



Multi-Modal Characteristics Analysis of Teaching Behaviors in Intelligent Classroom—Take Junior Middle School Mathematics as an Example

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Abstract. An intelligent classroom is based on constructivist learning theory and it is an intelligent and efficient classroom which based on “teacher-driven, student-centered”. Based on the original traditional classroom, the intelligent classroom combines emerging technologies such as big data, the Internet of Things, and artificial intelligence with campus management through hardware carriers, supported by application software services and campus management platforms. In addition to providing teachers with a wealth of teaching tools, the rapid development of intelligent classrooms leads to substantial changes in teaching behavior. In this study, the TEAM model was used to select representative intelligent classroom examples to evaluate the research status of the intelligent classroom. The NVIVO research tool analyzes and encodes video samples from selected areas frame by frame. It is to complete the research on the behavioral characteristics of intelligent classroom teaching and identify potential problems in intelligent classroom teaching. This study finds that analyzing teaching behavior characteristics in intelligent classrooms can help teachers to create an upward classroom learning atmosphere, finding and solving students’ pain points faster, it can also help teachers to teach students according to their aptitude.

Keywords: Intelligent Classroom · Characterization · Multi-modal · Teaching Behavior

1 Introduction

The General Office of the CPC Central Committee and General Office of the State Council issued the “Opinions on Further Reducing the Burden of Homework and Off-campus Training for Students in the Compulsory Education Stage”. This stage clearly mentioned that the education sector must guide schools to improve teaching management procedures, processing teaching methods, and strengthening teaching management to upgrade students’ learning efficiency in school [1]. Multimedia classrooms and equipment in traditional classrooms need to face the direction of digital and technologically intelligent

classroom teaching development. Through this way, to respond to the call of national policies and struggling to improve the quality of classroom teaching. At the same time, practicing the teaching policy about 'Putting students first', combined "teaching" with "learning", then through guidance from teachers to return the main body of the classroom to the students, and stimulate students' creative thinking, focusing on their learning process, it also achieves the effect of helping teachers reduce their burden. Intelligent classrooms can help teachers to carry out mixed teaching. It can not only enable them to get rich teaching resources which can bigger the classroom malleability of students and teachers but also higher teaching efficiency, which will fully stimulate students' interest and enthusiasm for learning which can enable every student to complete classroom learning in an interactive, relaxed, and warm learning atmosphere, also help the way teacher teach, making the teaching management easier. Therefore, it is vital to analyze and study the teaching behavior characteristics of intelligent classrooms. According to the qualitative analysis about intelligent classroom teaching videos in TEAM Model and summed up the teaching behavior characteristics of intelligent classrooms to some degree. We believe that the degree can provide experience and promote professional development for novice teachers like us.

At present, most of the research on intelligent classrooms focuses on students' learning behavior, and less attention is paid to teachers' teaching behavior. Based on this, this paper analyzes the characteristics of teaching behavior in intelligent classrooms, useing NVIVO research tools to comprehensively analyze the value information of teacher behavior data in intelligent classroom environment, discovering teachers' teaching advantages, disadvantages and characteristics, and providing new ideas for teachers' professional development in the era of big data [2].

2 Related Works

2.1 Intelligent Classroom

Pertinence, innovation, and intelligence are the three keywords associated with an intelligent classroom: (1) The pertinence of intelligent classrooms is reflected on the fact that teachers at various levels have corresponding solutions for students of different ages. For instance, the interactive learning approach of the intelligent classroom can help junior high school students in adolescents pay attention to the classroom. It can also assist new teachers with less experience in controlling classroom order efficiently. (2) The innovation of intelligent classrooms can fragment knowledge and enhance students' mastery of subject knowledge. As in the intelligent classroom, micro-lessons are a form of teaching; most of its presentation is centered on a knowledge point, an example problem, or an experiment which is highly different from the teaching style in the traditional classroom. (3) For the intelligence of the intelligent classroom. It is reflected not only on the advanced teaching equipment, but also on the development of teaching methods. Intelligent teaching has become an essential and central part of the intelligent classroom. At present, the intelligent classroom presents a development trend from universal teaching mode research to specific discipline-based teaching mode research, which also reflects the current development trend of intelligent classroom teaching research in China, gradually changing from technology dependence to technology application and from teacher

teaching informatization to the intelligent direction of two-way integration and interaction and harmony between teachers and students [3]. Meanwhile, in recent years with the update and development of information technology, the research and development of intelligent classroom has also matured. As a result, we hope to further promote our self-professionalism by studying the characteristics of teaching behaviors in an intelligent classroom. Furthermore, providing ideas and suggestions for building a mathematics middle school mathematics intelligent classroom.

