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Innovations in Classroom Interaction Driven by Online-Offline Hybrid Music Education Teaching Models in the Digital Age

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SUMMARY: *As an advanced presentation form of digital teaching, blended teaching integrates the dual advantages of traditional teaching and network teaching, greatly extending the spatial dimension of teaching, revitalizing teaching resources, and enriching teaching means in education and teaching reform. This paper carries out in-depth research on the modules of teaching resources sharing, teaching interaction and skills training under the hybrid music education teaching mode. And by optimizing the Flanders interactive coding system, it compares the interaction of students under the conventional teaching mode and the blended teaching mode. Matrix analysis and classroom structure analysis were used to analyze the classroom teaching performance of the sample classroom in terms of teacher-student language structure, student participation characteristics, and so on. Through comparison, it is found that the blended teaching mode is able to realize deep interaction in the classroom, with greater improvement in student participation and more in-depth and efficient interactions between teachers and students, and between students and students.*

KEYWORDS: *blended teaching; digitalization; Flanders interaction; matrix analysis*

1 Introduction

In the digital era, various disciplines actively carry out the exploration of online teaching, with the help of multimedia information technology to enrich the teaching mode of the course, whether in the teaching content, or in the teaching methods and means and other aspects of the new changes [1-3]. On-line and off-line hybrid is a new type of teaching mode combining “on-line” and “off-line”. In music teaching, teachers can flexibly arrange “online” and “offline” teaching activities according to the teaching content and the actual situation of the students, in order to enhance the students' interest in learning; at the same time, students can independently arrange the learning time and content according to their own progress and needs, realize their own personalized needs, and improve teaching and learning. At the same time, students can independently arrange the study time and content according to their own progress and needs, realizing their personalized needs and improving the teaching effect [4-6]. In addition, the online teaching mode breaks the resource limitations of traditional music education, and the rich music teaching videos, audio materials, electronic music scores and various music academic databases on the Internet provide students with massive learning resources [7-9]. In addition, the online teaching platform provides new channels and ways for teacher-student interaction. In addition to the face-to-face communication in the traditional offline classroom,

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teachers and students can communicate at any time through online forums, instant messaging tools, etc. Teachers are able to more conveniently track and guide students' learning, give timely feedback and suggestions, and enhance the coherence and effectiveness of teaching [10-12].

Online and offline teaching mode has many advantages, but is not entirely suitable for all the content of music courses, such as singing, playing and other courses in the skills and techniques aspects of learning, the traditional classroom teachers and students face-to-face words, to be able to instantly interact, on-site feedback, the content of these online teaching during the period of the live broadcast or video recording, the effect is not ideal [13-16]. Thinking collision generated between teachers and students in the live teaching, sometimes through the expression, the emotional communication transmitted by the eyes, the Internet platform is also relatively difficult to realize. Therefore, it is necessary to make full use of digital technology to innovate for the classroom interaction mode of online and offline mixed teaching in music education.

This paper provides an initial exploration of the application of blended instruction for a music course. In order to explore the innovation of classroom interaction by the blended music education teaching mode, the study used the improved Flanders Interaction Analysis System as a research tool to compare the classroom language structure, teacher's language, student's language, and classroom silence or chaos in the conventional and blended classrooms. The comparison found that the blended music education teaching mode realized the innovation of classroom interaction by extending the spatial and temporal dimensions of teaching, revitalizing teaching resources, and enriching teaching means.

2 Utilization of the blended music education model and the various pedagogical modules

2.1 Blended Learning Practice Process

In blended learning, teaching activities should be designed to fully demonstrate the content with an understanding of the cognitive level of the learners, and must take into account the leading role of the teacher and the subjective position of the students. The purpose of the teacher's teaching activities should not be limited to simple knowledge teaching in traditional teaching or allowing students to simply learn on their own in the online environment, but rather to guide students to obtain richer learning experiences to support various forms of learning. Therefore, the content of blended teaching practice unfolded in this paper is mainly accomplished through four parts. The blended teaching practice process is shown in Figure 1.

