Data Mining Algorithm and the Effectiveness of Mathematics Classroom Teaching based on Support Vector Machine

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Abstract

With the rapid development of big data, cloud computing, the size of the computer processing data is huge. Data mining is the process of revealing a new relationship, trend and pattern by a careful analysis of a large number of data. In this paper, the author analyzes data mining algorithm and the effectiveness of mathematics classroom teaching based on support vector machine. Through data analysis, the results show that teachers are more inclined to teach and ask questions, while students prefer to explore cooperative learning methods. In the process of classroom teaching, teachers should arouse students' enthusiasm and initiative, and further improve the efficiency of classroom teaching.

Keywords: Data mining algorithm, Mathematics teaching, Support vector machine, Teaching effectiveness

1. Introduction

As the data mining technology has the advantage of extracting the specific data model from a large number of data, it has been widely recognized and applied. At present, one of the main focuses of the application of data mining in the field of education is how to construct the teaching system of data mining [1-2]. With the rapid development of big data, cloud computing, Internet of things and other emerging areas, the computer needs to deal with the scale of the data becomes huge. Therefore, the analysis and mining of large data has become the focus of research in recent years [3]. The high performance of the existing database management system while providing data storage, query, update, security and other functions, but cannot realize the potential knowledge in data mining, therefore, intelligent analysis and mining of large data is imminent. Data mining, also called knowledge discovery in data, refers to the process of extracting or "mining" knowledge from a large amount of data, that is, by analyzing a large number of data, to find out the hidden and useful information [4]. The main steps of KDD include: data cleaning, elimination of noise data and inconsistent data; data integration, data mining from many different sources, will need multiple sources of data are combined to eliminate redundancy and aggregation; the selection of data, for each specific analysis and data mining, to extract relevant data from the database or data warehouse, in order to reduce the data size, ease the pressure of memory and processor resources; the data transformation, using the summary or aggregation operation, will transform the data into a form suitable for mining; data mining, the mining algorithm using machine learning or data for the selected data analysis, mining knowledge or models the potential from the model; evaluation, some based on interest measure [5-6]. To evaluate the mining results, to ensure the mining model is useful and novel; the knowledge representation, visual or graphical representation of data, convenient for users to understand.

Around the data mining work, a large number of researchers for many years of research. But with the rapid development of cloud computing, big data, networking and other emerging areas, the object of data mining, technology and applications have changed. Mathematics in the field of real life and science and technology has a wide range of

applications, mathematics everywhere, which shows the importance of mathematics learning[7]. However, students often do not feel the usefulness of mathematics and mathematics and the reality of close contact, of course, the reasons for the above phenomenon is multifaceted. From the point of view of education, education is to develop all-round development of people, but in fact, we evaluate the final results of education is only the students' test scores[8]. Effective teaching is a kind of modern teaching idea in order to improve the work efficiency of teachers, strengthen process evaluation and target management. That is to say, the effective teaching should pay attention to the student's lifelong development, pay attention to the teaching benefit, it is a kind of strategy to improve the teaching efficiency. This requires teachers in the usual course of teaching, effective teaching consciousness, skills and methods of flexible use of classroom teaching, using teaching resources, optimize the teaching organization, teaching situation, to improve the efficiency of classroom teaching, promote students' lifelong development.

2. Data Mining Algorithm and Support Vector Machine

2.1. Data Mining

Data mining is the process of revealing a new relationship, trend and pattern by a careful analysis of a large number of data. With the advent of big data era, a variety of common data analysis method has been widely studied and applied in research and industry. Among them, the data mining method is an important method in recent decades has been the focus of many researchers' attention. One of the hot spots. As a means of human visual data analysis channel based on Visualization in the field of play to help users understand the data, data characteristics, and auxiliary reasoning decision-making role. In recent years, with the development of visualization, analysis methods of visualization began to play an important role in many fields such as based on text analysis, social network analysis, spatial data analysis in the field of mining. The data, because the user needs to understand the result of data mining or process, testing and verification, visualization has become a kind of Auxiliary data mining process means, and gradually developed a series of visualization based data mining methods, and used to assist in enhancing the understanding of data mining, interactive, and even the algorithm accuracy.
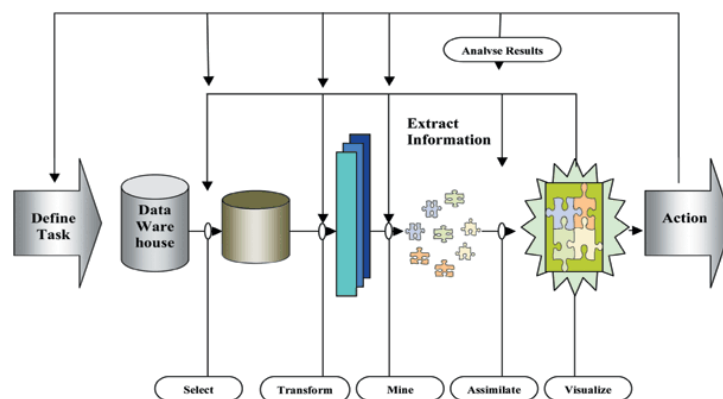