2.2 Mixed Teaching Mode

What is mixed teaching mode? According to some studies, “The emergence of various intelligent teaching tools has greatly promoted the diversification of education models. Traditional classroom teaching has organically combined with the “Internet+” technology which formed a “product of a new era” in education, named mixed teaching mode” [4]. In general terms, it means combining offline teaching with online teaching and using intelligent teaching equipment in the intelligent classroom, which not only helps teachers reflect the dominance of their classrooms but also protects students’ subjectivity in the classroom. Especially in today’s post-epidemic era, the development of mixed teaching modes ensures the successful expansion of teaching activities. At the same time, Qianwei Zhang and other researchers think that mixed teaching mode is regarded as the ‘new normal’ of education with flexibility, timeliness, and continuous learning qualities. However, it also poses significant challenges to teachers, such as changing classroom teaching mode, figuring out how to use intelligent classrooms to combine teaching objectives with teaching content, and teachers’ concerns about their ability to operate intelligent classroom technology proficiently and so on [5]. In recent years, China’s research results on blended teaching are various. In CNKI Journal Paper Database, 345 papers of Chinese core journals and above can be retrieved with the theme terms of “blended teaching”, “blended teaching” and “hybrid teaching mode”, including 179 papers in journal C. About 60% of these studies are empirical studies on the design and practice of mixed teaching models, as well as research on teacher mixed teaching competencies, learning analysis, and the theoretical basis of mixed instruction [6]. Therefore, it is crucial to help teachers research the study on the analysis of the characteristics of teaching behaviors in the intelligent classroom, which can help teachers to face the challenge of the mixed teaching mode in a certain way.

2.3 Foreign Related Research

Foreign research on intelligent classrooms can be traced back to 1988 from a man called Ronald, who mentioned the “Intelligent Classroom “ (Rescigno, R.C, 1988). He believes that an intelligent classroom is a classroom that embeds information technology such as personal computers, interactive CD-ROMs, and video programs in traditional classrooms [7]. Meanwhile, a foreign academic named Skipton asserts that intelligent classroom is a classroom that uses electrical or technological advancements. He imaginatively shared his thoughts on the topic. The University of Reading in the United Kingdom pays more attention to the interactive technology in the intelligent classroom and studies the interactive behavior of students in the intelligent classroom [8]. The intelligent classroom

at Arizona State University uses PDA and situational awareness middleware to achieve group cooperative learning based on ubiquitous computing and network technologies [9].

In recent years, foreign researchers have studied the efficiency of mixed teaching. Among them, mixed teaching is significantly more effective than both face-to-face and online-only learning. The report also reveals a point: the traditional teaching mode, known as face-to-face teaching, has low learning efficiency, which means the necessity to reform the traditional teaching model and the need for a mixed teaching model with the help of scientific and technological developments as a way to enhance learning efficiency. Meanwhile, the data shows that the majority of online courses offered by U.S. colleges and universities are taught in a mixed teaching model; 50% of U.K. colleges use it; Singapore colleges and universities have adopted 80% of the mixed teaching model.

2.4 Domestic Related Research

Domestic scholars also define the ‘intelligent classroom’ in terms of the learning environment. Bangqi Liu points out that the so-called ‘intelligent classroom’ is to transform and improve classroom teaching with the ‘Internet+’ mindset and the latest information technology tools to create an innovative, efficient, and intelligent classroom teaching environment. According to intelligent teaching and learning to improve students’ individual growth and intellectual development and solve long-standing and complex problems in traditional classroom teaching [10]. At present, the domestic research on intelligent classroom teaching presents four outstanding characteristics: (1) Research is heating up year by year. (2) The research paradigm shifts from theoretical speculation to design and application. (3) The research results are produced mainly by research groups and scholars specializing in educational technology. (4) The results of IT enterprise R&D institutions are unique. From this, we can find that the development of intelligent classrooms shows vigorous vitality, continuously attracting more and more teachers and scholars to participate in practice and research and promoting the teaching reform and development of front-line teachers [11].