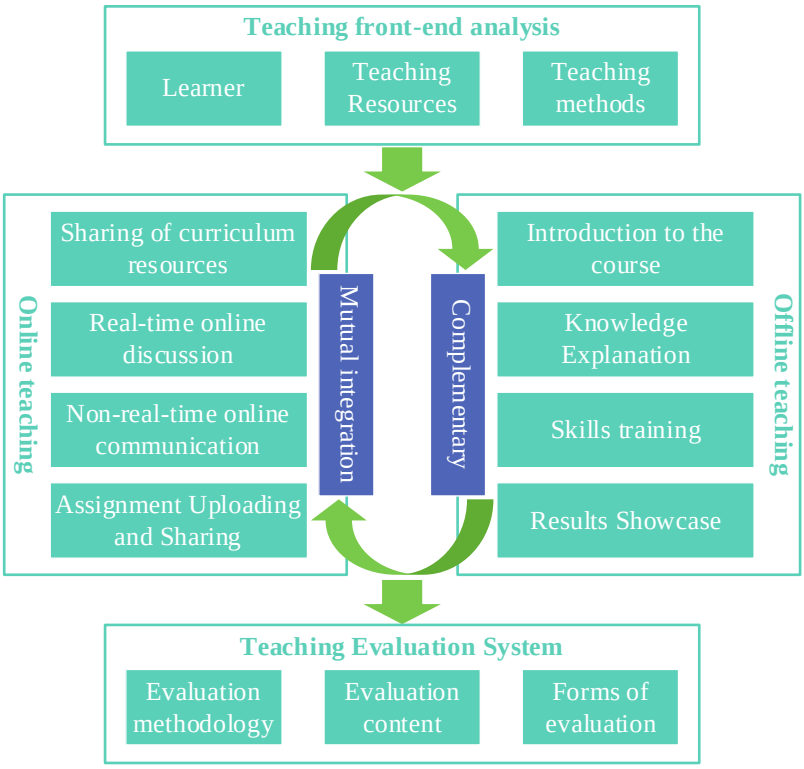

Figure 1: Mixed teaching practice process

First of all, the basic teaching front-end of teaching is analyzed, including three aspects of learners, teaching resources, and teaching methods.

(1) The analysis of learners includes foundation and ability, needs and motivation, interests and hobbies.

(2) The analysis of teaching resources includes the content of resources and the way of resource presentation.

(3) The analysis of teaching methods includes appreciation teaching method, contextual teaching method, and demonstration method. Secondly, music teaching is carried out through online and offline.

Among them, the online teaching link is carried out in three sections:

(1) Teaching resources sharing, relying on the network platform for course resources sharing, including music examples, audio, video, courseware and so on.

(2) Teaching interaction module, the online teaching interaction formed by the Internet can be divided into real-time and non-real-time communication.

(3) Skills training module, including basic skills and teacher and student information literacy.

The offline teaching link unfolds from two major segments:

(1) Classroom teaching module, including course introduction, knowledge explanation and application, and skill training.

(2) Practical activity module, including extracurricular activities and contextualized teaching.

Finally, a hybrid teaching assessment and evaluation system is formed:

(1) Evaluation subjects include teacher evaluation, student self-assessment, student-student mutual evaluation, and automatic machine evaluation.

(2) The evaluation content includes the evaluation of students' learning effect, the evaluation of teachers' teaching quality, and the evaluation of the course.

(3) Evaluation methods include process evaluation, summative evaluation, and diagnostic evaluation.

2.2 Resource Sharing Module

Complete resource sharing includes organizing and sending resources before class, using teaching resources during class and assisting learning resources after class. In the process of blended teaching practice, the use of internal and external platforms can effectively implement and complete these three links, and organically integrated with the offline teaching board. In the pre-course preparation, the platform is used to carry out reasonable course planning and make sufficient preparations for the course arrangement to assist offline classroom teaching. In the teaching process, contextualized teaching and appreciation teaching are utilized for resource sharing. In the after-school enhancement segment, teachers and students interact on the online platform or carry out virtual classes on the Internet to effectively extend and supplement offline classroom teaching. The three links are closely linked, forming a wrap-around resource sharing, broadening the breadth of students' thinking and creating an efficient classroom.

2.3 Pedagogical interaction module

Forming effective interaction between teachers and students in the teaching process is one of the important means to maximize the efficiency of classroom teaching. Music courses emphasize students' emotional experience and aesthetic cultivation, and teaching interaction is particularly important. However, since music is taught only once a week, teachers and students have less time and opportunity for face-to-face communication compared to other subjects. The interactive module of online teaching makes up for this shortcoming, effectively enhancing the interaction between teachers and students.

In both on- and off-campus platforms, teaching interactions can be accomplished through multiple channels, such as using class groups for group discussions, using the “Notifications” toolbar to issue lesson notifications, and using the “Class Log” to record and share lesson experiences, realizing both real-time and non-real-time Interactive communication.

