

# A Study of Intelligent Teaching in High School Mathematics-Take Ellipse Teaching As an Example

Yong Zhang\*, Qiu zhen, Xiaowei Zhang

School of Mathematics and Statistics,  
Yancheng Teachers University, Jiangsu 224002, China

\* E-mail of the corresponding author: [zyytc@126.com](mailto:zyytc@126.com)

DOI: 10.56201/ijee.v8.no5.2022.pg41.67

*The research is supported by the research project of higher education reform in Jiangsu Province.No.2019JSJG257, Special research project on Rural Education in Yancheng City.No.XCZX21090, Yancheng educational science planning project in 2021. No. 2021-L-136. (Sponsoring information)*

---

## Abstract

*This paper analyzes the origin, concept, and development of intelligent teaching and briefly introduces the environment of intelligent teaching. At the same time, this paper mainly compares the differences between traditional teaching and intelligent teaching and designs a lesson plan for intelligent teaching by taking the teaching of the ellipse in sophomore mathematics as an example. This paper also investigates the responses of high school students to intelligent teaching using a questionnaire. The advantages and problems of intelligent teaching in high school classrooms are analyzed, and suggestions are also given.*

---

**Keywords:** *High school mathematics, Intelligent teaching, Ellipse*

---

## Introduction

With the development of modern information technology and the improvement of science, China is in the era of big data. The Internet and information technology have been applied to every aspect of people's life and production, which has greatly improved people's way of life. The application of modern information technology to education has also become a trend, and intelligent teaching has come into being[1]. Intelligent teaching is a pedagogy that uses modern information technology and Internet technology to enable students to learn what they are learning, driven by interest and curiosity. At the same time, teachers are able to develop their teaching better with the aid of big data and devices. All in all, intelligent education has improved the efficiency of teaching and learning to a certain extent, completed the transformation of modern education, and is an important educational method in the world of education[2].

Some examples of Intelligent Class development abroad include Singapore's plan to set up wi-fi, interactive whiteboards, computers, and other equipment in the classrooms of "schools of the future." At the same time, a simulated learning environment and online heuristic learning agents have been set up to provide online question and answer services and relevant learning materials to students. [3] The TEAL classroom at the Massachusetts Institute of Technology (MIT) in the United States uses a multi-screen presentation, connecting classroom tables and chairs to electronic devices in a group layout. At the same time, each group is equipped with instruments to record all the students' computer data and provides an interactive web-based course management system and individual real-time feedback management system for students and faculty. [4] The "futuristic classroom" at Durham University in the UK uses intelligent boards and intelligent desks to form a intelligent teaching environment that allows for collaborative discussion and personalized learning among students. [5]

The focus of domestic research on intelligent teaching is mostly in the areas of spatial structure design, theoretical foundation, and functional analysis. Professor Huang Ronghuai believes that the formation of a intelligent learning environment requires learning methods, educational resources, teaching methods, and intelligent technology tools. In order for learners to have an easy and effective learning experience, they need to pay full attention to the role of intelligent learning in the four dimensions of environment perception, activity recording, community connection, and scenario recognition in response. [6] Hu Wang et al. designed a learning model specific to intelligent teaching based on the environmental requirements needed for intelligent teaching from the individual and collaborative learning models, respectively. [7]

The research object of this paper is intelligent teaching, and the Intelligent Class that appears in the paper is synonymous with intelligent teaching in this paper.

In this paper, we reviewed thesis materials, introduced the concepts of intelligent teaching and intelligent teaching design in detail, and also carried out intelligent teaching design through hands-on practice. At the same time, this paper tries to investigate the students' acceptance of intelligent teaching and the areas where intelligent teaching is not perfect by means of questionnaires and proposes relevant suggestions for the existing problems.

The research implications of this thesis are as follows:

1. To understand the actual acceptance of intelligent teaching by students, to improve the utilization of new media in Intelligent Class and to improve intelligent teaching activities, to provide teachers with some references to improve intelligent teaching methods, and to maximize the effectiveness of intelligent teaching.
2. Choose the right intelligent tools. Intelligent teaching requires thinking about the rationality of the intelligent tools in the classroom and encouraging teachers and students to integrate intelligent tools and information technology into the Intelligent Class environment to meet the necessary environmental requirements for intelligent teaching.

3. Select appropriate media devices and enhance the utilization of media tools. Schools should create intelligent teaching environments in Intelligent Class using various types of media devices so that teachers and students can establish a personalized and intelligent teaching environment, which is the only way to ensure that intelligent teaching systems meet the required standards while maximizing their value.

4. Choose appropriate teaching tools to improve teaching efficiency. Mathematics at the high school level requires more abstract thinking from students. For example, the lesson on ellipses involves changes in the movement of shapes and points that some students find difficult to imagine. The use of reasonable teaching tools can assist teachers in better explaining abstract knowledge points while helping students understand these abstract concepts.

5. Provide some theoretical basis for the development and application of intelligence in education.

## **1. Intelligent Teaching**

### *1.1 Origin of intelligent teaching*

The term wisdom has different meanings in different places, and in some places, it is simply interpreted as the ability of people to discern and be creative. In the ancient Chinese classic "I Ching," it is the "invisible dimension of the Tao" that can be seen as a manifestation of human wisdom.

In 1997, Professor Qian Xuesen made the first explicit reference to wisdom in his "Theory of meta-synthetic wisdom." One of the core elements of his theory is that "wisdom can only be attained through the collection of the great." This theory has provided the philosophical foundation for our work on wisdom education and has also been promoting the development of wisdom education.

In early November 2008, Samuel Palmisano (Chairman of IBM) introduced the concept of "Smarter Planet" at the Council on Foreign Relations in New York.

"Smarter Planet" actually means that modern information technology will be applied in various fields. By installing sensors in various facilities such as networks, railroads, bridges, and highways around the world and connecting them widely, the "Internet of Things" will be formed. Then, through the "Internet," the "Smarter Planet" will be formed.

The ubiquitous intelligent tools in modern society have created favorable conditions for the incubation of intelligent education, which is gradually coming into the public's view, said Michael King, IBM's global vice president. In other words, the concept, skills, and methods of "Smarter Planet" will be applied to education.

As a result, the integration of various aspects of intelligent education concepts, technologies, and methods with the science of teaching and learning can lead to intelligent teaching. On the one hand, intelligent teaching comes from intelligent

education, simply put, intelligent teaching is the full use of the concept, skills, and methods of intelligent education in teaching. On the other hand, intelligent teaching is also closely related to our intelligent education. Intelligent teaching is not only the core of our implementation of intelligent education but also a centralized embodiment of our implementation of intelligent education.

