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대학 기악 선택과목의 질적 향상을 위한 문제 중심 학습(PBL)과 팀 기반 학습(TBL) 모델의 통합 방안

Enhancing University Musical Instrument Elective Courses: Integrating Problem-Based and Team-Based Learning Models for Improved Learning Outcomes

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Abstract This study aimed to evaluate the effectiveness of the problem-based and team-based learning integrated model in enhancing university musical instrument elective courses. Conducted at B university in Shandong Province, China, the research employed a quasi-experimental design involving 80 freshmen studying dulcimer, divided into experimental and control groups over one semester. The experimental group, taught using the integrated model, received instruction focused on problem-solving, collaboration, and student-centered learning, while the control group followed traditional methods. Data was collected through performance assessments, questionnaires, and interviews. Results indicated that the experimental group showed significantly better performance, as well as greater interest and engagement across areas such as course content, teaching methods, curriculum goals, teacher-student interaction, and learning outcomes. These findings confirm the model's effectiveness in improving both musical proficiency and student motivation. The study provides music educators with a valuable framework for reforming instrumental instruction and calls for future research to explore broader applications across different musical instruments and educational settings.

Key words: problem-based and team-based learning integrated teaching model, musical instrument, university music education, dulcimer, student engagement

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초록 본 연구는 대학의 선택 악기 수업을 향상시키기 위한 문제 중심 학습(PBL)과 팀 기반 학습(TBL) 통합 모형의 효과성을 평가하는 것을 목적으로 하였다. 연구는 중국 산둥성 B대학교를 대상으로 실시되었으며, 양적 준실험 설계를 활용하여 1학기 동안 양금 전공 신입생 80명을 실험집단과 비교집단으로 나누어 수업을 진행하였다. 실험집단은 문제 해결, 협력, 학습자 중심 교수전략에 중점을 둔 통합 교수 모형으로 수업을 받았으며, 비교집단은 전통적인 교수 방법을 적용받았다. 자료 수집은 연주 수행 평가, 설문지, 면담을 통해 이루어졌다. 연구 결과, 실험집단은 연주 성취도뿐만 아니라 수업 내용, 교수 방법, 교육 목표, 교사-학생 상호작용, 학습 결과 등 다양한 측면에서 비교집단보다 높은 흥미와 몰입을 보이는 것으로 나타났다. 이러한 결과는 통합 교수 모형이 음악적 수행 능력과 학습 동기 향상에 효과적임을 확인해준다. 본 연구는 악기 수업 개선을 위한 유용한 교수 전략을 제시하며, 향후 다양한 악기 및 교육 환경으로의 확대 적용을 위한 후속 연구의 필요성을 제안한다.

주제어: 문제 기반 학습 및 팀 기반 학습 통합 교수 모델, 악기, 대학 음악 교육, 딜시머, 학생 참여

Ⅰ. Introduction

The shift towards student-centred education, driven by societal and technological developments, has led to a need for updated teaching models. With the continuous development of society and the continuous progress of educational ideas, the focus of education has changed from ‘teacher teaching-centred’ to ‘student-centred’ (Jacobs & Lie, 2022). The development of the level of science and technology and the change of focus in education promote the updating of the teaching model (Li, 2022). In the past ten years, it has become more common for universities to teach different subjects using a new model of teaching (Obidovna, 2023). These teaching methods can promote student-centred learning and improve student engagement, critical thinking, and problem-solving skills (Todd, 2020). Problem-Based Learning is a problem-oriented teaching model that promotes students active learning, critical thinking, and problem solving (Meng et al., 2022). Team-Based Learning is a collaborative learning teaching model that divides students into groups and solves problems together (Roossien et al., 2022). The combination of Problem-Based and Team-Based Learning teaching model integrates the strengths of both approaches, creating a student-centred learning environment in music education that fosters collaboration, critical thinking, and problem-solving skills.

The Problem-Based and Team-Based Learning models can improve students' learning outcomes in various academic fields, including science, engineering and medicine (Nawabi et al., 2021). However, its application in musical instrument electives in Chinese universities is limited.

