Research on English Classroom Teaching Interactive Strategy for Higher Vocational Students in smart Classroom Environment

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Abstract: *This study conducted experimental teaching of vocational college English listening and speaking courses in both smart classroom and simple multimedia classroom environments. Using an improved version of the Flipped Classroom Interaction Analysis System (SCIAS) and questionnaires, supplemented by S-T analysis as a complementary research method, the study conducted a comparative analysis of classroom records in terms of classroom structure, emotional atmosphere, interactive behaviors between teachers and students, interpersonal interactions, and interactions between teachers, students, and media technology. The results showed that compared to traditional classrooms, teaching in a smart classroom environment is more conducive to stimulating students' initiative, leading to deeper and more active classroom interactions.*

Keywords: *Smart Classroom; Vocational College English; Teaching Interaction*

Research on smart classrooms in China started relatively late, and there is a lack of empirical research. Moreover, research on teaching interactions in smart classrooms, especially in the context of vocational colleges, is scarce. This study aims to conduct teaching experiments in vocational college English classrooms, using an improved version of the Flipped Classroom Interaction Analysis System and questionnaires as research tools, to conduct a multidimensional comparative analysis of teaching interactions between smart classrooms and traditional classrooms.

As the current research status indicates, teaching English courses in smart classroom environments is still in the exploratory stage. Interactive teaching involves interaction and communication between teachers and students, as well as among students during teaching activities, forming a dynamic process of mutual influence and interaction between teaching and learning[1].By engaging teachers and students in discussions, explorations, and dialogues, thoughts collide and reach consensus, thereby constructing the meaning of knowledge and promoting the development of learners' subjectivity.

This study aims to analyze the teacher-student interactions in vocational college English listening and speaking demonstration classes in a smart classroom, and draw conclusions on how teachers should utilize the smart classroom environment to create an active classroom atmosphere and encourage students' active participation in the class.

1. Characteristics of Smart Classroom Environment

The smart classroom constructed by Wuhan Software Engineering Vocational College is a new type of information learning environment centered around interaction, utilizing advanced information technology and equipment. This smart classroom is equipped with devices such as wireless Wi-Fi, EasiNote cloud blackboard by Odyssey Technologies, group discussion screens, teacher control terminals, and intelligent classroom recording systems. These devices facilitate diverse learning activities such as collaborative learning, independent exploration, and interactive discussions. The design concept emphasizes cloud integration, diverse teaching modes, behavior visualization, and intelligent management, forming a mature smart classroom software and hardware system.

Additionally, teachers with high information literacy, possessing teaching support through

technology, solving teaching problems using technology, redesigning teaching activities with technology, and innovating teaching methods with technology, are also essential elements of the smart classroom environment.

2. Comparative Analysis and Optimization of Classroom Interaction Analysis Systems' Coding Characteristics

Starting from the 1960s, various classroom observation tools have emerged based on different observation objectives. Representative classroom analysis tools include the Flipped Classroom Interaction Analysis System (FLAS), Student-Teacher (S-T) Interaction Analysis Method, Classroom Assessment Scoring System (CLASS), and Communication-oriented Language Teaching (COLT) observation scales. Although FLAS enhances the objectivity and scientific nature of classroom interaction research, it overlooks students' behavior in the classroom and has limitations in reflecting the interaction between people and technology. Therefore, scholars have made their improvements based on FLAS. For instance, Gu Xiaoqing et al[2].developed the Information Technology-based Interaction Analysis System (ITIAS) from the perspective of implementing the new curriculum reform and applying information technology. Jiang Libing [3].drew on ITIAS and combined it with long-term observations of teacher-student behavior in classroom teaching to propose the Classroom Teaching Behavior Analysis System (CTBAS), using this analysis system to verify the promoting effect of smart classrooms on higher education classroom teaching reform.