### *1.2 Intelligent teaching concept reflection*

From different disciplinary perspectives, intelligent teaching can be divided into three categories. First, from the perspective of pedagogy, intelligent teaching is teaching that deals with the relationship between process and result, intuition and abstraction, theory and practice by entering into life, asking questions, solving problems, and independent inquiry. In the teaching process, teachers should guide students and make them become the main subject of the classroom, emphasizing the cultivation of students through intelligent teaching. It truly realizes the goal of China's new curriculum system reform about intelligent teaching construction. Through the construction of intelligent teaching, we can realize the major teaching transformation from educator-centered to learner-centered and the major transformation of the goal of teaching from simply teaching students' knowledge to guiding students' independent learning. [8] Second, from the perspective of educational psychology, intelligent teaching is teaching that aims to develop and promote students' creative thinking and problem-solving skills. Intelligent teaching is not about teachers instilling knowledge in students but rather about promoting the development of students' general qualities in the process of inquiry and application of knowledge and promoting the development of students' corresponding psychological levels according to different kinds and characteristics of teaching activities. Thus, in the psychological sense, intelligence is embodied and carried by the formation and development of human abilities. Intelligent teaching is the teaching for the formation and development of students' abilities. Third, from the perspective of information technology, intelligent teaching refers to the wisdom and efficiency of teaching created by "Internet+" and the new generation of big data. In conclusion, intelligent teaching refers to the use of modern and suitable intelligent technology to create a new and intelligent learning environment, promote the development of intelligent teaching, and achieve the purpose of improving teaching efficiency. [9]

### *1.3 Development of intelligent teaching*

This paper is a study of intelligent teaching, and the following definition of Intelligent Class by Professor Liu Bangqi is synonymous with this paper.

Professor Liu Bangqi (Executive Director of China Xunfei Education Technology Research Institute), who has long been committed to the construction and practical application of education informatization, proposed a formal definition of Intelligent Class in 2015, that is, Intelligent Class 1.0. "Intelligent Class" refers to modern information technology such as the Internet of Things, big data, and the Internet, which is based on constructivist learning theories and methods. It is a new model of classroom teaching in the current era of big data, using real-time learning data monitoring, analysis, and mobile devices to provide teachers with accurate data for teaching decisions. [10]

Professor Liu Bangqi's research team has been practicing and exploring the Intelligent Class in many primary and secondary schools. The understanding of the Intelligent Class has been developing and evolving as the practice continues to deepen and be explored. Subsequently, Professor Liu Bangqi proposed the definition of 2.0 on the basis of Intelligent Class 1.0: Based on constructivist learning theory, through "Internet+" and Internet of Things, cloud computing, big data, new generation artificial intelligence, and other technologies, combined with constructivist learning theory, a intelligent and efficient classroom is built to realize data-based teaching decisions, real-time feedback on evaluation, dynamic three-dimensional communication, intelligent delivery of resources, and intuitive teaching experiments, creating a learning environment conducive to collaborative communication and wisdom, promoting benign changes in subject teaching modes and classroom teaching methods, and allowing all students to develop in the direction of wisdom. [11]

In recent years, against the background of rapid development and application of intelligent information technology (e.g., artificial intelligence and big data), education has entered the era of smartification. The content of Intelligent Class has changed significantly. Professor Liu's research team has proposed a new generation of Intelligent Class definition-Intelligent Class 3.0: According to constructivism, connectionism, and other learning theories, intelligent information technology can be used to promote the development of students' core literacy and create a intelligent and efficient classroom. Its essence is to build a new learning environment by combining network, data, and intelligent information technology through building "cloud, network, and end." Through the integrated teaching application of online and offline, inside and outside the classroom, and virtual reality, it achieves the purpose of stimulating each discipline to improve intelligent teaching, personalized learning on the basis of mastering knowledge and promoting intelligent development. [12]

Intelligent teaching is, as the name implies, intelligent teaching. In this paper, intelligent teaching is defined in "Intelligent Class Teaching" by Tsinghua University School Online. Intelligent teaching is a combination of the Internet and the new generation of big data to establish intelligent and efficient teaching. It mainly uses intelligent teaching tools to assist teaching by analyzing student learning data. Through the application of intelligent teaching, teaching strategies based on data analysis, real-time feedback teaching evaluation, online and offline interactive three-dimensional communication, and accurate and intelligent teaching resources pushing can be realized. In a intelligent learning environment, through relevant education and learning, cooperation and communication between teachers and students and joint learning for the intellectual development of all students can be promoted. As early as 2019, the first Yangtze River Delta Teacher Training College Teacher Intelligent teaching Competition pointed out that intelligent teaching is a new classroom reform and proposed detailed scoring criteria for intelligent teaching, as detailed in the Appendix.

#### *1.4 Intelligent teaching environment*

A intelligent classroom is a teaching environment that uses new teaching modes and intelligent tools combined with modern teaching methods. It organically integrates IoT technology and mobile Internet technology to establish a comprehensive modern wisdom classroom system that integrates wisdom, talent training, daily attendance, environmental monitoring, remote operation of remote sensors, and other functions. The design goal is first to create a learning environment with personalization through intelligent applications based on meeting daily teaching needs.

Depending on the function of the classroom, the existing intelligent classrooms can be divided into the following categories: 1. In a mobile intelligent classroom, teachers and students can freely move their tables and chairs, freely design the layout of the classroom according to the needs of different subjects and teaching seminars, and build a classroom with class characteristics. Such a classroom is not only convenient for students to study by themselves but also for group exchanges and discussions. 2. In conventional intelligent classrooms, traditional teaching is mechanical, "cramming method in teaching" teaching, usually lacking in teacher-student and student-student communication. The use of conventional intelligent classrooms can change this lack and achieve a positive interaction in the classroom, transforming the process of learning knowledge from an individual, mechanical to a social, creative, and interactive process. 3. Seminar intelligent classroom, classroom tables, and chairs are equipped with a student iPad, while the tables and chairs can be moved quickly with individual needs to form personal learning and thinking space. In order to facilitate the seminar for each group of students, each group is equipped with an interactive function all-in-one machine suitable for connecting iPads and cell phone terminals with different screen sizes and resolutions for access. Students in different positions can clearly see the teaching content during the teacher's class. It also allows groups to easily present and display the seminar content, discussion screen, and seminar results.

## **2. Intelligent teaching design of high school mathematics**

### *2.1 Traditional teaching design*

The teacher's teaching design is generally determined by the subject characteristics of the teacher's subject and the requirements of the curriculum standards and the learning characteristics of the students in the class, the corresponding curriculum design plan, mainly including teaching objectives, the key points and difficulties in classroom teaching, emotional attitudes and core values, mathematical ideas and teaching steps and other components.

Teaching design should meet the following requirements: First, the purpose of teaching design is to address the content of instruction in strict accordance with pedagogical principles in the selection of objectives for the entire teaching process. Second, teaching design is a planned and decisive activity to achieve the goals of teaching and learning. Teaching design is a creative way of determining how to achieve teaching objectives and solve practical teaching problems in the form of rational planning of teaching structures. Third, a systematic teaching design approach is used to design the entire classroom. The teaching design treats all teaching elements as a system, analyzes

the possible teaching needs and problems that may arise when conducting classroom instruction, and proposes the most optimal solution. Fourth, teaching design should be able to enhance students' interest in learning. Teaching design is an important tool and part of the teacher's mastery of the teaching skills of the course. Its goal and task are to shape the classroom process in a systematic way and to develop it into a practical and operational process.

In traditional Chinese teaching, teaching is completely controlled by the teacher, and students obey the teacher's arrangement, passively receiving knowledge with little or no thinking of their own, being the supporting role of teaching activities. However, teachers are always the direct transmitters and organizers of the knowledge learned. They become the absolute protagonists and always occupy an important and dominant position. Therefore, the traditional teaching method is called the "cramming method in teaching," which confines students' minds and does not meet the needs of modern education to cultivate high-quality talents.

