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Analysis of Current Situation of Classroom Interactive Teaching Based on Mobile Devices: A Case Study of Middle School Mathematics Classroom Teaching

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Abstract: With the development of mobile technology and the popularization of smart devices, mobile learning has penetrated into people's life. In this paper, by referring to the interactive analysis system of different experts and scholars, and combining the actual situation of this study, the content analysis method of video is adopted to carry out the classroom interactive analysis of a junior middle school mathematics class using mobile devices for teaching. The study found that mobile devices to some extent effectively support classroom interaction. The specific performance is as follows :(1) the Android tablets mainly supports the learning behavior of students' independent inquiry; (2) the class supported by the Android tablets can provide instant feedback on students' answers; (3) Android tablets can help students' explicit thinking and support their thinking development.

Keywords: Classroom interaction, Mobile devices, Middle school mathematics

1. Introduction

The 43rd statistical report on the development of Internet in China (February 2019) pointed out that as of December 2018, 829 million Internet users were in China, and 29.8% of them used tablet computers to surf the Internet. In terms of place of use, the proportion of students accessing the Internet in school rose to 22.1 percent in 2018 from 19.1 percent last year. From the perspective of users' occupation structure, students account for the largest proportion of Internet users, as high as 25.4%. In terms of the usage rate of individual Internet applications, a total of 202.13 million netizens conducted online education, with a usage rate of 24.3 percent, an increase of 29.7 percent over last year. With the development and upgrading of mobile technology and the popularization of smart devices, it has successfully laid a foundation for mobile learning and provided more opportunities for people to learn lightweight, fragmented and structured knowledge through mobile terminals. Therefore, mobile learning has become one of the important trends in the application of new technology in education. Mobile learning is an educational interaction through mobile technology that students can access from any place (Traxler, 2013), which is also considered as the use of mobile devices and Internet connection for educational purposes (Kinash, Brand, & Mathew, 2012). Many studies have shown that in a learning environment, mobile learning can build and maintain the capabilities of creativity (Ranieri & Bruni, 2013), collaboration (Niels & Carreira, 2018), interactivity (Shen, Wang, & Pan, 2010). In traditional classroom teaching, the classroom interaction between teachers and students is only through simple interpersonal interaction and interaction based on simple mediation (such as blackboard). The form of interaction is monotonous, insufficient in depth and unidirectional. In the current classroom teaching, other technical equipment has been provided to improve classroom teaching, such as tablet computers. Because the tablet supports instant feedback, it provides more support for the real-time and efficient classroom interaction. Based on this, this study selects tablet computer as a third-party intermediary media for teacher-student interaction, and studies its influence on classroom interaction from multiple dimensions such as interpersonal interaction, human-computer interaction and mediation-based

interaction. The research will focus on two research issues: first, the supportive role of tablet computers for classroom interaction; second, the depth of classroom interaction.

2. Methods

Classroom interaction is the basic form of classroom teaching (Qu Bo & Sun Li-li,2019). The nature of interaction requires participants to understand the meaning of interaction with each other. Therefore, classroom interaction is related to the effectiveness of classroom teaching. The study will select "classroom interaction" as the entry point for video image analysis, and analyze the "classroom conversation" by using the content analysis method of classroom video. This research method encodes interactive behaviors and languages based on specific types of functions and analyzes classroom interactions. Based on this, this study takes a public course "Image and Nature of a Function" taught by a junior high school teacher in Beijing as a research case. There are 24 students in the class, study the classroom video of this lesson, and then use the classroom interactive analysis system. The classroom recorded video is sliced and coded to provide an in-depth analysis of the classroom interaction.

3. Interactive analysis and coding system based on mobile devices

In the 1960s, American scholar Ned Flanders proposed a system for classroom interaction analysis (Flanders Interaction Analysis System, FIAS). FIAS consists of three parts: a coding system that describes the interactive behavior of the classroom, a prescribed standard for observation and record coding, and a matrix table for displaying and analyzing the data. Although FIAS can present the classroom structure, behavioral patterns and teaching styles in a quantitative way, there are also many limitations, such as neglecting the interaction between teachers and students and the classroom environment; interaction analysis is limited to the interaction of the established classification, and Ignore the true intentions of teachers and students. Based on this, domestic scholars have made improvements to the system. For example, Gu Xiaoqing (2004) added technical classes based on FIAS and further refined these four categories into 18 coding rules. Feng Wisdom (2016) improved and optimized FIAS to form a Student Centered Interaction Analysis System (SIAS), which increases student behavior and technology, and is subdivided into 18 Article encoding rules. The author will refer to the research results of various scholars and combine the actual situation to organize a classroom interactive analysis system that is more suitable for this research. The classroom interaction analysis system used in this paper is shown in Table 1.