This study is committed to carrying out teaching experiments in English listening and speaking classroom in higher vocational colleges, using improved FLAS and questionnaire as research tools, to compare analyze the interaction between listening and speaking teaching in intelligent classroom and traditional classroom from multiple dimensions. As shown in Table 1:

Table 1:Interactive analysis system of classroom teaching based on smart classroom

Classification		Code alias	Code	Content	Specific expression
Teacher's words	Indirect effects	T1	1	Accept emotion	Accept their feelings in a way that the students are not threatened
		T2	2	Encourage praise	Encourage or praise the students' actions or actions
		T3	3	Adopt the opinion	Agree with or accept students' opinions or suggestions
		T4	4	Ask questions about openness	There is no only standard answer
		T5	5	Raise the problem of closure	There is the only standard answer
	Direct influence	T6	6	Lecture	Explain the teaching content and express their own understanding
		T7	7	Organization instruction	Organize learning activities
		T8	8	Criticize	Teachers criticize or maintain authority
Students' words		S1	9	Students respond passively	Students respond to the teacher's verbal behavior
		S2	10	Students take the initiative to respond	
		S3	11	Students ask questions	
		S4	12	Students will discuss with their peers	Companion guidance
Dead		C1	13	Does not help in the chaos of teaching	
		C2	14	Help to the silence	Including students thinking

					of teaching	problems and doing exercises And so on behavior
Technology spoken language	Teacher-technology	TT	TT1	15	Roll call、rouping	Students were named manually or randomly or grouped using techniques
			TT2	16	Operation demonstration content	Show the learning content or resources, such as animation, video, audio, etc
			TT3	17	Board writing, heavy and difficult points marking	Using technology on the electronic whiteboard, focus on the annotation of resources
			TT4	18	Real-time analysis of learning situation	Arrange the interactive exercises and review the analysis
			TT5	19	Show and evaluate students' achievements	Show and evaluate the students' discussion answers, works, etc
	Student-technology	ST	ST1	20	Resource learning	Watch videos, learning resources designated by teachers, etc
			ST2	21	Self-determination exercise	Use technology to do interactive exercises or express opinions, such as using mobile phones, objective interactive questions, etc
			ST3	22	Sharing and display of the creation	Use technology to create and share displays (individually or in a group)
			ST4	23	Student assessment	Peer-peer or intergroup evaluation

3. Research Plan for Interactive Strategies in Smart Classroom Environment for Vocational College English Classroom Teaching

3.1 Research Questions

Based on the literature review, this study focuses on the following research questions: 1) What are the differences between the smart classroom environment and the traditional classroom environment in factors such as interaction frequency, interaction participants, interaction content, and interaction feedback, which reflect the overall situation of classroom interaction? 2) What are the differences in the impact of various teaching interactive strategies, such as peer assessment, questioning, and peer guidance, on the overall classroom interaction? 3) Compared to the traditional classroom environment, can information technology equipment effectively improve the quality of classroom interaction?

3.2 Research Participants

This study will involve students from two regular classes of the 2021 intake in a vocational college. The research will be conducted using the listening and speaking modules of the mandatory course "General English for the Workplace 1," specifically focusing on four units as examples. The researcher will be the instructor during the experiments, and the teaching processes and content will be kept consistent. Both classes consist of non-English major students, and their English proficiency levels are comparable.As shown in Table 2:

Table 2: Study subjects

Group	Teaching environment	Student major	Number of students	Learning content
Experimental group	Smart classroom	Electronic Business	42 person	“The New Practical English Comprehensive Course 1”U2-5

Control group	Simple multimedia classroom	Finance	38 person	“The New Practical English Comprehensive Course 1”U2-5

3.3 Data Collection and Calculation Formulas

After adapting to their respective teaching environments in the experimental group and the control group, the control classroom will be coded according to Table 1. A time sampling method will be employed, with one sample extracted every 3 seconds from the U3 section, which demonstrates good teaching effectiveness, in each of the four units. Classroom behaviors will be coded and recorded to create a classroom observation record table.The following coding rules will be formulated: If multiple interaction behaviors occur within 3 seconds, all behaviors will be recorded, and a different interaction behavior from the previous 3 seconds will be chosen. Each coding will form an "order pair" in combination with the previous and subsequent codings. Except for the first and last codings, each coding will be used twice. The cumulative frequency will be used to record teacher-student classroom behaviors. The 23 coding categories in Table 3 will be used as both the horizontal and vertical axes, forming a 23x23 transition matrix. The recorded order pairs will be filled into the matrix.As shown in Table 4:

Table 3 :Basic information of data collection

Group	Sample video duration	Number of records encoded
Experimental group	40 Minutes and 13 seconds	804
Control group	39 Minutes and 52 seconds	797

Table 4: Schematic chart of classroom matrix encoding

Categories and encoding		Teacher's words					Students' words			Dead		Technical words				
		1	2	3	…	8	9	10	…	13	14	15	16	17	…	23
Teachers' words	1	1	2	1	…	0	1	3	…	0	0	0	0	0	…	0
	2	1	15	1	…	0	0	1	…	0	1	0	0	0	…	0
	3	0	1	4	…	0	0	13	…	0	0	0	0	0	…	0
	…	0	0		…	0	0	0	…	0	0	0	0	0	…	0
	8	0	0		…	0	0	0	…	0	0	0	0	0	…	0
Students' words	9	-	-	-	…	0	0	0	…	0	0	0	0	0	…	0
	10	7	2	33	…	0	0	165	…	0	0	0	0	0	…	0
	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
Dead	13	0	0	0	…	0	0	0	…	1	0	0	0	0	…	0
	14	0	0	0	…	0	0	8	…	0	9	0	0	0	…	0
Technical words	15	0	0	0	…	0	0	0	…	0	0	0	0	0	…	0
	16	0	0	0	…	0	0	0	…	0	0	0	3	0	…	0
	17	0	0	0	…	0	0	0	…	0	0	0	0	2	…	0
	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
	23	0	0	0	…	0	0	0	…	0	0	0	0	0	…	2