## *2.2 Intelligent teaching design*

Intelligent teaching is the deep integration of modern intelligent tools with teaching, transforming the traditional teaching form into a new form of information-based, intelligent teaching. It is modern intelligent teaching built on big data, cloud computing, and other emerging science and technology. Teachers can promote students' overall development when they conduct intelligent teaching activities.

The advantages of intelligent teaching over traditional teaching are: 1. Accurate teaching decision making. Using information technology, we collect and analyze teaching data before, during, and after class and use the data to get a precise grasp of the teaching situation and provide an objective and accurate data basis for teaching design. 2. Stereoscopic teaching communication and interaction. By using intelligent teaching technology, we can break the limitation of time and space and realize instant communication and interaction between teachers and students inside and outside the classroom. Especially when adopting group discussion and cooperative inquiry learning mode, students will actively participate in teaching and learning, which truly realizes student-centeredness. 3. Customization of teaching implementation. By monitoring processes such as the completion of students' homework and the learning of learning resources, it helps teachers to assess students' mastery of knowledge accurately and thus develop one-to-one teaching and support programs that truly tailor teaching to students' needs and ensure individualized development. [13]

## *2.3 Intelligent teaching design of high school mathematics*

### *2.3.1 High school mathematics subject characteristics and high school students learning characteristics of mathematics*

Mathematics is a science that studies quantitative relationships and spatial forms in real life. Because of its abstraction of concepts, the accuracy of results, rigor of logic, and wide use, mathematics is an important subject both at the compulsory and high school

levels. Compared with previous mathematics, mathematics concepts at the high school level are more challenging and abstract, requiring a high degree of abstract thinking to understand knowledge and accept it. At the same time, mathematics at the high school level has become more flexible and comprehensive in requiring students to master knowledge.

The arrangement of mathematical knowledge is in accordance with the laws of students' physical, mental and intellectual development. Therefore the learning of mathematics for high school students has its own characteristics compared to the past. First of all, high school students have higher self-awareness of learning than students in junior high school and can take the initiative to learn independently. Secondly, high school mathematics is more abstract, and mathematics learning styles are more diversified. High school students have stronger independent thinking ability, can accept abstract mathematical knowledge, and can also adapt to various mathematical learning styles. Finally, mathematics learning pays more attention to the cultivation of students' thinking methods and the formation of core mathematical literacy. Hence, students need to use the means of modern information technology to assist their learning.

In summary, the characteristics of mathematics at the high school level determine the necessity of intelligent teaching. The characteristics of mathematics learning for high school students create favorable conditions for intelligent teaching in high school mathematics. At the high school level, the development of intelligent classroom teaching in mathematics can help students receive knowledge faster and better. At the same time, it can help students develop mathematical thinking methods and mathematical core literacy.

### 2.3.2 Intelligent teaching design of high school mathematics

Through the investigation of previous intelligent teaching design theories, the author summarizes the principles that should be followed regarding the design of intelligent teaching in high school mathematics.

(1) The principle of high integration of information technology. The new curriculum reform requires the full integration of modern education technology with teaching design to make teaching more convenient and efficient. Intelligent teaching is a intelligent learning environment using modern information technology in the classroom. In the process of classroom teaching, teachers can fully use intelligent information technology such as geometry drawing boards to draw geometric figures and flash animation to help students understand and master abstract knowledge. Therefore, in the design of high school mathematics intelligent teaching, the application of information technology should be fully considered in every teaching link. Teachers should choose scientific and reasonable modern information technology to assist in teaching and guide students' learning so that students can really realize intelligent learning.

(2) Adhere to the principle of promoting students' development as the center. The new curriculum reform requires highlighting the main role of students in the classroom teaching process and promoting students' development. Therefore, when using the



Intelligent teaching model in the general high school mathematics classroom, teachers should let students become the protagonists of the classroom and encourage their individual thinking and communication in the classroom. Whether before, in class, or after class, teachers can use intelligent teaching software to guide students' learning, explore key points and important points in mathematics, encourage students to ask questions actively, think deeply, and improve their independent learning ability.

(3) Adhere to the principle of theory guiding practice. The implementation of any practice needs a scientific theoretical basis as a guide, so in the process of intelligent teaching, we should always abide by the principles of major educational theories. We can only carry out scientific and effective teaching by abiding by these scientific-educational theories.

(4) The principle of segmentation of teaching contents. Any teaching is to achieve the teaching objectives step by step according to certain teaching links. When designing the teaching design of high school mathematics based on intelligent teaching, teachers should also firmly grasp this principle and divide the teaching of high school mathematics into three stages: knowledge pre-learning, knowledge exploration, and knowledge consolidation. In the knowledge pre-study stage, the main goal is to help students to have a preliminary understanding of the basic knowledge they are going to learn immediately. Teachers can guide students to construct a new knowledge system through individual thinking and collaborative group discussion in the knowledge inquiry learning stage. In the knowledge consolidation stage, the main objective is to help students reacquaint themselves with and improve the knowledge they have mastered by analyzing the situation of what they have learned with the help of teaching resources after conducting classroom teaching. All three stages of teaching are indispensable, and only when all of them are in place can students truly master mathematics.

In conclusion, when studying and designing a new high school mathematics curriculum teaching design based on intelligent teaching, not only the educational theory and practical experience of intelligent teaching should be fully considered, but also the teaching reality of high school mathematics should be fully noticed. The educational theories and information technology of intelligent teaching are closely integrated with high school mathematics to design and develop a scientific and reasonable model of intelligent teaching. [14]

### **3. High school mathematics intelligent teaching design for "Geometric properties of ellipses"**

#### *3.1 Intelligent teaching platform*

In the course of the educational internship, the author used the easy-to-use, simple and convenient Cloud Class App. On the teaching iPad, the author installed the Cloud Class App. By using the mobile Internet and the APP, the teacher-student interaction, communication, and discussion, as well as homework correction were realized in the classroom and outside the classroom. Students are evaluated and motivated by the increase or decrease of experience value in the Cloud Class App, which fully mobilizes

students' motivation for independent learning and communication and discussion and provides teachers with accurate data for teaching design and student evaluation through monitoring and analysis of students' learning.

The Cloud Class App was chosen because it has the following features: 1、 Easy teaching. Teachers can easily manage classes, notify information, share resources, and conduct activities on any device. 2. Fun learning. Students can greatly increase their motivation to participate in activities by gaining appropriate experience values when they participate in daily learning and exchange discussions. 3、 Various classrooms. With Cloud Classroom App, teachers can carry out different forms of classroom activities, such as brainstorming, voice response assistants, classroom tests, discussion forums, and group assignments. 4. Big data and learning analysis. Cloud Classroom App will provide detailed information of students and analyze the learning situation. It provides an important basis for teachers to evaluate students' teaching.

### *3.2 Intelligent teaching design*

The Geometric Properties of the Ellipse are introduced after the definition of the ellipse and its standard equation. This lesson will guide students to explore the geometric properties of the ellipse from its graph and standard equation so that they can learn how to study the geometric properties of the graph from the standard equation and prepare for the later study of the geometric properties of hyperbola and parabola. Therefore, this lesson is very important. This lesson will improve students' mathematical literacy.