For the current status of mixed learning in China, Professor Zhu Zhiting of East China Normal University first introduced the concept of Mixed Teaching in his “Mixed Learning in Distance Education” in 2003 [12]. Professor Keqiang also proposed the idea of Mixed Teaching at the 7th Global Chinese Computer Education Application Conference and advocated actively introducing the mixed teaching model into course instruction. But in 2004, Professor Kedong Li completed a presentation on ‘Mixed Teaching – An Effective Way to Integrate Information Technology and Curriculum’, creatively proposing the eight steps of mixed Teaching and learning, providing a deeper discussion of mixed Teaching [13]. Then Professor Ronghuai Huang of Beijing Normal University proposed that mixed learning is ‘To learn at the right time and according to apply the fit learning technology and learning styles to deliver the right competencies to the right learners, finally get the learning styles that allows for the most optimal learning results.’, which sublimated the research on mixed Teaching [14].

To sum up, foreign research on intelligent classrooms and mixed teaching has developed innovatively and rapidly. It has good responses, so studying and learning from them is worthwhile. Taking the best of it and teaching it in a practical way so that it can play a

more significant role in the domestic classroom. In this paper, we will analyze and study the characteristics of teaching behaviors in intelligent classrooms and mixed teaching model instruction by borrowing from the Flanders Interaction Analysis Class List to provide experience for novice teachers and promote their professional development.

3 Research Design

3.1 Research Methods and Tools

This research mainly adopts qualitative research methods, which are based on the method of description and analysis, and obtain an explanatory understanding of the construction of their behavior and meaning through interaction with the research subject, with special emphasis on the particularity of the individual experience of the research subject. Qualitative research methods are superior to other research methods in terms of data collection, theory formation and understanding perspective [15]. The research tool used in this paper is NVIVO. NVIVO is a professional qualitative research software that is frequently used by researchers in conducting theoretical research methods. It helps researchers to quickly integrate and analyze imported relevant data, such as images, sounds, videos, documents, and questionnaires, then to code them, which improves the efficiency of the researcher’s research and makes the analysis of the research content more focused [16]. In this paper, the video samples from the selected area were analyzed and coded frame by frame by NVIVO, so as to complete the research on the characteristics of teaching behaviors in the intelligent classroom. The analysis process is shown in Fig. 1.



Fig. 1. NVIVO interface diagram

3.2 Research Subjects

We use the intelligent classroom teaching case films in the learning area of the TEAM Model as research samples. The research objectives of the platform are: studying theories

and technologies of intelligent education, collecting and studying big data on teaching behaviors, studying and refining intelligent models and intelligent classrooms, establishing a comprehensive database of typical intelligent classrooms, and promoting teachers' professional growth. Coaching and tracking the construction and development of TEAM Model Intelligent School and TEAM Model Intelligent School District to teach students in accordance of their aptitude and make a more ideal state of education for the promotion of talent [17]. The teaching videos in TEAM Model provide a great help for teachers' teaching to a certain extent, such as observation, discussion and reflection.

Most of the video samples selected in this paper are mainly in middle school mathematics, supplemented by two classic integrated courses which in order to observe and analyze the characteristics of teaching behaviors in intelligent classrooms more comprehensively from different perspectives. The course examples are shown in Table 1.

Table 1. Class name and location

Serial number	Lesson Name	Location
1	Side lengths of triangles	TEAM Model Intelligent Education Research Institute Public Welfare Lecture Wisteria Station Mathematics Field
2	Area of a triangle	TEAM Model Wisdom Education Institute Public Service Lecture Zhuhai Station Mathematics Field
3	Comparison of perimeter and area	TEAM Model Intelligent Education Research Institute Public Welfare Lecture Yixing Station Mathematics Field
4	Recognize positive numbers	TEAM Model Intelligent Education Research Institute Public Welfare Lecture Cloud and Station Mathematics Field
5	Recognize the average	Nanzhuang No. 3 Middle School offline classroom + online teaching and research mixed teaching and research
6	Integrated courses	The first '5G Intelligent Education Cup' Nantes Normal Student Intelligent Teaching Competition

3.3 Design of Category Analysis Table of Teacher and Student Behavior in Intelligent Classroom Teaching

This paper uses the most highly rated Improved Flanders Interaction Analysis System, which called IFIAS as a study to analyze the analysis of student-teacher behavior in middle school mathematics classrooms.