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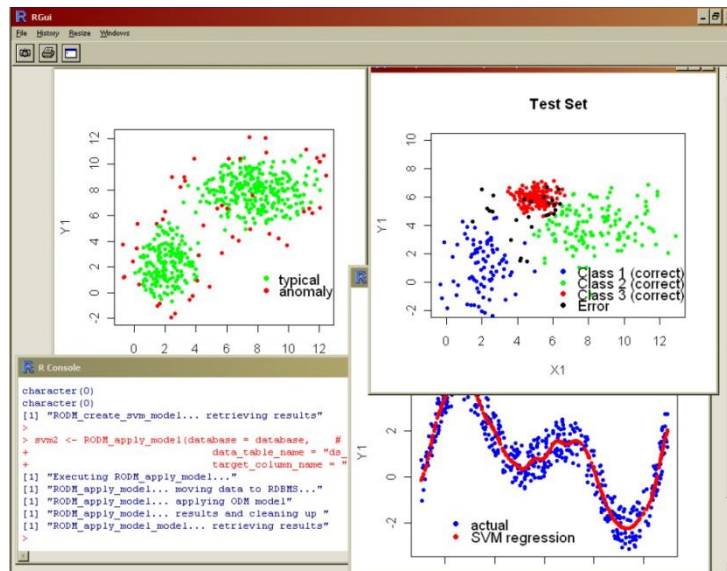

Figure 2. Data Mining Example

The task of data mining is to discover patterns hidden in the data, which can be found in the model is generally divided into two categories: descriptive model and predictive model. The description model of existing data in fact do specification, describe the general characteristics of the current data; predictive model is based on the time for the key parameters for time series data, according to the history and current value to predict its future value, according to the characteristics of the model, model is subdivided as follows:

1) *Classification model:* the classification is to construct a classification function (classification model), the data mapping has some characteristics to a given category. The process consists of 2 steps: the use of model creation and model! Model created by means of learning the training data set to build the classification model; the model refers to the use of test data and the new data are classified using the classification model. The training data set is a class label, *i.e.* before classification, divides the categories have been identified, usually the classification model is given by the classification rules, decision tree or mathematical expression of the.

2) *Cluster model:* clustering is the data points into several clusters, the difference between classes of data should be as large as possible, within class data difference should be as small as possible, which is to minimize the similarity between class similarity principle, maximum class, and different classification, clustering to divide the category is unknown, it is one kind does not rely on predefined classes and classes with unsupervised training data label sets, without background knowledge, including the number of classes by the system according to some performance indexes are determined automatically!

3) ***Regression model:*** the function definition and classification model of regression model is similar, the main difference is that the classification model using the discrete predictive value, and the regression model with a continuous predictive value! In this point of view, classification and regression are the prediction problem! But in the data mining industry, it is generally believed that: the prediction method for the class label classification, prediction of continuous values (for example, using the regression method for the forecast). Many problems can be solved by linear regression, for many nonlinear problems can be transformed by the variables, which can be converted to linear problems to solve.