The target students of this lesson are the sophomore students of a four-star high school who have mastered the definition of the ellipse and its standard equation, have preliminary knowledge of analytic geometry problems, and have a certain ability in graphical analysis and algebraic reasoning. In the previous study of functions and inequalities, they have mastered the calculation of inequalities, the study of functional properties and have some basic experience. All these provide sufficient basic knowledge and preparation of ideas and methods for this lesson.

The intelligent teaching design of this lesson is designed in three stages: before the lesson, in the classroom, and after the lesson. The steps of teaching are learning survey and analysis, pre-study plan design, pre-study result feedback, creating a situation, cooperative inquiry, follow-up test, lesson summary, assignment, homework correction and evaluation, and teaching reflection.

#### *3.2.1 Pre-lesson design*

The teaching tasks in the pre-course stage should include teacher preparation and student pre-study. In traditional teaching, because of the accurate understanding of students' pre-study, teachers can only analyze the important and difficult points of teaching based on teachers' experience, which leads to teachers' inability to prepare lessons for students and fewer communication activities between teachers and students before class. Cloud classrooms can help change this phenomenon from teaching based on experience to targeted teaching based on data.

First, the teacher opens the activity through the Cloud Class App and pushes the learning analysis questionnaire and related tests. To understand students' application and mastery of basic knowledge in the previous lesson, it is easy to guide teachers to set teaching objectives for this lesson. Second, teachers use the upload material function of the Cloud Class App to push the teaching resources related to this lesson to students, such as teaching PPT and basic knowledge tests, to help students clarify their learning objectives. If students encounter difficulties in pre-study, they can use the discussion group of the Cloud Classroom App to exchange and discuss. Considering the intense study tasks of high school students, the content of the preview before class should be short and concise and can help students quickly understand the content of the lesson, so that the time for students to preview is limited to 10 minutes. Finally, the teacher completes the teaching design based on the feedback data from the Cloud Class App. According to the accurate data analysis, the teacher can understand the teaching focus: the geometric properties of the ellipse and the definition of eccentricity; the teaching difficulty: the study of eccentricity and geometric properties of curve according to the standard equation of the ellipse and give the proof process. The method of creating situations, cooperative inquiry, and discussion can be adopted in combination with the characteristics of the class students. The preview homework pushed by the Cloud Class App should be basic content, and the PPT of the preview content should correspond to the book content and complete the corresponding test questions. The test questions will help students to understand the degree of mastering the definition of the ellipse and the basic understanding of the geometric properties of the ellipse.

### 3.2.2 In-class teaching design

In our traditional teaching, the whole process of teaching is controlled by the teacher, who always occupies an important dominant position, and the interaction between teachers and students becomes simple questions and answers, with students becoming the passive party, simply receiving knowledge, lacking independent thinking, and hardly participating in teaching activities. With the interactive functions of discussion groups and brainstorming in the Cloud Class App, we can change the teaching from "teacher-led" to "student-led" and turn teachers into instructors who guide students in independent learning and active promoters of students' development, truly fulfilling the requirements of teachers' and students' views in the new curriculum reform. The classroom activities are given to students so that they can become the master of the classroom and improve their comprehensive literacy through teacher-led, independent thinking and cooperative communication activities. Take "Geometric Properties of Ellipse" as an example. The teaching activities are as follows:

#### (1) Create the situation

In 2008, Shenzhou 7 was successfully launched, and the astronauts completed the perfect exit walk, which excited the Chinese. Before officially entering orbit, the spacecraft gradually escaped from the Earth's gravity along an elliptical orbit with the Earth as a focal point. We can know the perigee and apogee of "Shenzhou 7" when it flew away from the Earth by checking the data, so can we find the trajectory of its flight? Upload the related video in the Cloud Class App, and the teacher will explain it on the side.

The Cloud Class App posts the problem: definition of an ellipse, standard equation of an ellipse, and conducts group discussion.

In order to solve this practical problem, further study of the ellipse is required, which leads to the topic: of the geometric properties of the ellipse.

## (2) Exploration and Research

Use the Cloud Classroom group discussion to group students and explore the following questions in small groups (focus):

### Topics 1. Scope

What can be found by looking at the ellipse image displayed on the interactive screen and making parallel lines  $l_1$  and  $l_2$  of the  $y$ -axis through points  $A_1$  and  $A_2$ , and parallel lines  $m_1$  and  $m_2$  of the  $x$ -axis through points  $B_1$  and  $B_2$  (as shown in Figure 3-1)? Students can manipulate the geometry drawing board to get the corresponding conclusion

and then use the equation  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  to prove the correctness of this conclusion.

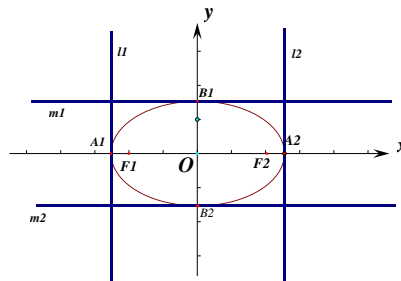


Figure 3-1 Ellipse

Use the Cloud Class App discussion group to share group results and communication.

The teacher concludes that the four lines  $x = \pm a$ ,  $y = \pm b$  form a rectangular region in which the ellipse lies exactly, which proves that the ellipse has a range.

By analyzing the structural features of the standard equation  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  of the ellipse, students can view the equation as the sum of the squares of two real numbers  $\frac{x}{a}$  and  $\frac{y}{b}$ , and then use the knowledge of inequality to obtain that  $x^2 \leq a^2$  and  $y^2 \leq b^2$ , then we have  $|x| \leq a$ ,  $|y| \leq b$ , so  $-a \leq x \leq a$ ,  $-b \leq y \leq b$ .

Posting questions using the Cloud Classroom App:

Discuss the range of the following ellipse

$$(1) 4x^2 + y^2 = 16; (2) 9x^2 + 4y^2 = 36$$

$$(1) 4x^2 + y^2 = 16; (2) 9x^2 + 4y^2 = 36$$

Students answer the questions promptly, and the teacher determines whether students fully grasp the range of the ellipse based on their answers.

### Topics 2. Symmetry

Look at the graph of an ellipse (shown in Figure 3-2) and determine the symmetry of the ellipse.

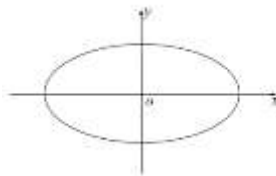


Figure 3-2 Elliptic symmetry

Use the cloud classroom discussion forum to share group results and communication.

Teacher's summary: Take out the ellipse made in the last lesson when learning the definition of the ellipse and fold it along the vertical bisector of the line connecting the two focal points, you can obviously find that the ellipse is an axisymmetric figure, and in Figure 2 you can see that the ellipse is symmetric along the x-axis and y-axis.

Posting questions using Cloud Classes;

- A.  $x^2 = 2y$                       C.  $y^2 = 4x$   
B.  $x^2 - 4y^2 = 5x$                 D.  $9x^2 + y^2 = 4$

Among the curves represented by the following equations, the one that is symmetric about the origin is( )

- A.  $x^2 = 2y$                       C.  $y^2 = 4x$   
B.  $x^2 - 4y^2 = 5x$                 D.  $9x^2 + y^2 = 4$

### Topics 3. Vertex

Determining the position of a curve often requires finding its special points. Observe Figure 4-2 to find the special points of an ellipse, which can be analogized using the image of the quadratic function and given a definition.