As integral components of university music curriculum systems, Musical Instrument Elective Courses afford students the opportunity to enhance their musical abilities, foster creativity, and refine their cultural and artistic awareness (Jingyi & Pattananon, 2022). The traditional teaching

methods used in instrumental music teaching tend to be teacher-centred, focusing on lectures and demonstrations, which may not be effective in attracting students today (Li, 2022). However, due to the particularity of musical instrument teaching, teachers seldom improve traditional models of instruction, the effectiveness of traditional teaching model is gradually diminishing, and they fail to engage the interest of modern students. (Wen, 2024). Hence, in order to increase students' interest in music Instrument elective courses and subsequently enhance the teaching effectiveness of these courses, teacher need to explore new teaching models that are suitable for university-level music instrument electives (Xiongjun & Lv, 2022).

The purpose of this study is to explore the effectiveness of the Problem-Based and Team-Based Learning integrated model applied in musical instrument elective courses in Chinese universities and its influence on students' learning interests. The results of this study may provide information for music educators to improve students' music learning academic performance through innovative teaching models.

Due to the aim of this study to improve students' learning effect and enhance their interest in Musical Instrument Elective Courses, two research questions were formulated:

(1) Can Problem-Based and Team-Based Learning integrated teaching model improve students' musical instrument learning effect?

(2) Can Problem-Based and Team-Based Learning integrated teaching models improve students' learning interest?

II. Literature Review

1. Problem-based learning teaching model

The Problem-Based Learning model, pioneered by Howard Barrows in medical education, is a student-centered approach that has expanded globally across diverse disciplines (Kong & Zhang, 2023). In medicine, Cuervo-Calvo and Cabedo-Mas (2024) found that Problem-Based Learning enhances clinical reasoning, problem-solving, self-directed learning, and peer collaboration. Similarly, in engineering education, Kolmos et al. (2009) demonstrated that Problem-Based Learning fosters deeper conceptual understanding, real-world application, and teamwork skills critical to the profession. Huaru (2019) extended these findings to general education, noting improved problem-solving abilities, learning outcomes, and student satisfaction.

In China, Problem-Based Learning initially emerged in medicine and biology before spreading to fields like mathematics and beyond (Ban, 2023). Institutions such as Nanjing University and Shandong University have recently adopted Problem-Based Learning across various disciplines, reflecting its growing acceptance (Li, 2022). In music education, da Fonsêca Barros and Penna (2023) highlight Problem-Based Learning's ability to engage students through real-world musical scenarios, encouraging exploration and collaboration. Huang and Zhang (2021) emphasize its role in developing critical thinking by requiring students to analyze music concepts, repertoire, and performance techniques, while Vasconcelos et al. (2023) underscores its promotion of creative problem-solving through tasks like composition and improvisation.

Despite its strengths, Problem-Based Learning has limitations, including resource constraints typically confined to the classroom and challenges in providing effective feedback, which demand high teacher competency (Yin, 2023).

2. Team-based learning teaching model

Team-Based Learning, developed by Michaelsen and colleagues in the 1980s, is a collaborative teaching model designed to maintain educational quality as student numbers increase (Yao & Li, 2023). In Team-Based Learning, students acquire subject knowledge and skills through group exploration and teacher-guided activities, fostering systematic learning and resource sharing (Yunikawati & Tuanani, 2022). In medicine, Rotgans et al. (2019) found that Team-Based Learning enhances active engagement, deepens understanding, and improves academic performance by promoting teamwork and peer accountability. Parappilly et al. (2015) reported similar benefits in physics education, noting increased retention, problem-solving skills, and teamwork, though their study applied Problem-Based Learning (corrected here as Team-Based Learning for consistency with your intent).

In China, Team-Based Learning has gained traction across disciplines, with institutions like Fudan University adopting it for instruction (Zhi & Xie, 2022). Meng et al. (2024) argue that Team-Based Learning improves teaching effectiveness by integrating knowledge into meaningful tasks, a view supported by Colsch et al. (2023), who highlights its impact on practical application. Scott (2023) extends this to education broadly, emphasizing enhanced communication, collaboration, and critical thinking skills. In music education specifically, Scott (2023) noted that Team-Based Learning fosters active learning through team discussions and problem-solving, while Taylor et al. (2012) underscored its role in collaborative analysis of musical concepts and performance

strategies. Herrera et al. (2020) add that Team-Based Learning's immediate feedback—via peer assessment and debriefing—enables real-time self-evaluation of music understanding. Despite its advantages, Team-Based Learning has limitations, including significant pre-class preparation and increased teacher workload due to frequent assessments (Ling, 2023).