The IFIAS interaction analysis system classifies the behaviors of classroom teacher-student verbal interaction into four major categories, which are teacher language, student language, silence, and technology use. All these kinds of behaviors are represented by codes 1–15, where 1–8 denote teacher language, 9–10 denote student language, 11–12 denote silence and confusion, and 13–15 denote technology use [18]. The specific codes are defined as shown in Table 2 below.

Table 2. Flanders Interactive Analysis

Classify		Encoding	Elements
Teacher Language	indirect impact	1	Teacher acceptance of emotions
	indirect impact	2	Teacher praise or encouragement
	indirect impact	3	Teachers adopt students' views
	indirect impact	4	Asking open-ended questions
	indirect impact		Asking closed questions
	direct impact	5	Teachers teaching
	direct impact	6	Teacher's instructions
Teacher Language		7	Teacher criticism or assertion of teacher authority
		8	Students respond passively
Student Language		9	Student-initiated response
			Student-initiated questions
		10	Student discuss with their peers
Stillness		11	Dose not contribute to the confusion of teaching
		12	Contribute to the silence of teaching
Using technology		13	Teacher manipulation techniques
		14	Student manipulation techniques
		15	Technology in action for students

According to the video analysis coding on the TEAM Model as well as its own understanding, a new coding system was formed through the improvement of the Flanders interactive analysis table, which is suitable for studying the intelligent classroom videos of middle school mathematics, which incorporates the mixed teaching model as well as the unique interactivity of the intelligent classroom. It is shown in Table 3 below.

3.4 Data Encoding and Acquisition

3.4.1 Data Encoding

The research process for the study subjects was broadly divided into the following three steps. Firstly, the video samples selected on the TEAM Model are recorded using video

Table 3. List of categories of teacher and student behavior

Classify	Encoding	Elements
Teacher Conduct	1	Introduce the new lesson and indicate what to learn in this lesson
	2	Teacher questions, push questions
	3	Teachers share students' answers
	4	The teacher explains
	5	Issue instructions (what students are asked to do, assigned student responses)
	6	Intelligent selection of people (random selection of people and groups)
	12	Group scoreboard: grading students; students also grade the teacher
	14	Commendation
	15	Point out the error
Student behavior	7	Students engage in reflection
	8	Read the PPT
	9	Students grab the right to answer
	10	Proactively answer teacher questions and make points
	11	Passive answers to teacher questions
	13	Student discussions: round-table format, face-to-face discussions
Using technology	17	Statistical graphs: showing student participation and correctness of completion
	18	Timer: calculate the time for students to complete the problem
	19	Quick question and answer: The teacher quickly throws out questions and the students immediately answer them, testing their knowledge

recording software and imported into the NVIVO for analysis. Secondly, based on the imported video samples, observations were made second by second, noting the teacher's behavior and the students' behavior, and recording important letters in the time span and content. Finally, nodes were created based on the main content and teaching behavior category analysis table one by one.

Divide the video nodes into three main parts: name, material, and reference point. Indicate the content in the time span of each node separately, such as "Students are having a discussion during the time of 29 s–33 s", which ensures that the coding is consistent with that shown in Figs. 2 and 3 below.



Fig. 2. Coding of teaching behaviors1



Fig. 3. Coding of teaching behaviors2

3.4.2 Data Collection

The integration of the codes and nodes are resulted in Table 4.

In the Table 4, ‘content’ refers to the teacher’s actions in the classroom; “Triangle-based Lessons” refers to the lessons which are “Side Lengths of Triangles”, “Area of Triangles” and “Comparison of Perimeter and Area”; “Number-based Lessons” refers to “Recognizing Positive Numbers”, “Recognizing Mean Numbers”, and the Integrated Curriculum; “Integrated Curriculum Teaching Clip 1”, “Integrated Curriculum Teaching Clip 2”, and “Integrated Curriculum Teaching Clip 3” stand in for the interspersed activities that appear in the curriculum, which is the three teaching segments that appear in the integrated curriculum.