2.4 Skills training modules

The skills training module of the blended teaching online program includes not only the training of students' musical skills, but also the training of teachers' and students' information technology processing skills. The use of a variety of online software for blended teaching has a certain impact on the teaching effect and objectives. The Intra- and Extra-school Platform is a one-stop solution for all aspects of the music course teaching process, from the preparation of curriculum resources to teaching evaluation. Since the founders of the platform are relatively young, the design and development process of the platform is characterized by strong operability and ease of learning. During the implementation of the course, teachers select modules based on their own needs and distribute resources, assign homework, etc. by using various toolbars such as "Class", "Homework", and "Notifications". It allows students to learn online wherever they are, as long as they have a cell phone and the Internet, so that they can do sight-singing training even without a teacher, a score or an instrument. This way can realize the transformation of implicit knowledge to explicit knowledge and apply it in extracurricular activities, and enhance students' ability to learn independently and perceive aesthetics. Teachers and students in the process of implementing the music curriculum gradually mastered the skills of using online platforms for online teaching, with the unique experience of online learning.

3 Assessment of the effectiveness of innovative classroom interactions

There is a big gap between the online and offline hybrid music education teaching model and the conventional music classroom model in terms of classroom interaction effects. This paper evaluates the two teaching models using the Flanders Interaction Analysis System to explore the innovative effects of classroom interaction in the blended music teaching model.

3.1 Flanders Interactive Analysis System

FIAS is a technique for analyzing classroom behaviors such as teacher-student verbal interactions in the classroom. Evaluating a class using FIAS can categorize and count the teaching behaviors in the teaching process, and by quantitatively analyzing and evaluating the teaching process, we can determine the interaction between teachers and students in the teaching process and the impacts. The FIAS consists of three parts: first, the classroom observation record sheet, which is used to record teacher-student interactions during the teaching process, and then generates quantifiable codes; second, the observation and recording rules and standards, which categorize the codes and assign corresponding meanings to each of them; and third, the migration matrix, which is generated by categorizing and counting the coded data, and then exploring the language behaviors of the teachers and students through the analysis of the codes.

(1) Classroom Observation Record Sheet

FIAS requires observers to sample and record their observations at 3-second intervals during classroom observations, then analyze them according to the nature of the instructional activities within the time period sampled and the coding system developed, determine a code for each sampling point, and record the codes sequentially in a table. The rows of the table recorded behaviors over a 1-minute period, and the columns of the table represented the time in minutes that the classroom was recorded.

(2) Coding system

The FIAS coding system is shown in Table 1. The FIAS coding system categorizes classroom speech activities into ten different types, each of which is represented as a numerical code. Classroom behaviors can be classified into three categories in the coding system, which are teacher speech, student speech, and silence or confusion, where teacher speech can also be classified into indirect influence and direct influence.

Table 1: FIAS coding system

Behavior classification		Code	Behavior content	Concrete meaning
Teacher language (D1)	Indirect influence	1	Receive feelings (express feelings)	Teachers accept students' positive or negative emotions without any threat
		2	Praise	Teachers praise or encourage the students' language and actions
		3	Adopt opinions	A teacher's opinion or idea of repetition, supplement or development
		4	Question	The teacher makes the conversation between the contents or the steps
	Direct influence	5	Explain	The classroom enumerates the facts or expresses their opinions
		6	Give instructions or orders	A teacher makes a pointer or a command
		7	Criticize or defend authority	Teachers change their behavior in an authoritative way, including criticism and applause
Student language (D2)		8	Passive response	The reaction made by students in response to their teachers
		9	Active response	Students express their thoughts voluntarily
Silence or confusion (D3)		10	Invalid language	A pause, silence, or other unrecognizable language

(3) Migration matrix

After the researcher has observed the classroom teaching and recorded the classroom observation recording form, the codes are to be further processed. If ten consecutive sampling points are coded as 4, 3, 7, 9, 6, 10, 11, 6, 4, 3, then the coding of each sampling point is to be formed into number pairs with the coding of the previous sampling point and the coding of the next sampling point, respectively, i.e., this sampling point will form the set of number pairs (4, 3), (3, 7), (7, 9), (9, 6), (6, 10), (10, 11), (11, 6), (4, 4), (11, 6) (6, 4), (4, 3) this set of number pairs. Then count the data recorded for the same pairs of numbers and list the counted numbers in a tally sheet, where the ten numbers on the vertical column represent the numbers in front of the pairs and the ten numbers on the horizontal row represent the numbers behind the pairs. The Flanders Classroom Observation Record Sheet will be completed and organized and regularized, and the final statistical table generated will be the Flanders Migration Matrix.