4) ***Association pattern:*** association patterns are the association rules between data items, which are related to the different items in the same event, such as the correlation between different commodities purchased by customers in the same purchase activities.
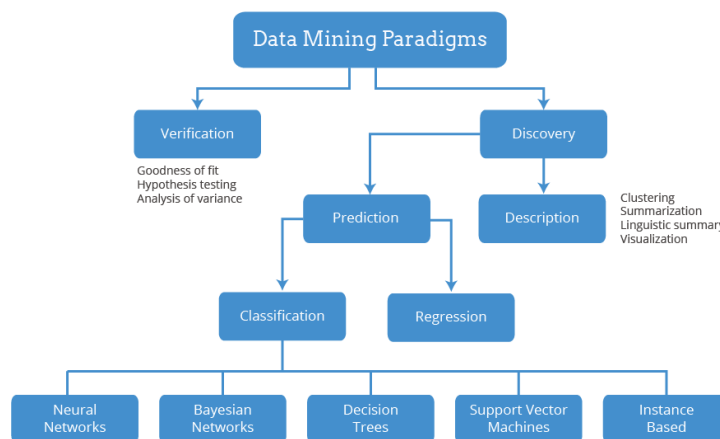

Figure 3. Classification of Data Mining

Cloud theory is a new theory for handling uncertainty, as the main tool to deal with fuzzy problems, fuzzy set theory is proposed to describe the fuzzy membership function of things to be this or that; however, once the membership function is used to describe fuzzy sets, fuzzy reasoning and other aspects after longer this is the traditional fuzzy, fuzzy set theory is not complete. To solve this problem, Professor Li based fuzzy set theory and probability statistics in the traditional forward qualitative and quantitative uncertainty conversion model, cloud model, the fuzziness and randomness of the qualitative concept fully integrated together, a qualitative analysis and mapping the quantitative basis between them, as the knowledge representation.
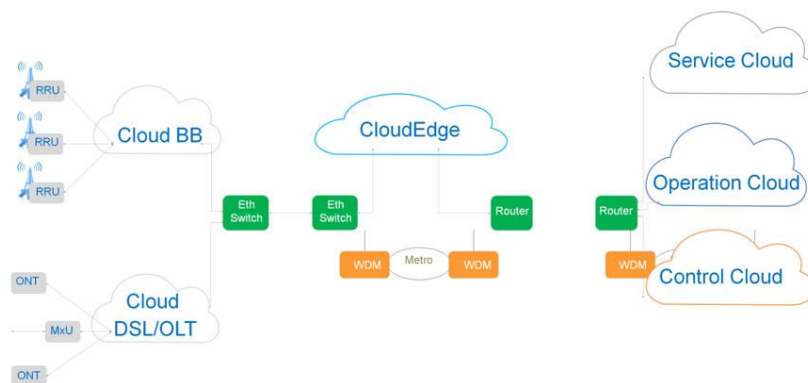

Figure 4. Cloud Model

2.2. Support Vector Machine

Support vector machine (SVM) is a statistical learning theory based on the new machine learning method, because of its excellent learning performance, has become a current research hotspot of machine learning.SVM is a machine learning based on the kernel function, its generalization ability is largely dependent on the choice of kernel function. Depends on the learning efficiency of SVM in the sample data set size, but the SVM sample data for large-scale practical problems set training efficiency and can not achieve the desired training efficiency. Therefore, in order to make the SVM algorithm to further improve the training efficiency and generalization performance, the algorithm is improved and inevitable. Although SVM has very prominent the advantage in theory, but compared with the theoretical research. Application research is still lagging behind, there are only a limited number of experimental reports, and more of the simulation and comparison test. How to apply SVM to the real life is the need to continue to carry out new exploration.

In order to find an optimal function, a requirement follows the minimization of the expected risk:

$$R(\pi) = \int L(y, f(x, \pi)) dF(x, y)$$

Therefore, the expected risk of R (π) to replace the experience of risk:

$$R_{emp}(\pi) = \frac{1}{l} \sum_{i=1}^{l} L(y_i, f(x_i, \pi))$$

Vapnik after in-depth study put forward the principle of structural risk minimization (SRM), that is:

$$R(\pi) \leq R_{emp}(\pi) + \sqrt{\frac{h \ln\left(\frac{2l}{h}\right) - \ln\left(\frac{\eta}{4}\right)}{l}}$$

