A Study on the Analysis of Teacher-Student Interaction Behavior in Middle School Information Technology Quality Classes

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Abstract. Quality classrooms, as a form of deep integration of information technology and education teaching, have a crucial impact on classroom teaching change. This paper takes the Improved Flanders Interaction Analysis System (iFIAS) as a research tool. It adopts a combination of quantitative and qualitative research methods, from which it analyzes the interaction structure of eight junior high school information technology high-quality classrooms, the interaction style and tendency of the teachers, the interaction behavior of the students, as well as the teacher-student question-and-answer behavior, and finds that although high-quality classrooms have many highlights to be learned from, there are shortcomings of insufficient practice and students' questions are scarce. Thus, we propose strategies to deepen classroom interaction and build teacher-student question-and-answer sessions. Hopefully, this will provide classroom optimization suggestions for teachers' instructional design and practice and a reference for future classroom teaching research of information technology teachers.

Keywords: Information Technology Quality Courses, Interactive Behavior Analysis, iFIAS

1   Introduction

Information technology is compulsory for junior high school students to develop essential skills and literacy. It has been designed with a history of more than 40 years and has received attention from scholars at home and abroad. Scholars such as Zhan (2021) explore the difference between intelligent classroom and traditional classroom interaction[1]; Hou Shuangshuang (2014) analyzes the current situation and puts forward the interaction strategy under the new curriculum standard[2]. Teachers have many strategies, but optimization requires experience, and limited concepts affect the effect. This paper analyzes the teacher-student interaction in eight excellent lessons and provides optimization suggestions for information technology teachers.

2   Research Design

2.1   Overview of Research Samples and Tools

In this study, eight excellent junior high school information technology lessons were selected as samples from the China Association for Educational Technology 2022[3], and the lessons contained program algorithms, skill practices, and theory discussions. Given the accuracy and low coding burden of iFIAS in analyzing teacher characteristics and teacher-student interactions[4], it was used for the analysis. iFIAS was subdivided into four categories: teacher language, student language, silence, and technology application, with 14 behaviors to ensure a comprehensive and accurate analysis of teacher-student interactions.

2.2   Research Process

In this study, the iFIAS tool of the Fang Haiguang team was used to simplify the coding analysis: 8 junior high school information technology excellent lessons were randomly selected, and the iFIAS assistant generated Excel data, noting interactions every 3 seconds, importing the program to set up references, and generating matrix diagrams for in-depth profiling.

3   Research Findings and Analysis

3.1   Analysis of the Structure of Classroom Interactions

In this paper, we processed the coded data of 8 quality lessons based on the iFIAS ratio formula. We referred to the Flanders experimental specification criteria[5], and the results are shown in Table 1.

Table 1. Structure of classroom teacher-student interaction.

brochure	Teachers' speech ratio (%)	Student speech rate (%)	Useful for teaching silence rate (%)	Ratio of teachers manipulating technology (%)	Ratio of students manipulating technology (%)	Teacher speech-to-student speech ratio
A1	63.43	23.33	1.13	7.31	4.67	2.72
A2	58.02	25.03	8.34	7.69	0	2.32
A3	55.61	16.32	20. 1	7.44	0	3.41
A4	68.16	23.17	4.47	3.79	0	2.94
A5	42.88	22.45	3.4	24.34	6.94	1.91
A6	67.06	12.97	11.54	7.78	0	5.17
A7	53.99	26.03	3.87	16. 11	0	2.07
A8	52.13	35.58	3.88	6.73	1.68	1.47
normality	68	20	11—12	/	/	/

Table 1 shows that a high percentage of teachers speak, A4 is high; students speak actively, A3 and A6 up to 35.58% better than the norm, able to promote oral and divergent thinking. The beneficial silence rate varies widely (0.26%-20.21%); only A6 teachers control the average level, indicating a variety of strategies but a lack of moderation. Teacher modeling accounted for 24.34%, indicating that micro-lessons aid comprehension. Students' practical activities were few (6.94% at most), indicating the lack of practical IT skills development[6].

3.2   Analysis of Teachers' Interaction Styles and Tendencies

After iFIAS analysis, the authors calculated the frequency and percentage of indirect/direct control and positive/negative reinforcement for the eight teachers[7], obtaining proportional data as shown in Table 2.

Table 2. Comparison of teachers' classroom interaction tendencies.

		A1	A2	A3	A4	A5	A6	A7	A8
indirect control	frequency	120	156	134	186	110	109	114	239
	percentage	15.14%	20.34%	17.49%	25.20%	13.86%	14, 14%	14.7%	30.91%
direct control	frequency	383	289	292	317	230	408	305	164
	percentage	48.3%	37.68%	38. 12%	42.96%	29%	52.91%	39.31%	21.21%
Ratio of indirect to direct control		0.31	0.54	0.46	0.59	0.48	0.27	0.38	1.46
intensify vigorously	frequency	66	57	75	97	39	20	42	135
	percentage	8.33%	7.43%	9.79%	13. 14%	4.91%	2.6%	5.42%	17.46%
negative reinforcement	frequency	72	47	62	50	40	18	30	40
	percentage	9.08%	6.13%	8.09%	6.78%	5.04%	2.33%	3.87%	5.17%
The ratio of positive to negative reinforcement		0.92	1.21	1.21	1.94	0.98	1. 11	1.4	3.38

Table 2 shows that the remaining teachers' indirect/direct control ratios were less than one except for A8, with A6 having the lowest ratio of 0.27, indicating that the first seven teachers tended to have direct control. a8, on the other hand, had indirect control using praise and so on. Positive reinforcement is more than negative reinforcement for the rest of the teachers except A1 and A5, and the ratio is as high as 3.38 for A8, indicating that IT teachers are more affirmative and encouraging, especially in class A8, where the atmosphere is harmonious. Due to more directives and fewer criticisms, the low positive and negative reinforcement ratios for A1 and A5 indicate that teachers are less criticized in quality classes.