Use the Cloud Classroom APP discussion group to exchange and discuss. By observing, students can easily find that the ellipse has the same four intersection points with the coordinate axis and the axis of symmetry.

The teacher inspires students to derive the definition of the vertex of an ellipse by analogy.

Students have a group discussion and use the ellipse equation to get the vertex coordinates.

When  $y=0$ ,  $x = \pm a$ , the coordinates of the intersection of the ellipse on the x-axis  $A_1$   $(-a, 0)$ ,  $A_2$   $(a, 0)$ , when  $x=0$ ,  $y = \pm b$ , the coordinates of the intersection of the ellipse on the y-axis  $B_1$   $(0, -b)$ ,  $B_2$   $(0, b)$  can be obtained. According to the definition to get the length of the ellipse, short axis length, and focal length, combined with the graph to get the quantitative relationship and geometric significance of  $a$ ,  $b$ ,  $c$ .

Cloud class publishing issues:

Find the coordinates of the vertex of the ellipse  $\frac{x^2}{9} + \frac{y^2}{4} = 1$  and the length of the long axis, and the length of the short axis.

#### Topics 4. Centrifugal rate

The teacher introduces the definition and formula of eccentricity.

Students work in groups to explore: If the same length of thin rope is used to make an ellipse, are these elliptical shapes the same?

Divide students into two groups: the algebraic and the experimental groups, where the algebraic group uses the algebraic method to prove the relationship between  $e$  and elliptic shapes. The experimental group uses graphing methods to make a diagram to prove it.

The teacher and students will summarize the effect of  $e$  on the ellipse: the larger the eccentricity  $e$ , the flatter the ellipse.

Cloud Classroom Posting Question.

Compare the shapes of the two ellipses in each of the following groups; which one is flatter?

$$(I) \frac{x^2}{9} + \frac{y^2}{5} = 1 \text{ 与 } \frac{x^2}{16} + \frac{y^2}{12} = 1; \quad (II) x^2 + \frac{y^2}{2} = 1 \text{ 与 } \frac{x^2}{6} + \frac{y^2}{10} = 1.$$

$$(I) \frac{x^2}{9} + \frac{y^2}{5} = 1 \text{ and } \frac{x^2}{16} + \frac{y^2}{12} = 1; \quad (II) x^2 + \frac{y^2}{2} = 1 \text{ and } \frac{x^2}{6} + \frac{y^2}{10} = 1.$$

### (3)Class summary

Knowledge Summary: This lesson focuses on the geometric properties of ellipses, which are the basis for solving elliptic problems.

Ideas and methods: the combination of numbers and shapes, hypothesis and conjecture, cooperative inquiry, analogical imagination.

Teachers issue accompanying test questions through the Cloud Class App to test students' learning and provide timely feedback on students' knowledge mastery through analysis of answer results.

#### 3.2.3 Post-lesson teaching design

In traditional teaching, after-school instruction is all about students' homework. Every student's homework is the same, and it takes time and effort for the teacher to correct the homework, and the feedback and evaluation given are lagging behind. Based on information technology, Cloud Class App has obvious superiority in terms of layered assignment pushing, timely correction, personalized tutoring, and teaching feedback. First of all, teachers can easily push graded assignments through the Cloud Class App according to the learning needs of students at different levels and set compulsory questions and extended questions. Students who are strong learners can use this to deepen their understanding and broaden the depth of their knowledge. Secondly, students submit their homework in time according to their own schedule. Cloud Class App will automatically correct objective questions and provide answer analysis in a timely manner. Students can view homework corrections through the platform, and teachers and students can discuss online. In addition, Cloud Classroom App provides detailed answer data analysis, including answer completion rate, correct answer rate, and score distribution, enabling teachers to effectively evaluate students' mastery of knowledge points and guide the next step of lesson preparation for timely improvement and implementation of targeted teaching.

#### *3.3 Reflection of intelligent teaching*

The combination of modern information technology, network technology, and education have produced intelligent teaching, which reflects the future trend of education and helps to solve the problems associated with traditional education. [12] As teachers in the new era, we must actively follow the trend of the times and embrace new technologies. At the same time, we must recognize the connection between education and technology. Teachers should use modern educational technology as the basis for developing intelligent teaching and improving teaching efficiency. Because teaching cannot be only technology, technology should not dominate teaching. Teachers should use teaching design as the basis of teaching to support teaching and improve teaching efficiency.

### **4. High school students' math intelligent teaching response questionnaire**

#### *4.1 Basic information of the questionnaire about the response to intelligent teaching*

With the development of information technology in schools, intelligent teaching has become a development trend in all schools, but many schools are not yet fully prepared for it. In order to the current situation of intelligent teaching, the author designed a questionnaire to study the response questionnaire of high school students to intelligent teaching in mathematics in the internship school.

In order to understand the situation of intelligent teaching in high school, this questionnaire has 14 questions, covering three areas:

- (1) Students' understanding of intelligent teaching.
- (2) Students' attitudes toward intelligent teaching.
- (3) Students' reactions to the effects of intelligent teaching.

By investigating these three aspects, we can understand the real situation of high school mathematics intelligent teaching from multiple perspectives.

Question 1 mainly examines students' understanding of intelligent teaching. Only when they really understand intelligent teaching can they make it work. Questions 2, 3, 4, and 5 mainly examine students' attitudes towards intelligent teaching. Questions 6-14 look at 9 aspects to understand the effect of intelligent teaching.

After the questionnaire was completed and approved by the instructor, the survey was officially distributed. The questionnaires were distributed to 109 students in the second year (3) and (9) classes of the four-star high school. A total of 109 questionnaires were distributed, and 109 questionnaires were collected, 105 of which were valid.

#### *4.2 Analysis of survey results*

##### *4.2.1 Students' understanding of intelligent teaching*

Intelligent teaching requires students to be truly involved in every step of the teaching process. Teachers should guide students to actively participate in classroom activities, problem discussions, and assignment submissions. Only when students truly understand the meaning of intelligent teaching can they become the main body of the classroom.

Through question 1 of the questionnaire, we understand students' interpretation of intelligent teaching, and the situation is as follows:

- Q1. What does intelligent teaching look like to you?
- A. Use iPad for class, complete and upload homework on iPad.
  - B. Conduct group cooperation and exchange for getting answers during the class.
  - C. Students are the main body of the class, and the teacher is the leader of the class.

The distribution of options for question 1 is shown in Figure 4-1:



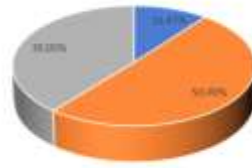


Figure 4-1 Pie chart of students' understanding of intelligent teaching

From Figure 4-1, it is obvious that about 10.47% of the students think that intelligent teaching is simply using iPads for class, completing and uploading assignments on iPads, and cannot understand intelligent teaching at all. About 50.49% of the students thought that intelligent teaching was about getting answers through cooperative group work during class. Although this is an important tool of intelligent teaching, it is not the essence of intelligent teaching. These students also failed to recognize the essence of intelligent teaching. Only 39.05% of the students thought that intelligent teaching is that the students are the main body of the classroom and the teacher is the leader of the classroom, and they really recognized the essence of intelligent teaching.

