algebra is the poor mathematical foundation. In addition, 63.5% of the students think that the linear algebra course is difficult and the content is rather abstract, which is the main reason why many students think that their performance is not satisfactory. At the same time, due to the numerous knowledge points and limited class time, teachers cannot take into account all students in the course of teaching, cannot allow students to practice many contents, and cannot correct and solve various problems of students in a timely manner. Therefore, students always found it difficult to master the knowledge of linear algebra and their grades were not satisfactory.

The rapid development of information technology has accelerated the process of modernization of educational technology and make students understand that the achievement of good grades can only rely on their own efforts, and cannot rely on the "care" of teachers before the exam at the same time: Highlighting, intentional or unintentional help for them to review, etc., which can greatly reduce students' impulsive behavior before exams, thereby consciously and actively participating in the classroom, which is conducive to forming an active classroom atmosphere and establishing a good academic atmosphere.

## 2. Construct the Question bank Based on Chaoxing Fanya Platform

Because the construction of the linear algebra question bank is a long process and cannot be completed in a short time, we should gradually establish and perfect the construction of the linear algebra question bank. The question bank is not a simple patchwork and list of test questions. It should be organized and implemented according to the unified requirements of course standards, teaching syllabuses and so on.

### 2.1 Develop curriculum standards

The curriculum standard is the basis to Construct a question bank. In the formulation of curriculum standards, on the basis of fully understanding the professional personnel training program, the nature, positioning, objectives, class hours, course assessment, etc. of the course are clearly defined to point out the direction for teachers and students.

### 2.2 Construct a question bank

(1) First is to establish a directory folder for the question bank. The directory is the frame of the construction of the question bank. The directory must be a relatively independent set on content. And according to the need for randomly composing a test paper, each directory should contain a certain number of questions of the same question type, otherwise it will lose the meaning of randomly composing a test paper. According to the linear algebra curriculum standards and the main knowledge points of linear algebra, we have established 22 directory folders on the platform.

(2) Second is the choice of question type. Chaoxing Fanya platform provides us with a wealth of question types, including single choice, multiple choice, judgment questions, fill in the blank, short answer, calculation questions, connected questions and more than ten kinds of questions. And according to the nature of the course, we can set our own new question type. For the course of linear Algebra, considering the diversity of problem-solving methods for mathematical problems, the flexibility of problem-solving forms, and the difficulty of students inputting mathematical symbols on mobile phones, we mainly use fill-in-the-blank, multiple-choice and comprehensive questions when setting question types.

(3) Third is the establishment and addition of exam questions. For the paperless examination, the number of questions in the question bank should be large enough, the coverage should be wide enough, and the difficulty of the questions should also be taken into account, otherwise it is difficult to implement the goal of the curriculum.

Due to the large number of questions in the question bank, our work is completed by the teachers of the whole course group. Different from the question types that should not be too various, the number of questions in the same knowledge point should be enough to meet the requirements for composing a test paper in order to meet the requirements of randomly composing a test paper and reduce the repetition rate.

Under the established directory, teachers will use different types of questions according to the curriculum standards and the degree of difficulty of the teaching contents that teachers require students to master. The platform can meet the requirements for adding test questions in each catalog and adding questions by manual input. The platform provides common characters, formulas, underscores in the question stem box. It can even be used to upload pictures to the problem stem. It can meet the requirements of the problem. However, due to the excessive number of mathematical symbols, there will be a large number of formulas floating up when manually entering the question. In order to ensure the neatness of the final question, we allow teachers to edit the questions in a Word document and upload a screenshot of the questions in the form of an image.

The course of linear algebra requires students to master knowledge points such as determinant calculation, matrix operations and properties, rank of vector systems, general solutions of linear equations, standardization of orthogonal vector systems, quadratic forms, and so on. When setting questions, we propose targeted questions such as multiple-choice questions, fill in the blank questions, and comprehensive questions. In order to facilitate students' answering with mobile phones or computer keyboards, part of the solving process of comprehensive questions has been presented, and students only need to fill in the blank spaces in the questions according to the existing process.

### 2.3 Compose a linear algebra test paper

There are two ways to compose a test paper. One is to compose a test paper manually. Teachers only need to select the corresponding knowledge points in the question bank and click to complete it. The other way is to compose a test paper randomly and create the paper on the Chaoxing Fanya platform. Teachers can compose a test paper according to the prompt settings of "automatically and randomly compose a test paper" and the number of questions. In order to ensure that the repetition rate of the questions chosen by the students is low, we can generally set the number of randomly composing a test paper to 10 sets.

To a large extent, the structure of the exam paper is the concentrated embodiment of the curriculum standards. The distribution

of question type scores can be carried out by question bank,question bank directory and difficulty degree.In order to better reflect the curriculum standards in the exam paper,it is suggested to choose the more important knowledge points under the directory of selected questions to compose a test paper according to the question bank directory,and the proportion of scores in a test paper is relatively high,and vice versa,it is relatively low.After the construction of the question bank,it can be realized that chapter testing,final test,automatically composing a test paper,manual typesetting,etc.,which is convenient for students to practice in peacetime and review at the end of the semester.

## 2.4 Implementation of mixed online and offline linear algebra teaching activities

The platform has a score management function,which can set the weight of attendance,homework,chapter exams,and participation in class questions and discussion in the teaching process,and the teacher or the platform will score the teaching activities accordingly,so as to form the classroom performance of each student.

## 2.5 Organization of paperless exam activities and grading exam paper

(1) First is the organization of paperless exams.Multiple sets of test papers can be extracted from the question bank as backup papers.The teacher can release the test papers according to the test arrangement before the test,and the students in the test class will immediately receive the test information on their mobile phones,but the students cannot see the test papers at this time.Since the teacher also randomly publishes the test papers and does not know which set of papers to be tested before the test starts,such a paperless test can ensure that the test papers will not be leaked and can reflect the students'learning situation more objectively.

(2) Second is grading exam paper.It is necessary to be objective and fair in the process of grading exam paper,and paperless examination can realize automatic marking,which greatly improves the fairness of examination.However,subjective questions such as fill-in-the-blank questions and comprehensive questions also requires manual grading,because the grading of paperless examination papers on the Chaoxing Fanya platform will face the recognition of characters,the letter case,numbers and Chinese characters.If the possible results provided by students are not taken into account in advance in the answer area,the system will determine errors.

## 3. Conclusions

Through a systematic analysis of the shortcomings of linear algebra teaching in our school,relying on Chaoxing Fanya platform,the teaching team has built an online linear algebra course suitable for students in our school,which meets the learning requirements of students of different categories and levels in our school,and further improves students' independent learning ability. However,our current work is far from enough,and we will continue to explore various teaching reforms,such as the establishment of a test paper evaluation index system consisting of validity,difficulty and reliability.In addition,the construction of the question bank is the basis of examination separated from teaching.It is necessary to combine the knowledge points of each chapter of the course and set the scores of each chapter reasonably.At the same time,it is necessary to avoid the repetition of the test questions,and ensure the richness of question type and sufficiency of the question quantity of the question bank.In the future,we should constantly update and supplement the question bank to meet the different requirements of the subject.

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