Table 1. *Classroom interactive analysis system*

Classification		code	representation	content
Teacher language	indirect influence	1	Accepting emotions	Accept or clarify student attitudes and emotions in a non-threatening manner
		2	Praise encouragement	Encourage and praise students' behavior through language or software
		3	Adoption of opinions	Adopt and repeat the student's speech perspective
		4	submit questions	Ask students questions and expect students to answer
	direct impact	5	Content teaching	Use the blackboard, technology, etc. to present facts or insights, express the concept of the teacher, and present the teacher's own interpretation or other authoritative scholars' views.
		6	Behavioral instruction	Command the student to do something
		7	Criticize and correct	Teachers criticize or correct students' classroom behavior with authority or self-referential

Student language	8	Passive response	The teacher named the student to answer the question.
	9	Active response	Students take the initiative to answer questions from teachers
	10	Active questioning	Students take the initiative to ask questions to teachers
	11	Brainstorming	Students and peers discuss and exchange
Quiet	12	Silent confusion	Temporary quietness or confusion that does not help teaching
	13	Thinking problem	Students thinking about problems
	14	Classroom practice	Students use paper or pencil or school tools for classroom exercises
Technology	15	Teacher operation technique	Teachers use technology to clarify ideas, teach demonstrations, evaluate works, view student data, etc.
	16	Student operation technique	Students use technology to do experiments, practice, express opinions, view materials, etc.

4. Analysis results and discussion

Through the method of case study, the author selects a junior high school mathematics class "Image and Nature of Once Function" as a case study of this study. The course uses the combination of Rui Xuetang teaching software and GeoGebra drawing software. The study will use a combination of qualitative and quantitative methods to analyze the classroom interaction of mobile devices in this class. The following is an analysis of the classroom interaction in this lesson:

4.1 Time sequence analysis of teaching process

The time sequence analysis of the teaching process of "images and properties of primary functions" is shown in table 2. Through analysis, it is found that teachers mainly guide students to learn by independent inquiry and independent learning, and can carry out situational teaching in combination with real life. In the whole class, the teacher guides the students, enlightens their thinking and enables them to think independently to deepen their impression of what they have learned.

Table 2. *The Teaching Process of "Image and Nature of a Function"*

Time	**teaching activities**	**teaching description**		**Android tablets support**
		teacher	**students**	
00:31-01:27	Situational import	The picture shows the situation and leads to the teaching content of this lesson —— the first function	According to the teacher's guidance, think about the quantitative relationship between x and y	
01:27-08:50	The independent inquiry	Inquiry question: the position relation of the solution of the bivariate quadratic equation in the plane rectangular coordinate system?	Under the teacher's inspiration, students can understand the solution of binary quadratic equation in a straight line through software self-exploration	software : GeoGebra
08:50-11:30	With practice Course teaching	The concept of first order function is derived from the practical problems in life	Learn the definition of a function through the teacher's guidance	
11:30-	The	Q: what does the graph of a	Independent thinking, the use	software :

13:30	independent inquiry	function look like?	of geometric sketchpad software to explore the first function of the image	GeoGebra
13:30-34:50	Autonomous learning Course teaching	Assign tasks, guide learning, ask questions, summarize and comment	Using the geometry drawing board to learn independently, take pictures and upload the function image, and summarize the image properties of the function	software : GeoGebra 、Sharp school
34:50-41:42	Independent practice	Assign tasks, direct, summarize and comment	Draw a graph of the function on the graph paper and upload it. Summarize the drawing method of function image	software : Sharp school
41:42-43:48	Contents summary	Summary of content Classroom reflection	Share the knowledge and methods gained in this lesson	

4.2 The analysis matrix is formed according to the interactive coding system

In the observed case course, excluding the useless parts at the beginning and end of the class, the total length of the class is 44 minutes. According to the coding rules of Ned Flanders, a coding number is determined every 3 seconds, and 879 pairs of coding sequence pairs are finally formed. According to this arrangement, a 16*16 order Ned Flanders transfer matrix is formed (table 3).

Table 3. *Interactive Analysis Matrix of "Image and Nature of Once Function" Video*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2
2	0	16	1	0	0	0	0	0	0	0	0	0	0	0	0	0	17
3	0	0	19	1	0	0	0	0	0	0	0	0	0	0	0	0	20
4	0	0	0	73	1	0	0	0	0	0	0	0	0	0	0	0	74
5	0	0	0	0	179	1	0	0	0	0	0	0	0	0	4	2	186
6	0	0	0	0	0	38	1	0	0	0	0	0	0	0	0	0	39
7	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	3
8	0	0	0	0	0	0	0	90	1	0	0	0	0	0	0	0	91
9	3	0	0	0	0	0	0	0	37	0	0	1	0	0	0	0	41
10	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
11	1	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	9
12	0	0	0	0	0	0	0	0	0	0	0	20	1	0	0	0	21
13	0	0	0	0	0	0	0	0	0	0	0	0	12	1	0	0	13
14	0	0	0	0	0	0	0	0	0	0	0	0	0	99	1	0	100
15	0	0	0	4	0	0	0	0	0	0	0	0	0	0	45	1	50
16	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	210	211
total	4	17	20	78	180	39	3	92	38	1	9	22	13	100	50	213	879