#### 4.2.2 Students' attitudes towards intelligent teaching

Students' attitude toward intelligent teaching reflects their acceptance of intelligent teaching. Only when students truly accept intelligent teaching can intelligent teaching give full play to their benefits and help students learn better.

Questions 2, 3, 4, and 5 of the questionnaire were used to find out students' attitudes towards intelligent teaching. Questions 3 and 4 investigated which form of homework students prefer and their attitudes towards cooperative inquiry-based learning in groups:

Q2. Do you like intelligent teaching?

A. Strongly agree B. Agree C. Generally agree D. Disagree E. Strongly disagree

The distribution of options for question 2 is as follows:

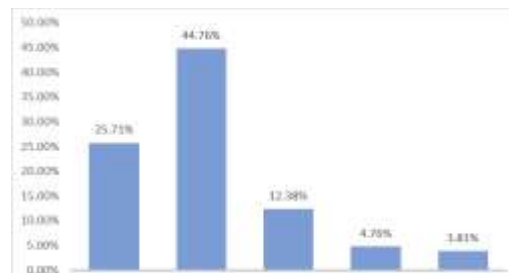


Figure 4-2 Bar chart of students' attitudes towards intelligent teaching

From Figure 4-2, we can find that 25.71% of students like intelligent teaching very much, 44.76% of students like intelligent teaching, 12.38% of students feel average about

intelligent teaching, 4.76% of students do not like intelligent teaching very much, and 3.81% of students do not like intelligent teaching.

Q3. Do you prefer paper-based or electronic assignments?

A. Paper assignment B. Electronic assignment C. Doesn't matter

The distribution of options for question 3 is as follows:

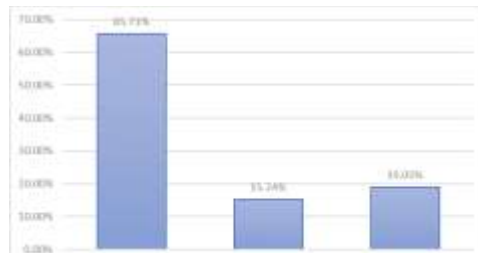


Figure 4-3 Bar chart of students' attitudes towards the form of homework

From Figure 4-3, it can be found that about 65.71% of students prefer paper assignments, 15.24% prefer electronic assignments, and 19.05% feel indifferent. This may be determined by the subject characteristics of mathematics, which often requires hands-on calculations and reasoning in the process of doing problems. At the same time, most students are not accustomed to completing homework on iPads because they hardly ever used iPads for learning in elementary and middle school.

Q4. Do you enjoy collaborative inquiry-based learning in groups in the math classroom?

A. Strongly agree B. Agree C. Generally agree D. Disagree E. Strongly disagree

The distribution of options for question 4 is as follows:

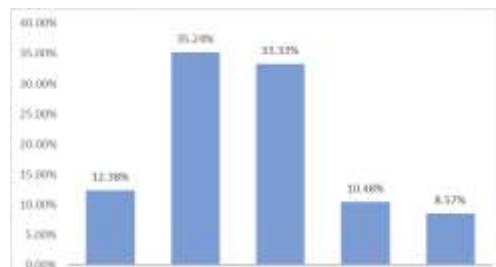


Figure 4-4 Histogram of students' attitudes toward cooperative inquiry-based learning in groups

From Figure 4-4, it can be found that only about 12.38% of students like it very much, 35.24% of students like to work in groups for cooperative inquiry-based learning, 33.33% of students feel average about conducting cooperative inquiry-based learning, 10.48% of students do not like it very much, and 8.57% of students do not like to conduct cooperative inquiry-based learning. This indicates that students prefer inquiry-based

teaching to traditional transmission-based teaching, and it also reflects that students prefer intelligent teaching to traditional teaching.

Q5. What aspect of intelligent teaching do you like?

- A. Timely evaluation
- B. Interactive three-dimensional
- C. Resource pushing
- D. Information technology assistance

The distribution of options for question 5 is as follows:

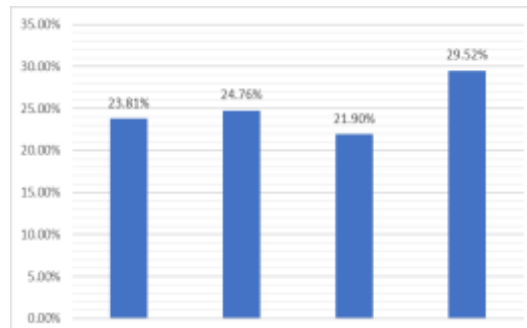


Figure 4-5 Bar chart of which aspect of intelligent teaching students prefer

From Figures 4-5, we can find that about 23.81% of students like intelligent teaching's timely assessment, 24.76% of students like intelligent teaching's interactive stereo, 21.90% of students like intelligent teaching's resource push, and 29.52% of students like intelligent teaching's information technology assistance. This indicates that students like several characteristics of intelligent teaching almost equally, and it can also reflect that student like intelligent teaching very much from the side.

After analyzing the results of questions 2, 3, 4, and 5 together, it is easy to see that the vast majority of students have a favorable view of the intelligent teaching model. They like several features of intelligent teaching. Many of these students prefer cooperative inquiry-based learning in groups. Still, because of the subject matter characteristics of mathematics, there are also many students who do not like electronic work.

#### 4.2.3 Students' reactions to the effectiveness of intelligent teaching

This questionnaire was administered to classes in four-star high schools that had been intelligent teaching for a period of time, and the effectiveness of this teaching model was a concern for both teachers and students. Questions 6-14 focused on whether intelligent teaching could reduce the burden of homework, promote depth of thinking, improve learning efficiency, improve mathematics performance, promote cooperation and communication, allow more people to show themselves, promote the development of independent learning skills, and promote knowledge understanding from these aspects.

The results are as follows:

	Strongly agree	Agree	Hard to tell	Disagree	Strongly disagree
Q6. Applying this mode of teaching to math classes can reduce your burden of homework after class	6.67%	20.00%	47.62%	14.29%	11.43%
Q7. Using this mode of teaching in math class can make you think more deeply	11.43%	36.19%	35.24%	12.38%	4.76%
Q8. Using this mode of teaching can improve your learning efficiency	13.33%	36.19%	40.00%	5.71%	4.76%
Q9. Using this teaching mode to take math class can improve your math performance	8.57%	19.05%	61.90%	3.81%	6.67%
Q10. Using this teaching mode in math class can promote cooperation and communication between you and your classmates	14.29%	46.67%	30.48%	6.67%	1.90%
Q11. Using this mode of teaching in math class can give you more opportunities to demonstrate yourself	10.48%	42.86%	34.29%	7.62%	4.76%
Q12. Using this teaching mode in math class can develop your independent learning ability	13.33%	40.00%	34.29%	8.57%	3.81%
Q13. Using this mode of teaching in math class can deepen your understanding of knowledge	11.43%	30.48%	45.71%	9.52%	2.86%
Q14. Intelligent teaching is more effective than traditional teaching.	8.57%	25.71%	52.38%	7.62%	5.71%