4. Systematic analysis results of teaching cases

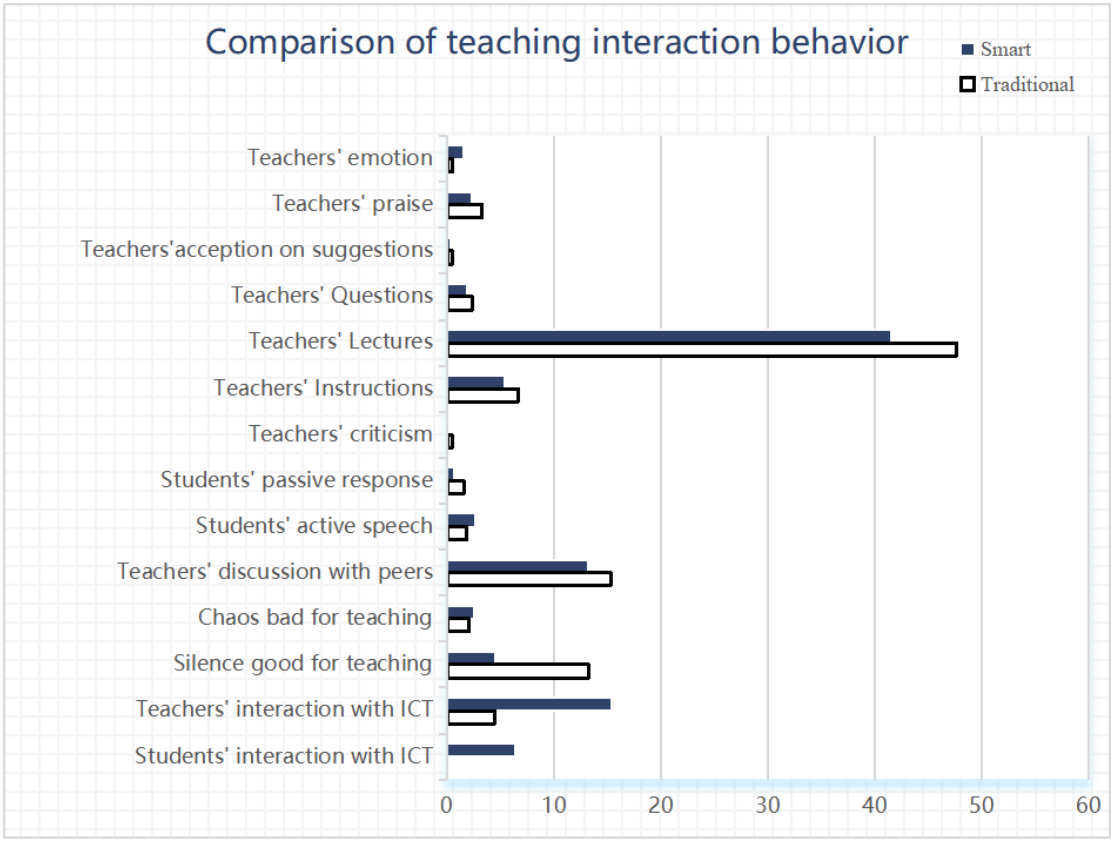

Figure 1: Comparison diagram of teaching interaction behavior

Figure 1 shows the overall comparison of the experimental class and the control class on the 23 codes. The following will be analyzed and discussed in detail from four aspects: classroom structure, technology integration, classroom atmosphere and question-and-answer mode.

4.1 Classroom structure

Teacher-student language interaction is one of the primary manifestations of interactive teaching behaviors in the classroom. Therefore, analyzing data in four aspects: teacher language ratio, student language ratio, silence ratio contributing to teaching, and confusion ratio hindering teaching, can help analyze the classroom structure. In data processing, the proportion of teacher language behaviors (codes 1-8) to all teaching interactive behaviors (codes 1-23) is defined as the teacher language rate. Similarly, the student language rate, the rate of confusion hindering teaching, and the rate of silence contributing to teaching can be deduced. Table 5 presents the statistical comparison of teacher-student language rates and silence rates between the experimental group and the control group with normative data. It indicates that in the smart classroom, students are more actively engaged, and their role as the main participants in the classroom is strengthened. The main reason for this is that the technological support has given students more voice, and with a simple instruction from the teacher, students can engage in real-time online discussions and express their opinions, which are displayed on the teacher's screen. This has facilitated knowledge exchange and interaction between teachers and students, promoting efficient classroom operation. Combining with classroom recordings, it was observed that after applying interactive teaching models with well-designed rules and division of tasks, the classroom became more efficient. Students actively thought and cooperated to complete learning tasks, and their suggestions were frequently adopted by the teacher.

Table 5 :Statistical table of the language ratio and silence ratio of teachers and students

Statistical items	Design formulas	Control group	Experimental group	Norm

Teacher speech rate	$\sum_{i=1}^{8} Ri/Total$	61.31%	52.9%	about68%
Student speech rate	$\sum_{i=9}^{12} Ri/Total$	18.6%	16.46%	about20%
Not help the chaotic ratio of teaching	R13/Total	2.01%	2.45%	about11%-12%
The chaotic proportions that contribute to teaching	R14/Total	13.21%	4.43%	about11%-12%

From the perspective of the speech rate of teachers and students, the speech rate of teachers in the experimental group was 52.9%, which was 8.41% lower than that of 61.31% in the control group, indicating that the teachers spent less time in the smart classroom than that in the simple multimedia classroom. The speech rate of students in the experimental group was slightly lower than that in the control group, mainly due to students spending part of their time on technical operation in the smart classroom environment. In both classroom environments, the speech rate of teachers exceeded 50%, but both were lower than the usual model, indicating that in this example, the teachers gave students the right to speak in classroom teaching.