3.2 Optimizing the Flanders interactive coding system

Considering the actual situation of the music classroom, this paper further improves and optimizes the Flanders Interaction Analysis System and conducts consistency tests for this.

3.2.1 Improved Flanders interaction analysis system

Since the Flanders Interaction Analysis System can no longer meet the analysis of teacher-student interaction behaviors in today's classroom, such as the lack of technological aspects of the behavior, it should be improved with the times. In this paper, based on the real situation of the music classroom, the Flanders interaction system is improved to further refine the content of each code. The improved Flanders interaction coding system is shown in Table 2.

Table 2: Improved Flanders interactive coding system

Behavior classification	Code	Behavior content
Teacher language (D1)	1	Receptive feeling
	2	Commend
	3	Student opinion
	4	Open question
	5	Raise the problem of closure
	6	Teacher explanation
	7	Instruction
	8	Criticize
Student language (D2)	9	Passive response
	10	Active response
	11	Active expression
	12	Discuss communication
Silence or confusion (D3)	13	Silence or confusion
	14	Thinking problem
	15	Student practice

This paper integrates the ratio analysis method based on the Flanders coded interaction analysis system. The analysis from the perspective of ratios mainly includes the analysis of the verbal structure of the classroom, the teacher's teaching interaction style, the emotional atmosphere of the classroom and the use of technology by teachers and students.

(1) Classroom verbal structure

The formula of teacher's speech ratio is as equation (1):

$$\left[\sum_{i=1}^{7} Row(i)\right] \div Total \times 100 \tag{1}$$

The ratio of teachers' words to all behaviors in classroom interactions. The norm is roughly 63%.

The formula for the ratio of student speech is shown in equation (2):

$$\left[\sum_{i=8}^{12} Row(i)\right] \div Total \times 100 \tag{2}$$

The ratio of student speech to all behaviors in classroom interactions. The norm is roughly 24%.

The formula for the ratio of silence or disorganization is shown in equation (3):

$$\left[\sum_{i=13}^{14} Row(i)\right] \div Total \times 100 \tag{3}$$

The ratio of silent or chaotic behaviors to all behaviors in the classroom during instruction. The norm is roughly 13%.

(2) Classroom teacher-student question and answer

The formula for teacher questioning ratio is shown in equation (4):

$$Row(4) \div \left[\sum_{i=4}^{5} Row(i)\right] \times 100 \tag{4}$$

The ratio of teacher questioning behavior to teacher verbal behavior of explaining and asking questions during instruction. The norm is roughly 24%.

The formula for the ratio of students' active speech is shown in equation (5):

$$[Row(8-2)+Row(9-2)]\div\left[\sum_{i=8}^{12}Row(i)\right]\times 100 \tag{5}$$

The ratio of student-initiated responses and questions to total student speech is roughly 36% for the norm.

3.2.2 Tests of the improved Flemish interaction analysis system

A consistency test was conducted on the Improved Flanders Interaction Analysis System (FCFIAS). In this study, the lesson example - “Yaoi Dance” was selected and coded for testing. Three observers were selected for recording and recorded as A, B and C. After a series of training for the observers, each of the three observers coded the selected lesson example.

The data of the three groups were analyzed for consistency using SPSS software, and Friedman's test was used to test whether there was any difference between the three groups. When $P<0.05$, the difference was considered statistically significant at the $a=0.05$ level, i.e., there was a significant difference in the results recorded by the three observers, and when $P>0.05$, the opposite was true. The results of this study show that $P=0.833$ and $P>0.05$, which means that there is no significant difference in the results of the three observers.

To further ensure the consistency of the three sets of data, Kendall's W was also applied to test when $P<0.05$, indicating that the results of the study are significant. In this paper, the results of the study $P<0.05$, that is, there is significant consistency, and the consistency coefficient reaches 0.999, which is close to 1, indicating that the three observers have a high degree of consistency in their recording results, thus indicating that the coding has validity and feasibility. Therefore, this paper used the improved coding form as a research tool for this paper's subsequent study on subsequent mixed and regular music classrooms.