*Table 4-1 Intelligent teaching effect survey table*

As shown in Table 4-1, 6.57% of students completely agreed, and 20.5% agreed that intelligent teaching could reduce the burden of homework, which shows that intelligent teaching can indeed reduce the burden for students. 11.42% of the students fully agreed, and 36.22% of the students agreed that intelligent teaching could promote the depth of thinking, and intelligent teaching did provide a way for some students to think. 13.33% of the students completely agreed, and 36.19% agreed that intelligent teaching could improve learning efficiency and adopting intelligent teaching is more suitable for students' learning than traditional teaching. 8.63% of the students fully agreed, and 19.07% of the students agreed that intelligent teaching could improve their performance

in mathematics. It is evident that some students have been improved after adopting intelligent teaching. 14.99% of the students fully agreed, and 47.87% agreed that intelligent teaching promotes cooperation and communication, and most students' ability to cooperate and communicate can be improved through the intelligent teaching process. 10.53% of students fully agree, and 42.81% agree that intelligent teaching allows more people to show themselves, and intelligent teaching can provide opportunities for most students to show themselves. 11.53% of the students strongly agreed, and 31.38% of the students agreed that intelligent teaching could promote the understanding of knowledge. Some students can understand the nature of mathematics knowledge better through intelligent teaching than traditional teaching. It is evident that the majority of students' feedback on the effectiveness of intelligent teaching is positive. Therefore, promoting intelligent teaching helps students' development. At the same time, it is understandable that some students do not understand the connotation of intelligent teaching well, have a short exposure to the intelligent teaching model, are not adapted to this model, and maintain a neutral attitude towards intelligent teaching. I believe that with the growth of intelligent teaching and the continuous improvement of intelligent classrooms, students will become more and more comfortable with this teaching model and find more advantages.

## **5 The advantages and problems of intelligent teaching in high school classrooms**

### *5.1 Advantages of intelligent teaching*

#### (1) Simple and efficient teaching

Every student has an iPad in his or her hand, and the teacher can control the iPad from the teacher's side so that the students can clearly see every operation of the teacher. The classroom board can be screenshotted and saved at any time, and practice questions can be pushed directly to save the time of copying the questions. At the same time, it can also save the teacher's time in writing and wiping the blackboard, which is more environmentally friendly and hygienic, and also improves the efficiency of the classroom.

#### (2) Personalized teaching

Teachers can provide targeted teaching resources and personalized teaching tutorials based on the learning records and assignment accuracy provided by intelligent teaching software. For students with a good foundation, they can have more time for independent learning, while students with a weaker foundation can make up for their deficiencies through continuous learning of teaching resources.

#### (3) Develop students' sense of cooperation

In the process of intelligent teaching students often need to cooperate and communicate, and share their learning results with each other, which enables students to form learning interest groups and helps develop their sense of cooperation.

#### (4) More accurate and timely evaluations

Intelligent teaching software can judge students' objective answers in a timely and accurate manner, understand each student's knowledge mastery, and help teachers evaluate students in a timely manner.

### *5.2 Problem of intelligent teaching*

(1) It is difficult for students to adapt to this new model

Since some students have not been exposed to intelligent teaching in their previous learning careers, their long-formed learning habits are difficult to be changed, and they are slow to accept new teaching modes, leading some students to reject intelligent teaching and even become averse to learning.

(2) Teachers are having a hard time accepting this new format

Some of the older teachers have been using the traditional teaching mode and are used to "lecturing with chalk only" and seldom use intelligent teaching; in addition, as teachers get older, they are slow to understand and accept new things and cannot accept this new teaching mode, so it is difficult for them to change their teaching style within a short period of time and thus do not. They are unable to accept this new teaching mode. It is difficult for them to change their teaching style in a short time, so they do not pay attention to intelligent teaching.

(3) Intelligent teaching is a formality

In some areas, teachers' intelligent teaching is just a formality, and they fail to understand the essence of intelligent teaching. Some teachers simply make the knowledge points into PPT courseware. The transformation of traditional teaching to intelligent teaching is completed on the surface. Still, in essence, it does not combine the teaching content and intelligent classroom, and many functions of intelligent classroom are not realized, and there is no great difference compared with traditional teaching.

(4) Intelligent teaching hardware and software facilities are not perfect

Although the 5G network is now becoming popular, the network status is often unstable. The network status in the school building is poor, resulting in too slow uploading and downloading of courseware resources. At the same time, it is not easy to mark and perform calculations on the iPad, separating the questions and the answering process, which brings inconvenience to the later revision.

(5) Management issues of intelligent teaching

Intelligent teaching must be supported by the Internet, and some students will use iPads to access the Internet for non-learning things, distorting the role of intelligent tools. At the same time, staring at electronic screens for long periods of time can become dry and even damage eyesight. Prolonged use of electronic devices can easily distract students' attention. Therefore, the use of electronic devices can make it more difficult for teachers to manage.

### 5.3 Suggestion for intelligent teaching

#### (1) Focus on optimizing the school's hardware facilities

When investigating the problems of intelligent teaching, the first issue raised by teachers and students was the poor wireless network signal. It takes a long time to upload and download materials. At the same time, when playing teaching videos or using teaching software in the classroom, it often lags and takes time to buffer, which seriously affects teaching efficiency and learning efficiency. Therefore, schools should focus on the construction of hardware facilities in schools, increase capital investment, enhance network signals, improve network speed, and provide a strong foundation for the construction of intelligent and efficient intelligent teaching.

#### (2) Increase the library stockpile and build a large database

An important part of intelligent teaching is the pushing of teaching resources, but many teachers and students report that the school's resource library is too small and too outdated. Thus, teachers need to spend a lot of time to find materials, and some materials cannot be downloaded, which undoubtedly increases teachers' workload in lesson preparation. At the same time, the personalized learning system for students does not accurately target students' needs with personalized materials and practice questions, and sometimes there are no required questions. Therefore, schools should establish a large database, and constantly update it, optimize the intelligent teaching platform, and increase the variety and quantity of learning resources for each subject.

#### (3) Teachers respond positively to education reform to transform teaching mode

Intelligent teaching also places demands on teachers. Teachers should respond positively to the call for educational reform, actively face the new teaching model, and transform from traditional teachers to new intelligent teachers as soon as possible. Teachers should take the initiative to accept the teaching concept of wisdom and master the teaching process and the functions and operation methods of each teaching software proficiently, and also instruct students to learn the relevant operations. In addition, teachers should pay special attention to students' emotional changes caused by the change of teaching mode to prevent rejection leading to aversion to learning, and should encourage students to adjust to the intelligent teaching mode as soon as possible and find a suitable learning method for themselves.

#### (4) Schools strengthen intelligent teacher teams to improve teaching efficiency

As an important part of intelligent teaching, teachers must collect teaching materials, create teaching materials, provide targeted teaching tutorials for students at all levels, record micro-lessons, organize learning activities, and assign homework, etc. If all these tasks are done by the mathematics teacher of each class alone, the teacher's workload will become huge and much of the work will be repeated. Therefore, if we take the school as a unit and set up relevant teams as needed, classify the required materials, classroom materials, etc., and we all divide the work and choose the areas we are better at. We all learn from each other, we can reduce the teachers' work pressure and improve the quality,

so that teachers can have more time to think about intelligent teaching and improve the quality and efficiency of teaching.