4.2 Technology integration

Table 6 :Statistics of technical application rate for teachers and students

Statistical items	Design formulas	Control group	Experimental group
Technology application rate	$\sum_{i=15}^{23} Ri/Total$	4.43%	21.71%

From Table 6, it can be observed that in terms of technology usage, the application rate in the experimental group is 21.71%, whereas in the control group, it is only 4.43%. Further, combining with Figure 1, in the experimental group, both teachers (15.31%) and students (6.4%) participate in manipulating technology, with a teacher-student technology manipulation ratio of approximately 2.4:1. On the other hand, in the control group, technology application is solely controlled by the teacher. In the traditional classroom of the control group, technology is only used when the teacher uses a computer to display PowerPoint slides. In contrast, in the smart classroom of the experimental group, both students and teachers can use smartphones. During classroom activities, the teacher publishes activities through a WeChat public account called "Micro-Assistant Teaching," and students participate in the activities by receiving real-time notifications. After group discussions, students can upload their results, and the teacher can instantly view and use split-screen technology to evaluate and discuss the results with the whole class through the web version of "Micro-Assistant Teaching."

4.3 Classroom atmosphere

The analysis of the positive integration zone and defect zone in the matrix reflects the classroom atmosphere. The areas where the first three rows and first three columns intersect form the positive integration zone. A higher frequency in this zone indicates a positive and harmonious classroom atmosphere. On the other hand, the areas where the 7th and 8th rows intersect with the 8th and 9th columns form the defect zone. A higher frequency in this zone indicates more issues in communication and interaction between teachers and students.As shown in Table 7:

Table 7 :Statistical table of classroom atmosphere data

		Experimental group	Control group
Actively integrate areas	Frequency	26	11
	The rate of the total behavior	1.43%	1.30%
Actively integrate areas	Frequency	2	5
	The rate of the total	0.36%	0.67%

	behavior		

The frequency difference between the experimental group and the control group in the active integration area is quite large, indicating that the classroom atmosphere of the two classes is quite different, and the classroom atmosphere of the intelligent classroom environment is obviously better than that of the simple multimedia classroom.

4.4 Q & A mode

Question asking is a means of process evaluation to detect the effect of students' learning, and it is a very important link to promote the interaction between teachers and students. Because the content of the teacher is basically the same, this paper focuses on the students' speech and response.As shown in Table 8：

Table 8: Statistical table of students' speech and response

Statistical items	Computational formula	Control group	Experimental group
Students speech students initiative Speak ratio	$\sum_{i=10}^{12} Ri/Total$ / $\sum_{i=9}^{12} Ri/Total$	11.13%	16.74%
Students take the initiative to ask questions accounted for students Proportion of active speech	R11/$\sum_{i=10}^{12} Ri/Total$	1%	33%
Students' active response accounts for the students Proportion of active speech	R10/$\sum_{i=10}^{12} Ri/Total$	99%	67%

During the teaching period, students in the experimental group actively express their own opinions and provide responses during the pre-, mid-, and post-discussion activities. In contrast, students in the control group only actively speak during the post-discussion activity to showcase their results. Furthermore, upon further investigation, the experimental group students not only actively respond but also actively ask questions, while the proportion of active responses and questions from the control group students is only 1%. This indicates that the experimental group students have a better and deeper understanding of the class content and are willing to share and present their thoughts. The experimental group students closely follow the pace set by the teacher and are eager to express their viewpoints, while the question-and-answer mode in the control group still leans towards "teachers asking questions, students answering."

5. The teaching effect difference between smart classroom and traditional classroom teaching environment

This study focused on vocational college students and revealed the impact of the smart classroom environment on teaching interaction through experiments. The results showed that compared to traditional English listening and speaking classrooms, the smart classroom had a limited effect on improving the classroom structure. However, in terms of technological content, classroom atmosphere, and question-and-answer mode, the positive effects of the smart classroom were quite significant. Therefore, teaching in a smart environment was more conducive to stimulating students' proactivity, enriching and deepening classroom interaction, and encouraging more active student participation.However, this study also has some limitations, such as the general nature of the research tools, which may not fully reflect the specific characteristics of the English subject, and the sampled videos may not represent the overall situation of various types of English classrooms. Thus, the generalizability of the research findings requires further validation through subsequent studies.

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