A more visual graph of the statistics is shown in Fig. 4 below.

The Fig. 4 shows that the main teacher teaching behaviors in the intelligent classroom are: issuing instructions, sharing answers, tablet responses, and passive responses. And the teaching behaviors that are less active are reading PPT, power grabbing answers,

Table 4. Frequency collection of teaching behavior characteristics

Encoding	Elements	Trigonometry Classes	Digital Courses	Integrated Curriculum Teaching Clip 1	Integrated Curriculum Teaching Clip 2	Integrated Curriculum Teaching Clip 3	Aggregate
1	Introduction of new lesson	1	3	1	0	1	6
2	Questions from teachers	4	6	0	2	1	13
3	Share the answer	4	9	1	3	3	20
4	Teachers explain	2	2	1	0	0	5
5	Issue instructions	8	8	1	1	1	19
6	Intelligent Selection	3	2	1	3	2	11
7	Student reflection	2	1	1	1	0	5
8	Read the PPT	2	0	0	0	0	2
9	Power grabbing answers	2	0	0	0	0	2
10	Unsolicited answers	2	1	0	0	0	3
11	Passive Answers	5	3	1	3	2	14
12	Panel Scoreboard	1	0	0	0	0	1
13	Student discussion	1	4	1	1	2	9
14	Teacher praise	2	0	0	1	0	3
15	Point out the error	2	0	0	0	0	2
16	Flat answer	2	7	2	1	2	14

and group scoring board. It can be seen that the intelligent classroom is a student-centered classroom where the teacher acts as a guide and facilitator of student learning, throwing out questions, asking students to answer, prompting them to think, eventually giving some encouragement and supporting based on their answers, sharing answers, guiding students to reflect on their answers, and teaching them how to learn rather than just learning knowledge. For activities with lower teaching behaviors, we can find that teachers no longer use marks as the only criteria to measure students, weakening the presence of the scoreboard and in line with the direction of quality education.

In terms of technology, the usage of the statistical chart, timer, and quick question and answer in the intelligent classroom is shown in Table 5 below.

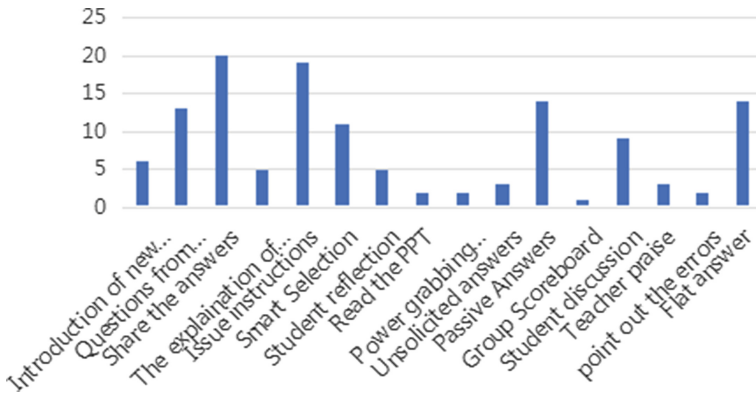


Fig. 4. Frequency histogram of teaching behavior characteristics

Table 5. Total usage rate of teaching behavior characteristics in technology

Number	Elements	Total utilization rate
17	Statistical graphs: showing student correctness and participation	37
18	Timer: calculates the time it takes for students to complete the problem	2
19	Quick questions and answers	11

As can be seen from Table 5, the usage rate of the statistical chart and quick question and answer in the intelligent classroom is the highest, while the timer is used less frequently. It can be seen that in the intelligent classroom, teachers pay more attention to students’ classroom participation and enthusiasm, which can relax the response time for students under appropriate conditions, so as to ensure that students have sufficient time for thinking.