4 Analysis of the interaction between blended and conventional music teaching and learning

In this paper, the music regular classroom (DZ) and the corresponding online-offline hybrid music classroom (LO) offered by University A were selected as the research objects. The “Yao Dance” was selected as the teaching content of this case study. FCFIAS was used to code the statistics of the two classes one by one respectively.

4.1 Matrix analysis

The effective duration of regular classroom instruction was 40 minutes and 25 seconds, which produced 767 raw codes for classroom language activities. The coding matrix of regular classroom teaching interaction behaviors is shown in Table 3. From the coding matrix, it was found that the total frequency of classroom teacher-student verbal interactions was 767. From the interaction pattern presented in the coding matrix, the classroom, basically, was taught in a way that the teacher asked questions and the students answered, and the teacher seldom praised the students, so it is obvious that the teacher favored the conventional type of music teaching mode.

Table 3: The normal classroom teaching interactive behavior encoding matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	All
1	0	1	0	0	0	70	0	0	0	0	0	11	0	0	2	84
2	0	0	0	1	0	0	0	0	40	32	0	0	0	0	0	73
3	70	0	19	0	0	0	0	0	0	0	0	0	0	0	0	89
4	0	1	0	0	0	0	0	0	0	0	0	0	0	39	1	41
5	0	0	0	0	0	0	40	0	0	0	0	0	0	1	0	41
6	0	0	70	0	0	0	0	0	0	0	0	0	0	0	8	78
7	0	70	0	0	0	0	0	0	0	0	0	0	0	0	2	72
8	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	6
9	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	40
10	0	0	0	0	0	0	0	0	0	0	0	0	28	0	9	37
11	0	0	0	0	0	0	0	0	0	0	14	41	0	0	0	55
12	14	0	0	0	40	0	0	0	0	0	0	0	0	0	2	56
13	0	0	0	0	0	0	30	0	0	0	1	0	0	0	0	31
14	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	40
15	0	1	0	0	1	8	2	0	0	5	0	4	3	0	0	24
All	84	73	89	41	41	78	72	6	40	37	55	56	31	40	24	767

The LO teacher's classroom was recorded for 40 minutes and 06 seconds, generating 869 raw codes for classroom verbal activities, forming the matrix shown in Table 4. The total frequency of classroom teacher-student verbal interactions was 869 times, and the teacher's frequency of accepting feelings (1, 1) and adopting students' opinions (3, 3) was the highest, both 90 times, indicating that the teacher used blended teaching and lecturing, the classroom atmosphere was better, and the teacher paid attention to giving acceptance of students' answers, which indicated that the relationship between the teacher and students was more cordial, and the atmosphere of teaching was more democratic.

Table 4: Mixed classroom teaching interactive behavior encoding matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	All
1	90	0	9	0	0	0	0	0	0	0	0	0	0	0	0	99
2	0	0	0	0	0	50	0	0	0	29	0	0	0	0	0	79
3	0	0	90	10	0	0	0	0	0	0	0	0	0	0	0	100
4	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	50
5	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	40
6	0	0	0	0	0	0	0	5	50	10	0	0	0	0	0	65
7	0	29	0	0	0	0	0	0	0	0	0	49	0	0	0	78
8	0	0	1	0	0	0	0	0	0	0	0	5	0	0	0	5
9	0	0	0	0	0	0	0	0	0	2	0	0	1	36	10	51
10	0	0	0	0	0	15	0	0	0	0	0	0	23	10	0	47
11	0	0	0	0	0	0	78	0	0	0	0	0	0	0	0	78
12	0	0	0	40	0	0	0	0	0	0	0	29	0	1	13	83
13	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	24
14	2	0	0	0	0	0	0	0	1	6	38	0	0	0	0	47
15	7	0	0	0	16	0	0	0	0	0	0	0	0	0	0	23
All	99	79	100	50	40	65	78	5	51	47	78	83	24	47	23	869

4.2 Ratio Analysis of Teaching Interaction in Music Classroom

4.2.1 Comparative analysis of classroom language structures

The comparative analysis of language structure in LO and DZ classrooms is shown in Figure 2, with gray shading indicating the difference between the proportion of each LO dimension and the proportion of each DZ dimension. It can be seen that: the proportion of teacher's language (D1) decreased by 4.1%, the proportion of student's language (D2) increased by 5.3%, and the proportion of silence or confusion (D3) decreased by 1.2% in the online and offline blended music classroom compared with the regular classroom. And it shows that students get more initiative in online and offline blended music classroom, the teacher's control over the classroom is weakened, the blended classroom teaching mode is conducive to the development of student initiative, thus reflecting the idea of “teacher-led, student-led”.