According to the interactive analysis matrix of video in "the image and nature of the first function", the statistical table of the ratio of interactive behaviors in classroom teaching can be obtained (table 4), through which the classroom can be analyzed in depth from different perspectives. From the perspective of classroom structure, the teacher's speech ratio is 38.79%, the student's speech ratio is 16.27%, the silence ratio is 5.24%, and the technology ratio is 29.69%. It can be seen that the teacher occupies a dominant position in the classroom, and the use of technology is reasonable, and the student's speech rate is also high. Among them, the question asking rate of teachers is 2.28%, and the thinking rate of quiet middle school students is 84.33%, indicating that teachers can guide students to think through questions and have deep classroom interaction with students. Students use technology ratio was 80.84%, the ratio of teachers' use of technology was 19.16%, more can show students the use of more technology issue to explore, practice and browse other students answer, teachers use technology demonstration for operation, answers and comments on student responses from the student, to improve the students' participation and self-efficacy, in order to achieve the depth of the subject and object interaction.

In addition, it can be seen from the diagonals of the matrix in the above table that the three largest data are (16,16), (5,5) and (14,14) successively, which also indicates that students make full use of technology to conduct classroom exercises and knowledge exploration under the guidance of teachers. From the perspective of the emotional atmosphere of teachers and students, teachers and indirect effects directly affect the rate of 49.55%, in line 1-3 and 1-3 columns of the area of the positive grid frequency is 36 times, on line 7-8 and 6-7 column defect of the frequency of 2 times, that teachers pay attention to the interaction with the students in the classroom, active communication with students, be good at to adopt the opinions of the students, the classroom atmosphere is very harmonious whole, student's participation is also very high, and the teacher's direct impact is mainly composed of lectures and guide students to think about, to help students better understand knowledge.

Table 4. *Classroom teaching interaction behavior ratio statistics*

Analysis content	**calculation formula**	**proportion**
Teacher speech ratio	1-7 total number of rows/total number of rows	38.79%
Student speech ratio	8-11 total number of rows/total number of rows	16.27%
Silence ratio	Total number of rows from 12 to 14 / total number of rows	5.24%
Android tablets ratio	Total number of rows of 15-16 / total number of rows	29.69%
The rate of students thinking about problems	The total number of rows from 13 to 14 over the total number of rows from 12 to 14	84.33%
Teacher question ratio	The total number of rows divided by the total number of rows	2.28%
The percentage of students using tablets	The total number of rows divided by the total number of rows between 15 and 16	80.84%
The percentage of teachers using tablets	Total number of rows of 15 / total number of rows of 15-16	19.16%

As a whole, this case video lesson in the technology and the classroom teaching can fully mix, and conducive to the students in the classroom interaction and teacher, student and equipment, teachers and equipment, equipment - students such as deep multi-dimensional interaction, and classroom atmosphere is very harmonious, friendly, is conducive to teachers inspire students to think about, to mobilize students' learning enthusiasm and initiative.

4.3 Mobile device support, interactive depth, interactive feedback and interactive engagement

After the whole process of observing classroom interaction, this study also interviewed several teachers who observed this class on the spot. Teachers basically believe that mobile devices are better supported, can better support interaction, significantly improve students' participation and efficacy, but have not helped students achieve high-level learning goals; for the depth of interaction, teachers It is believed that high-effect interaction can be achieved, mainly in the multi-dimensional and overall interaction; for

interactive feedback, teachers believe that mobile devices can promptly feedback right and wrong, encourage and promote attitudes and emotions; and for interactive participation, teachers believe that interactive participation The degree is good, showing that most students can deeply participate in the interaction.

5. Conclusion

Based on the above analysis, this study believes that mobile devices effectively support classroom interaction to some extent in this class. The specific performance is as follows :(1) the tablet computer mainly supports the learning behavior of students' independent inquiry. In class, students make full use of the learning resources in the tablet computer, and complete the tasks assigned by teachers through resource viewing, inquiry and simulation experiments, so as to help students think actively and promote their self-directed learning. (2) the class supported by tablet computer can provide instant feedback on students' answers. Real-time feedback technology can be used to accurately reflect students' learning data to teachers, so as to make data-based teaching strategy adjustment. For example, through students' answers, students' knowledge confusion points or knowledge blind spots can be systematically explained. (3) tablet computers can help students' explicit thinking and support their thinking development. As a learning tool, tablet computers can help students make their thinking process explicit step by step. Learning scientific research shows that when students express the knowledge they are forming externally, the learning effect will be better, thus promoting students' independent thinking and developing thinking.

The real classroom interaction is to help students to construct knowledge and develop their thinking ability. Although the cases examined in this study are not necessarily representative, teachers' use of mobile devices in class does improve classroom interaction. Therefore, this case can help other teachers to reflect on teaching and take practical actions to some extent. This kind of case study will be more conducive to the practice and development of mobile learning in classroom teaching.

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