### Conclusion

As a product of the development of the times, intelligent teaching represents the future trend of education and is a new skill that every teacher should master. In this paper, we start from the concept and development of intelligent teaching and the design of intelligent teaching. We then use questionnaires to investigate students' responses to intelligent teaching and find out the shortcomings of intelligent teaching. This paper is based on relevant literature and the author's internship experience, which may be one-sided and immature. As an abstract subject, the use of intelligent teaching can help students understand abstract concepts. However, due to the characteristics of mathematics, students need to think and calculate by themselves, so too much use of intelligent teaching methods will weaken students' own imagination.

### References

- [1] Chen Li, Xiaoqing Zhong, Jianyong Cai. Research on Intelligent Teaching Method under the Background of "Internet+" [J]. Journal of Innovation and Social Science Research, 2019, 6(7).
- [2] Wang Zhongyi, Hu Jingjing, Liu Yong. Research on intelligent teaching model in the context of big data era [J]. Rural Economy and Technology, 2020, 31(10): 378-379.
- [3] Gao Yan. Heuristic online learning agent [J]. Foreign Education Research, 2013(1): 61-64.
- [4] Xie Wei, Jiang Fengguang. A case study of KALS at the University of Tokyo and TEAL Future Classroom at MIT [J]. China Information Technology Education, 2013(9): 99-100.
- [5] UK creates a futuristic classroom with touch interactive intelligence [EB/OL] <https://blog.csdn.net/metoo250/article/details/42030203>
- [6] Huang Ronghuai, Yang Junfeng, Hu Yongbin. From digital learning environment to intelligent learning environment: changes and trends of learning environment [J]. Open Education Research, 2012, 18(01): 75-84.
- [7] Hu Wang, Yang Cheng. Research on the design of teaching mode based on intelligent classroom [J]. Guangdong Open University Journal, 2015, 24(04): 87-92.
- [8] Macleod J, Yang H H, Zhu S, et al. Understanding students' preferences toward the intelligent classroom learning environment: Development and validation of an instrument [J]. Computers & Education, 2018: 80-91.
- [9] Wang Tianping, Yan Junzi. The conceptual interpretation and essential attributes of Intelligent Class [J]. Electrochemical Education Research, 2019, 40(11): 21-27.
- [10] Liu Bangqi. When Intelligent Class meets Big Data [J]. China Education Network, 2015(07): 65-67.
- [11] Li Xinyi, Liu Bangqi. Intelligent Class Teaching Theory and Practice [M]. Hefei: Anhui Education Publishing House, 2018: 18-24.
- [12] Liu Bangqi. The development, platform architecture, and application design of Intelligent Class—from Intelligent Class 1.0 to Intelligent Class 3.0 [J]. Modern Educational Technology, 2019, 29(03): 18-24.



- [13]Zhou Fang, Fang Cheng, Yin Shimin, Li Hua. The design of Intelligent Class is based on Rain Classroom[J]. Journal of Science and Education (Zhongjian),2020(35):118-120.
- [14]F Lu, Liu Z, Liu Z. Intelligent Phone Endowed Intelligent Teaching for University General Education Curriculum in China[C]// 2018 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE).IEEE,2018.
- [15]F Lu, Liu Z, Liu Z. Intelligent Phone Endowed Intelligent Teaching for University General Education Curriculum in China[C]// 2018 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE).IEEE,2018.

## Appendix

High school students' mathematics intelligent teaching response questionnaire

### *I. Multiple choice questions*

Q1. What does intelligent teaching look like to you?

- A. Use iPad for class, complete and upload homework on iPad.
- B. Conduct group cooperation and exchange for getting answers during the class.
- C. Students are the main body of the class, and the teacher is the leader of the class.

Q2. Do you like intelligent teaching?

- A. Strongly agree B. Agree C. Generally agree D. Disagree E. Strongly disagree

Q3. Do you prefer paper-based or electronic assignments?

- A. Paper assignment B. Electronic assignment C. Doesn't matter

Q4. Do you enjoy collaborative inquiry-based learning in groups in the math classroom?

- A. Strongly agree B. Agree C. Generally agree D. Disagree E. Strongly disagree

Q5. What aspect of intelligent teaching do you like?

- A. Timely evaluation B. Interactive three-dimensional
- C. Resource pushing D. Information technology assistance

### *II. Form single choice*

	Strongly agree	Agree	Hard to tell	Disagree	Strongly disagree
6.Applying this mode of teaching to math classes can reduce your burden of homework after class					

7.Using this mode of teaching in math class can make you think more deeply					
8.Using this mode of teaching can improve your learning efficiency					
9.Using this teaching mode to take math class can improve your math performance					
10.Using this teaching mode in math class can promote cooperation and communication between you and your classmates					
11.Using this mode of teaching in math class can give you more opportunities to demonstrate yourself					
12.Using this teaching mode in math class can develop your independent learning ability					
13.Using this mode of teaching in math class can deepen your understanding of knowledge					
14.Intelligent teaching is more effective than traditional teaching.					

III. What problems do you think the current intelligent teaching needs to be improved?

Scoring criteria

Item	Rating content	Value of points	Score
Intelligent teaching course resource building	1.Access to relevant course resources through the intelligent teaching platform. 2.Complete course descriptions and syllabi on the platform. 3.Detailed teaching information of courses on the platform. 4.Rich teaching resources of the courses on the platform. 5.Reasonable, diverse and timely videos of course teaching activities on the platform.	25	

	<p>6.The teaching content is refined and full, the basic concepts are accurate, scientific, logical, clear, and focused.</p> <p>7.Clear, smooth and concise video sound and in-depth explanation.</p> <p>8.Clear, aesthetic, and attractive video effects.</p> <p>9.The video length is appropriate.</p> <p>10. The design of the courseware is reasonable.</p>		
Teaching design	<p>1.Complete and clear information about the course.</p> <p>2.Clear and reasonable teaching objectives.</p> <p>3.The teaching content is arranged in a reasonable and clear hierarchy.</p> <p>4.The teaching design is reasonable, clear, and feasible.</p> <p>5.The teaching activities and evaluation are detailed, comprehensive, reasonable, and operable, with clear teaching purposes and clear teaching ideas.</p> <p>6.The teaching content is concise, scientific, theoretical, and practical, which meets the requirements of the syllabus and reflects the frontiers of the discipline.</p> <p>7.The teaching process is reasonably organized, and the methods are appropriate and effective.</p> <p>8.Accurate and clear expression of words.</p>	15	
Classroom teaching	<p>1. Well-groomed, spirited and passionate.</p> <p>2.Focus on heuristic teaching and cultivate critical thinking.</p> <p>3.Focus on teacher-student interaction and be able to mobilize students to think positively and actively effectively.</p> <p>4.Timely identification of student problems and development of targeted teaching activities.</p> <p>5.Develop students' higher-order competencies based on the video.</p> <p>6.Strong classroom adaptability.</p> <p>7.Concise language, clear and accurate presentation.</p> <p>8.Play the role of demonstration and leadership of curriculum thinking.</p>	60	
Total score		100	