In the linear separable model, classification of SVM in a H inner space structure for super plane:

$$\langle w, x \rangle + b = 0, \qquad w \in H, b \in R$$

For linearly separable sets of samples, the total can be adjusted by w and b:

$$\langle w, x \rangle + b \geq 1, y = 1$$

$$\langle w, x \rangle + b \leq -1, y = -1$$

Obviously, this adjustment does not change the discriminant function (5). Define two standard canonicalhyper planesas:

$$\langle w, x \rangle + b = 1 \qquad and \qquad \langle w, x \rangle + b = -1$$

Define the classification interval (margin) as:
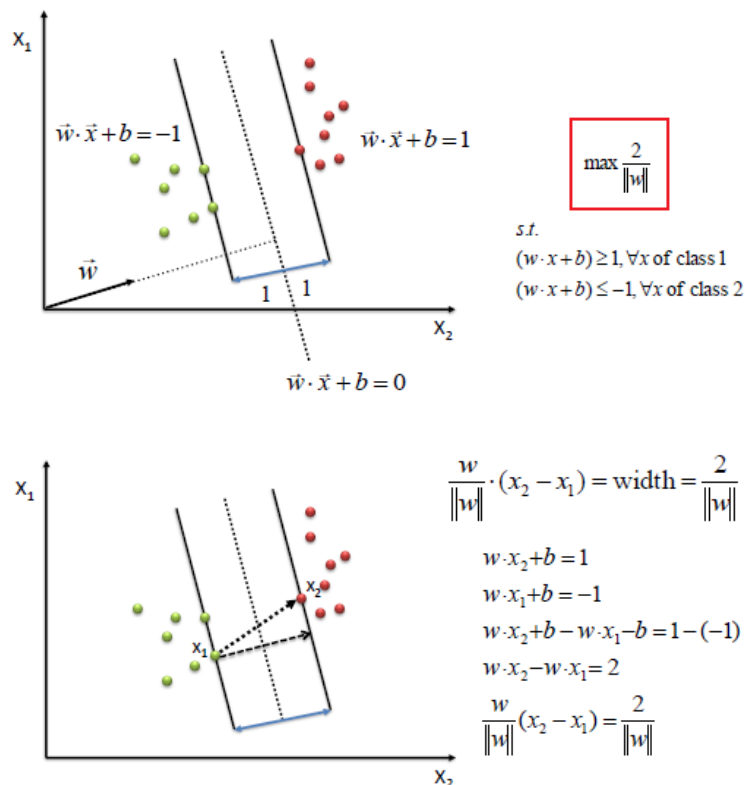
$$\rho = 2r = \frac{2}{\|w\|}$$

Figure 5. SVM Classification

As a result, the optimization problem for linearly separable SVM is:

$$\min J(w,b) = \frac{1}{2}\|w\|^2$$

The problem can be solved by constructing the Lagrange multiplier method to solve the problem.

$$\max W(\alpha) = \sum_{j=1}^{l} \alpha_j - \frac{1}{2}\sum_{i.j=1}^{l} \alpha_i \alpha_j y_i y_j x_i x_j$$

$$\sum_{j=1}^{l} \alpha_i y_j = 0$$

3. Research Design

3.1. Questionnaire

Classroom teaching is the main position of the implementation of education, but also an important channel for the implementation of quality education. However, the current situation is: teaching takes a long time, students learning pressure, the efficiency of classroom teaching is low. Abstract according to the height of the mathematical and logical features, we need to change the traditional teaching concepts, improve teaching efficiency, improve students' learning efficiency, reduce the learning pressure. Through the questionnaire survey, to understand the existence of mathematical problems in classroom teaching, to further understand the impact of various aspects of the effectiveness of classroom teaching, and puts forward the corresponding strategies to solve these problems.

A total of two questionnaires were investigated, and the factors influencing the effectiveness of mathematics classroom teaching were investigated. The production of this questionnaire is under the guidance of the teacher, in reference to a large number of relevant information on the basis of the completion.

3.2. Data analysis

Through the collation and statistical analysis of the questionnaire, the students' mathematics learning situation and teachers' teaching situation were obtained:

Table 1. Preview Situation

Not Preview	Rarely Preview	Teacher arrangement	Often preview
32%	33%	6%	29%

Table 2. Preview of Students

Content see it again	Find the key	Draw a question	Query data
8.5%	25%	29%	6.5%

Can be seen from the above analysis, the real Keqianyuxi students accounted for very little, which prepare students only a small part of the correct and effective preview, can really achieve the preview effect, at the same time, teachers are mostly on teaching material preparation and the preparation of teaching design. Preparing for the study of mathematics is very important, which requires teachers to improve the degree of attention to prepare before class, and guide the students to correct the preview before class. In addition, the teaching material is only a tool of teaching, the students are the real masters of the classroom. In order to achieve effective classroom teaching, must have the thorough understanding and mastering of the students, master students have the cognitive structure, students have some knowledge of the level of understanding of students' mathematics learning psychology and the recent developments in the area, understand the teaching environment, make full use of the existing teaching facilities.