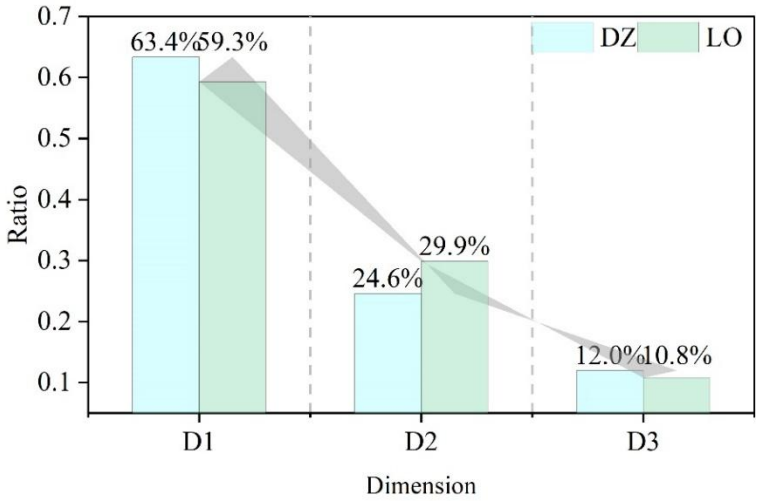

Figure 2: LO and DZ classroom language structure contrast analysis

4.2.2 Comparative analysis of teachers' language

The comparative analysis of teacher language in LO and DZ classrooms is shown in Figure 3, with gray shading indicating the difference between the proportion of each indicator in LO and the proportion of each indicator in DZ (below). It can be seen that: the proportions of acceptance of feelings (1), encouragement of praise (2), adoption of students' opinions (3), teachers' questions (4&5) and instructions (7) are higher in the blended music classroom than in the conventional classroom.The proportions of teachers' explanations (6) and criticisms (8) in the LO are lower than those in the DZ by 3.4% and 0.4%, respectively. It shows that the emotional climate of the blended music classroom is slightly better than the conventional classroom, the teacher has more components of accepting students' feelings, encouraging praise and adopting students' opinions, and the number of teachers' questions has increased, and teachers' explanations of instruction have decreased substantially.

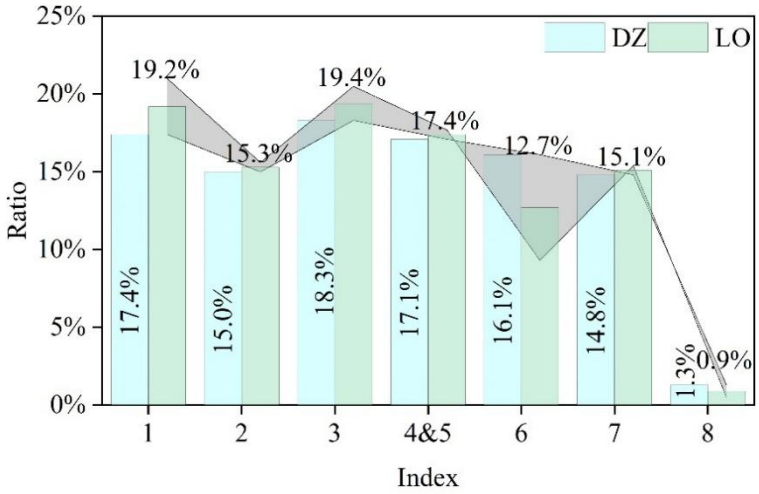

Figure 3: LO and DZ classroom teacher language comparison analysis

4.2.3 Comparison of students' languages

The comparative analysis of students' language in LO and DZ classrooms is shown in Figure 4. It can be seen that the proportions of students' passive response (9) and active response (10) in the blended music classroom were 1.8% and 1.2% lower than in the conventional classroom, and the proportions of students' active expression (11) and discussion and communication (12) were 0.8% and 2.2% higher than in the conventional classroom. The decrease in the proportion of students' passive responses indicates that it is due to the quality of the teacher's questions. Teachers' questions do not only require students to answer “yes” or “no”, but also require students to think before they can give a certain answer. The decrease in the percentage of active responses is due to the increase in the percentage of students' active expression and discussion in the blended music classroom, where the questions asked by the teacher triggered students' thinking and discussion.