4 Results of the Feature Analysis of Teaching Behaviors in the Intelligent Classroom

4.1 Analysis of Structure of Teaching Activities and Learning Atmosphere in the Intelligent Classroom

Flanders divided teaching activities into teacher’s language, student’s language, silence and using of technology, and structure of teaching activities in the intelligent classroom also corresponds to this, that we can complete the course together through teacher’s teaching and student’s learning. From Table 4, we can find that the classroom is dominated by the teacher, teacher asked questions 13 times, issued instructions 19 times. Teacher guided students to think and mobilized the classroom atmosphere by asking and issuing instructions, thus it can be seen that teacher’s language occupies the main

time of teaching activities, much higher than student's language, silence and using of technology. Meanwhile, teacher's language control the rhythm and the atmosphere of the classroom, when students unable to keep up with the teaching content and their attention is not focused on the class, teacher will take the method of random selection to improve the situation, as seen in Table 4, the number of students' active responses is only 3 times, while the number of students' passive responses is 19 times. Therefore, this method can not only bring back students' thoughts, but also master students' current knowledge learning degree, which is used frequently in the class. Using of technology in the intelligent classroom can ensure that the classroom atmosphere is not depressed and slience phenomenon is reduced. For instance, the using of scoreboards, answer machines and timers, fully mobilize the enthusiasm of students, supervise and urge students to attend classes. In Table 4, the total number of 'students answered questions with tablet is as high as 14 times, the number of teacher shared answers through the tablet is 20 times. It is evident that using technology in the intelligent classroom can create better learning conditions and positive learning atmosphere, and help students activate their thinking, let all of the students participate in the class.

4.2 Analysis of Teacher's Verbal Style Tendencies in the Intelligent Classroom

Teacher's language can be divided into two main areas: direct and indirect influence. Indirect influence includes: encouragement, questioning, adopting students' ideas and so on, while direct influence includes: lecturing, criticizing, instructing and so on, where indirect influence accounts for a larger proportion and it is in the main position of teacher's verbal style in the intelligent classroom. There are three reasons for this situation: (1) Take asking questions in class as an example, it is a process of two-way information exchange between teachers and students, and the appropriate performance of questioning can stimulate students' interest, inspire their thinking and improve classroom efficiency. The usage rate of quick questions and answers in the Table 5 can illustrate this point, it is up to 11 times in total, which shows the frequency and effectiveness of class questioning are high. (2) The new curriculum standard points out that "when we want to evaluate students' mathematics learning, we should not only pay attention to the understanding and mastering of students' knowledge and skills, but also pay more attention to the formation and development of their feelings and attitudes; we should not only pay attention to students' learning results, but also pay more attention to their development and changes in the learning process." [19] Therefore, the behavior that teacher encourages students in time after getting answers, can make students take an interest in this course and let them learn knowledge more actively, which accord with the requirements of the new curriculum standard. Adopting students' views and take it as an opportunity to encourage students to expand the discussion can enhance their confidence and enthusiasm, meanwhile, it can not only help students to understand the knowledge content, but also strengthen their impression of knowledge points and improve their learning quality. (3) The indirect influence of finding the right direction can significantly improve students' learning effects, for example, asking questions from the growth point of knowledge, can lose the extensibility of students' thinking, enrich students' imagination and creativity and help students to construct knowledge structure system. To sum up, indirect influence plays an important role in teacher's language. The intelligent device technology

in the intelligent classroom can help teacher find the entry point of indirect influence better, such as the statistical chart in the intelligent classroom, which shows its highest usage rate in Table 5, 37 times, it can show the participation and correct rate of students' answer, and help teacher find the difficulties and doubts of students' learning, and then solve and guide them.

4.3 The Impact of Mixed Learning in the Intelligent Classroom on the Characteristics of Teachers' Teaching Behaviors

Blending learning in the intelligent classroom has the mission to promote the classroom revolution in colleges and universities. Although the traditional teaching system is characterized by scale and standardization, the talents it has cultivated show the "thousand a voice" phenomenon, which is out of line with the goal of educating talents in the new era. However, blending learning utilize the information technology in the intelligent classroom, has brought changes to college classrooms. As shown in Table 5, the usage of statistical charts and timers in the intelligent classroom makes teacher have the spare time to handle students' individualized learning, educate the students in accordance with their aptitude and educate purposefully instead of dealing with repetitive work, so as to cultivate innovative talents, enable students to acquire the ability of lifelong learning, so that the traditional classroom, which is born in the industrial era, can gradually change into the intelligent classroom in the intelligent era [20].