Table 3. Students' Learning Style

Inquiry Teaching	Autonomous learning	Teacher explain	Cooperative learning
22%	25%	19.5%	33.5%

Table 4. Teaching Methods of Teachers

Professor type	Question type	Inquiry form	Other
35%	27%	19%	17%

From the above analysis, we can see that teachers tend to teach, ask questions, and students prefer to explore cooperative learning methods. Students do not like the way of teaching will reduce their interest in learning mathematics, reduce the enthusiasm of learning mathematics, and affect the effectiveness of mathematics classroom teaching. Therefore, in the future, teachers should change the teaching idea, improve the teaching methods, and further improve the efficiency of classroom teaching.

Table 5. Student Participation

Positive thinking	Passive participation	Take part in the class that you are interested in	actively participate in
25%	33%	21%	19%

From the above analysis can be drawn, the main task of the students in class is to listen carefully, in the teacher's request to participate in classroom teaching activities; more teachers also just ask students to listen, to think. The whole classroom activities, teachers occupy the main position, cannot be left to the students enough time and space, reflecting the subjectivity of the students. Students are the masters of the classroom teaching, to mobilize the enthusiasm and initiative of the students in the classroom teaching process, play the subjectivity of students, teachers play the leading role, to further improve the efficiency of classroom teaching.

Table 6. Ways of Learning after Class

Do math problems	Reading textbooks	Summary of knowledge	Preview
48.7%	15.4%	14.2%	21.7%

Table 7. The Efficiency of Learning Mathematics

Low	Commonly	High	Very high
37%	35%	19%	9%

The above analysis shows that the students' mathematics learning most of the way to do, a small part of the students is summarized. Most of the students do not love learning mathematics, mathematics learning efficiency is low, In fact, in the usual course of study, students are exposed to mathematics is abstract, rigorous logic level, students feel mathematics interest, practicality and the beauty of mathematics, only through repeated exercises and mechanical exercises to learn mathematics, making mathematics learning into a vicious spiral.

3.3. Result Analysis

Through the analysis of the questionnaire we found that students and teachers agreed that pre class preparation is very important for mathematics learning, but students do not master the correct method of preparation, do not know how to prepare, teachers have not paid enough attention to, cannot effectively guide. Careful teaching design is conducive to the mobilization of students' learning enthusiasm; stimulate the students' learning motivation, but teachers still use the traditional teaching methods. Students hope to be more involved in the classroom activities, the real master of the classroom, but the teacher did not leave enough time and space for students. Under the new curriculum requirements, the problem teaching is very popular, but the "Q" is not the core issue, "ask" is not a guide value, only pay attention to "ask" the surface, do not pay attention to "ask" to questions light feedback phenomenon everywhere.

The teacher knows the right way to learn the importance of really learn math classes, but there are few teachers in this aspect to give students the correct and effective guidance, mistakenly believe that problem is the only way to learn mathematics. In fact, such a mathematical learning method, the student's learning pressure, learning mood, learning efficiency is low, is not conducive to the comprehensive and sustainable development of students. This requires teachers to pay attention to the guidance of students' mathematics learning methods, and further research in this area, through the improvement of students'

learning methods to improve students' learning efficiency, reduce the pressure of primary school students' learning.

4. Influencing Factors and Improving Strategies of Mathematics Teaching Effectiveness

4.1. Factors Affecting the Effectiveness of Mathematics Teaching

There are many factors that affect the effectiveness of mathematics classroom teaching, but the influence of teacher's personal efforts on the lesson preparation is the influence of the teacher's personal efforts, that is to say, the influence of teachers' subjective initiative. Pre class preparation in the whole teaching process of the position cannot be ignored, the preparation before class is an essential part of teaching, it is the embodiment of teachers' subjective efforts and teaching attitude. In addition to the preparation of teaching materials, the students and the teaching environment are also essential to prepare lessons. First of all, teachers teaching content, teaching content is not prepared but will read textbooks lesson plans, write again, and to further study in this section based on the textbook, to further grasp the teaching content in the status of the whole chapter and even the whole teaching, measure its teaching value. Secondly, teachers should grasp the rich teaching resources, in the process of teaching, appropriate increase the relevant extra-curricular knowledge, to improve students' learning interest. Again, the students are the main body of education, subject teaching, classroom teaching must be combined with the age characteristics and psychological characteristics of students, learning ability, thinking ability, to improve the effectiveness of classroom teaching, so students are preparing the necessary steps. In addition, the teaching environment has an important influence on the teaching effect, so teachers should according to the characteristics of students and teaching content, make full use of existing teaching facilities, create a favorable teaching atmosphere and improve teaching efficiency.