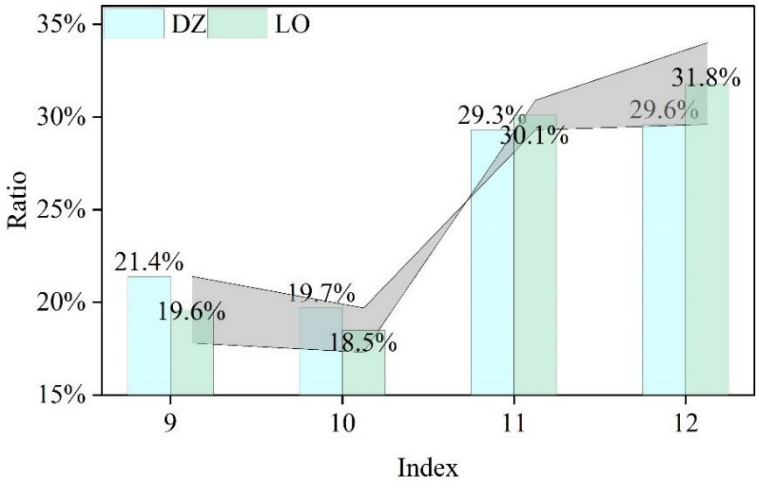

Figure 4: LO and DZ classroom student language comparison analysis

4.2.4 Silence or Chaos Contrasts

The comparative analysis of silence or confusion in LO and DZ classrooms is shown in Figure 5. It can be seen that compared with the conventional classroom, the proportion of silence or chaos (13) in the blended music classroom decreased, and the students' thinking about problems (14) and technical operations (15) increased to 49.9% and 24.6%, respectively. It shows that

after the teacher releases the problem, it allows to disperse the students' thinking, so as to exercise their ability to think independently about the problem, and also reflects that the blended music classroom is better for the maintenance of classroom discipline, and the rhythm of classroom teaching is better controlled, and there is almost no chaotic or silent behaviors that do not contribute to the teaching and learning.

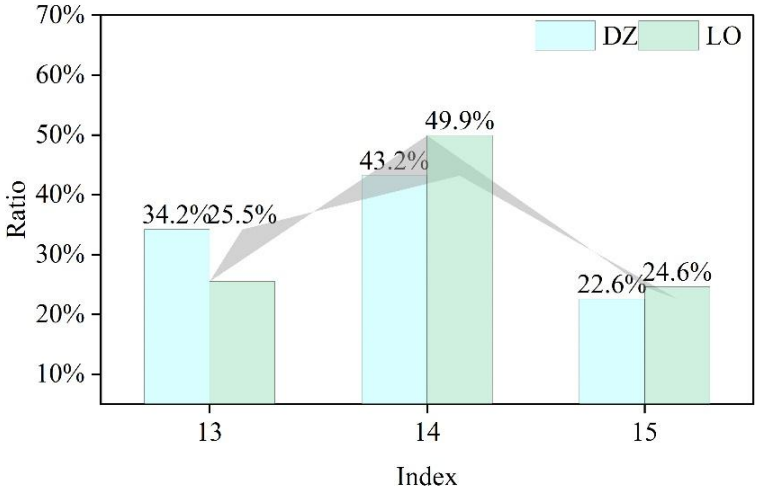

Figure 5: LO and DZ classroom silence or confusion

5 Conclusion

The study investigates the blended music education teaching model and analyzes its innovative effects on classroom interaction compared to the conventional classroom education model through the improved Flanders Interaction Analysis System. Through comparison, it was found that the proportion of teacher's language and the proportion of silence or chaos in the online and offline blended music classroom decreased by 4.1% and 1.2%, and the proportion of student's language and increased by 5.3%, respectively, compared with the conventional classroom. It shows that blended teaching breaks the traditional classroom teaching mode dominated by teachers' lectures, and teachers change from knowledge transmitters to students' guides, facilitators and collaborators.

The design and application of blended teaching is an intricate and integrated process of various elements, and the research in this paper still has shortcomings:

(1) The research object is only two classes of teachers and students, the sample size is small and not representative enough, so the scope of application derived is relatively small.

(2) This study only applies the practice to college A in the process of practice, but the specific implementation of blended teaching varies from region to region, from course to course, and from student to student, so the implementation of blended teaching needs to be further considered.

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