3.3   Analysis of Student Interaction Behavior

The analysis system used in this study divides student interaction behavior into verbal and nonverbal behavior. Given that the above has already detailed analysis of nonverbal behavior, such as students' practice and silent thinking, this study only focuses on the

comparative analysis of students' verbal behavior. The author compiles student interaction behavior data in eight high-quality class examples, as shown in Table 3.

Table 3. Comparison of Students' Verbal Behavior Data.

	A1	A2	A3	A4	A5	A6	A7	A8
Ratio of Passive responses to student speech	12.97%	1.04%	19.20%	14.62%	3.37%	23.00%	15.35%	20.00%
Active response as a percentage of student speech	48. 11%	43.75%	44.80%	33.33%	49.44%	77.00%	35.64%	41.82%
Active questioning as a percentage of student speech	0	0	0	0	0	0	0	0
Discussion with peers as a percentage of student speech	38.92%	55.21%	36.00%	52.05%	47.19%	0	49.01%	38. 18%

Table 3 shows few passive responses and active statements (30%- 77%), with a minimum of 1.04% and no active questions. The peer discussion rate was higher than 35% except for A6, the highest being 55.21% in the A2 class. It shows that most IT teachers shift the discourse, encourage speaking, promote cooperative inquiry, and enhance thinking, but there are many limiting factors, and students ask fewer active questions.

3.4   Teacher-Student Question and Answer Behavior Analysis

In the classroom, teachers ask questions and guide students to answer them, promoting the collision of ideas. The level and quality of the questions are related to the development of students' thinking, and students' answers reflect the effectiveness and level of teaching.

Table 4. Classroom Teacher-Student Question and Answer Behavior Ratio Table.

	A1	A2	A3	A4	A5	A6	A7	A8
Teacher questioning as a percentage of classroom behavior	6.81	12.91	7.7	12.06	8.95	11.54	9.28	13.45
Open-ended questions as a percentage of questions asked	53.7	97.98	71.19	79.78	78.87	76.4	70.83	56.73
Closed questions as a percentage of questions asked	46.3	2.02	28.81	20.22	21.13	23.6	29.17	43.27
The ratio of students' passive responses to classroom behavior	3.03	0.26	3.13	3.39	0.76	2.98	3.99	7. 12
The ratio of student-initiated responses to classroom behavior	11.22	10.95	7.31	7.72	11. 1	9.99	9.28	14.88

Table 4 shows that A2, A4, A6, and A8 teachers asked more than 10% of questions, with A8 having the highest rate of 13.45%, indicating that IT teachers use questions and answers to promote interaction. In contrast, A1, A3, A5, and A7 had a low questioning rate, with a minimum of 6.81%. The study pointed out that open-ended questioning in IT classes benefits creative thinking. Table 2-4 shows that the percentage of open-ended questions is higher than closed-ended for all eight teachers, indicating that

lesson planning emphasizes open-ended question design. Regarding student responses, passive responses were less than active statements in all eight classes. a8 had the highest rate of student statements at 14.88%, followed by A1, A2 and A5 classes. All four teachers organized group discussions and reports to promote cooperative and competitive speaking, reflecting the student-centered classroom[8].

4   Teaching and Learning Recommendations

4.1   Deepening the Mode of Classroom Interaction and Improving the Quality of Interaction

First, it enhances students' verbal participation, designs student-centered activities, reduces the time teachers spend on lecturing and makes the classroom a platform for students to express themselves[9]. Second, balancing the teacher-student verbal ratio, although the teacher should maintain the role of a facilitator, they should step back at the right time to give students more opportunities to express themselves. Third, strengthen the practical application of multimedia technology and ensure that multimedia technology is not just an aid to presentation in teaching but a tool to promote students' understanding, exploration, and innovation.

4.2   Shifting Teacher Interaction Tendencies to Promote Active Student Engagement and Communication

First, various group work strategies should be promoted to increase exciting interactions in the classroom. Second, it enriches the language of evaluation and clarifies strengths and weaknesses. Third, set up "question time" and "question box"[10] to stimulate questioning, guide critical thinking, and reduce dependent thinking. In communication, students dare to question and put forward new ideas.

4.3   Structuring teacher-student Q&A Sessions to Promote In-depth Thinking Collisions

First, design high-quality questions that inspire open multi-level discussion. Second, use diversified questioning strategies tailored to promote understanding. Third, deepen question-and-answer interaction to ensure students' right to speak.

5   Conclusions

In this paper, we analyze eight quality lessons with iFIAS, summarize the commonality and individuality of teachers' interactions, and propose optimization strategies to address the problems. The results will inspire educators to practice and innovate, promote the quality of teaching and learning, and create a vivid and efficient learning environment.

Acknowledgment

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