Effective interaction between teachers and students is the main factor to improve students' ability to learn mathematics, and questions are often used as a dialogue between teachers and students. But many times for questioning, teachers or cannot grasp the whole or the difficulty is too large, or too simple, or can't fasten the hearts of students, or only pay attention to the questions and feedback to the light, will reduce the students' interest in learning mathematics. In the course of classroom teaching, teachers lack of students' respect and care, they always concern outstanding achievement, enthusiastic students, while ignoring the students' overall learning mood, and could not fully understand students' situation. This requires teachers to make a comprehensive understanding and evaluation of students' learning process and learning results, in order to improve students' learning motivation and improve the efficiency of classroom teaching.

4.2. Strategies for Effective Classroom Teaching

Classroom learning is an important part of student learning, and classroom time is limited, to improve the efficiency of student learning, we must first improve the efficiency of classroom teaching. Teachers are the leading teachers in classroom teaching, we must realize the harm of low efficiency teaching, we should have the awareness of improving the efficiency of classroom teaching, and be able to take effective measures to improve the teaching efficiency. To change the concept of teaching, we must first change to teach how much to measure the quality and efficiency of teaching ideas, abandon the old teaching concept in my center, to improve the students' learning efficiency by improving their teaching skills, teaching methods, rather than the increase in the number of students learning time and do. The purpose of education is not only to enable students to learn knowledge, but also to learn to think, learn to innovate, to learn the knowledge can be flexible application. Our teaching is not to finish the teaching task as the goal, but to the

students' lifelong development as the starting point, so that students learn to think, learn to learn. The first student is a person, we cannot use them temporarily to evaluate their achievements, teaching is not a process of knowledge and reception, but a process of students' interest in learning, learning to master the methods of training, improves the learning ability. Only have interest in learning mathematics, students will take the initiative to learn; only to improve learning ability, students can learn more knowledge at the same time; only to learn, students can at any time and any place to learn any knowledge required.

Teachers should encourage and guide students to participate in classroom activities, it is left to the students to observe, explore, thinking, speaking, imagination, participation, performance of time and space, so that students do the real master of the classroom. For example, the concept of learning function of the class, function concept is the difficulty of this section, through the way of questioning teachers can guide students to think, the gradual introduction of the concept of function, but also can deepen students' understanding. In the process of mathematics teaching, teachers can use the novel teaching methods, arouse students' curiosity, arouse students' curiosity, and stimulate students' interest in learning mathematics. In addition, you can also design some interesting problems, create some interesting artistic conception, stimulate students' interest in learning, and improve the efficiency of classroom teaching. At the same time, it can also guide students to collect some curious mathematical knowledge, organize students to take part in some interesting activities, *etc.*, which are beneficial to students interested in mathematics.

5. Conclusions

This article through the literature, using data mining techniques and questionnaire analysis and interview results combing, studied the present situation of the effectiveness of mathematics teaching; a new understanding of effective mathematics classroom teaching; the teaching and learning of two dimensions of the preliminary establishment of the effective mathematics classroom teaching evaluation standard. Classroom learning is an important part of student learning, and classroom time is limited, to improve the efficiency of student learning, we must first improve the efficiency of classroom teaching. Teachers are the leading teachers in classroom teaching, we must realize the harm of low efficiency teaching, we should have the awareness of improving the efficiency of classroom teaching, and be able to take effective measures to improve the teaching efficiency. To change the concept of teaching, we must first change to teach how much to measure the quality and efficiency of teaching ideas, abandon the old teaching concept in my center, to improve the students' learning efficiency by improving their teaching skills, teaching methods, rather than the increase in the number of students learning time and do. This can reduce the student learning time and learning pressure based on the improvement of students' learning efficiency; increase the interest of learning mathematics, so that students get a sense of achievement in learning mathematics.

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