Mixed teaching can increase the utilization of intelligent classroom instruction. As shown in Table 4, the number of new lesson introductions is low, only six, but in the last three lessons of cognition average shows that the new lesson introductions utilize a hybrid teaching device, combining online teaching with offline learning. It can be seen that teacher can make good use of the powerful functions of platforms such as MOOC, SPOC, and Wisdom Tree to achieve the task of teaching reform in the new era and new technology environment. It can also be seen that blending learning in the intelligent classroom has a positive impact on the characteristics of teacher's teaching behaviors.

Mixing teaching can solve the cognitive aspects of teaching in the intelligent classroom: how to transform teacher's thinking and teaching behaviors, and the TEAM Model is a good platform for this. By watching videos of intelligent classroom lessons and expert explanations on the platform, we can further understand how to use the intelligent classroom and how to maximize the functionality of the intelligent classroom, which can largely influence teacher's teaching behaviors. According to the above statistics, up to 14 tablet responses are more than enough to give teacher a full understanding of each student's needs and mastery and facilitate teacher self-reflection and improvement.

The problem of teaching workload and self-regulation can also be solved with the blending learning in the intelligent classroom. Through the data, we can see that there are 6 times from the new lesson introduction, teacher stimulate students' interest in learning through flexible and varied new lesson introduction, active classroom atmosphere and enhance the learning effect; the number of times the intelligent selector is used 11 times, which can help teachers control the classroom order and mobilize students' enthusiasm; the quick question and answer system can help teacher quickly throw out questions, while students immediately give the answer, testing the degree of mastery of student

knowledge and so on. A system of intelligent classroom technology equipment can largely reduce the burden of teacher and help teacher complete blending learning.

5 Conclusion

5.1 Research Conclusion

Through the use of technology, such as statistical charts, timers, and quick-question-and-answer software, intelligent classroom activities create good learning conditions for students, an upward learning atmosphere as a way to activate students' thinking, and allow all of the students to participate in the class. At the same time, the intelligent classroom also affects the teacher's language characteristics, making the teacher change from the main speaker to the guide, from the teacher alone to the teacher and student's interactive teaching. The teacher's language influence also gradually changed from direct influence to indirect influence, mostly to encourage, praise, and motivate students. Mixed learning in the intelligent classroom also greatly impacts the characteristics of teachers' teaching behaviors. Firstly, Mixed learning in the intelligent classroom has the technology and mission to drive the revolution in the college classroom, which indirectly influences the teaching behavior characteristics of teachers and makes their lectures more technical and structured. Secondly, blending learning can increase the utilization of teaching and learning in an intelligent classroom, making teachers' teaching behaviors more innovative. What's more, mixed instruction can solve the cognitive aspects of intelligent classroom instruction: how to transform teachers' instructional thinking and teaching behaviors, making teachers' teaching behavioral characteristics more rational. Finally, the problems of teaching workload and self-regulation can also be solved by blending learning in the intelligent classroom, making the characteristics of teachers' teaching behaviors more convenient.

As a result, the act of teaching and learning in the intelligent classroom has the following characteristics: indirectness, technology, structure, innovation, rationality, and convenience.

5.2 Possible Problems in the Intelligent Classroom

Although the teaching of the intelligent classroom is rich, there are still some problems: (1) Classroom activities are so rich, and the lecture is so fast-paced that some students may not fully grasp the knowledge. (2) When the network or equipment malfunctions during the class, improper handling may affect normal teaching. (3) Using electronic devices such as tablets for too long to affect students' eye health. In the current era of information explosion, the development of the intelligent classroom is undoubtedly as helpful as it can be in helping the teacher to complete their teaching tasks while carrying out higher-level teaching activities. At the same time, the form of seating arrangement in the intelligent classroom is worth having a careful look at, 5–6 students sit in groups in a circle, which is helpful for group discussions, and the positive influence of the group members allows every student to participate in class discussions.

Acknowledgements. This work was supported by the Key Project of Teaching Reform of Nanjing Normal University of Special Education “Teaching Model Reform and Practice Based on ‘Intelligent Classroom’” (No. 2021JXJG10); the Innovation and Entrepreneurship Projects for University Students in Jiangsu Province “Characteristics Analysis of Teaching Behaviors in Intelligent Classroom—Take the Teaching Video in Team Model as an Example” (No. 202212048053Y); Jiangsu Qinglan Project “Sign Language Translation” Excellent Teaching Team; the Third Level Training Object of the Sixth “333 High-level Talent Training Project” of Jiangsu Province.

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