3. Present situation of university instrumental music elective courses teaching

University instrumental music elective courses are optional courses offered to university students with the aim of developing their performance skills and musical expression on specific musical instruments, these courses are typically taught by professional music teachers or performers and cover a variety of instruments (Fu & li, 2023). The traditional method of teaching instrumental music in Chinese universities is the 'master-apprentice' method. This means that a more experienced musician or performer acts as a tutor and teaches the students (Stijnen et al., 2024). In this teaching method, students gradually master the playing skills and musical expression of musical instruments through listening to the teacher's performance and guidance, continuous practice, and imitation.

Due to the nature of the instrument, traditional ways of teaching instrumental music often involve one-on-one lessons (Zheng, 2025). This is to make sure that the lessons work, and the students learn. However, in instrumental music elective courses, a teacher often faces a class size of 10-20 students, and due to limited teaching resources, each instrument is typically shared by 4-5 students (Xue, et al., 2023).This makes it difficult for teachers to ensure the quality of learning for each student when applying traditional teaching model in instrumental elective courses, leading to varying academic performance, a lack of interest in instrumental elective courses, and a reduction in teaching effectiveness (Li & Rodloytuk, 2022).

However, there are currently few teaching models designed specifically for Musical Instrument Elective Courses. Although a variety of teaching models have emerged in the field of education, there are very few specifically designed for music education. With the development of the times, music teaching models also need innovation to ensure teaching effectiveness (Stijnen et al., 2024). As an important part of music education, Musical Instrument Elective Courses have long relied on traditional teaching models and urgently require innovative teaching approaches to meet modern educational demands (Meng et al., 2024). Through daily teaching practices and a review of the literature, this study found that combining the strengths of the Problem-Based and Team-Based

Learning models can result in a teaching model well-suited for Musical Instrument Elective Courses. Therefore, this study aims to develop a teaching model tailored for these courses, evaluate its effectiveness, and determine whether it can enhance students' interest in learning.

III. Research Design and Method

1. An analysis of the similarities and differences between problem-based and team-based learning teaching models

By analyzing the literature and comparing the similarities and differences between Problem-Based and Team-Based Learning, the author found that both teaching models are student-centered. The evaluation methods of the Problem-Based and Team-Based Learning teaching models are a combination of process evaluation and terminal evaluation. The two teaching models combine with each other to some extent, which can promote the development of students' abilities (see Table 1).

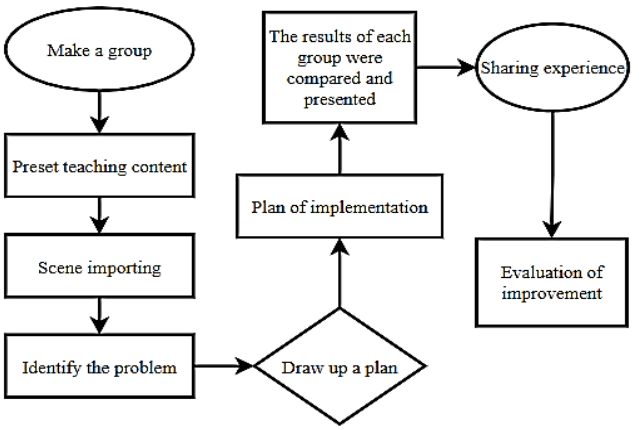
<Table 1> Similarities and differences between problem-based and team-based learning integrated teaching models

Concept	PBL	TBL
	Problem-based learning	**Team-based learning**
Focus on cultivation	Think independently and solve problems	Teamwork and ability of expression
Education center	Student-centred	Student-centred
Evaluation method	Process evaluation and outcome evaluation	Process evaluation and outcome evaluation
Personnel composition	It's usually made up of individuals	Team or group

2. Problem-based and team-based learning integrated teaching model

When teaching students solely through the Problem-Based Learning teaching model, some students inevitably exhibit lazy or plagiaristic behaviors when exploring relevant questions, leading to subsequent course discussions failing to achieve the expected teaching objectives (Yin, 2023). Team-Based Learning relies on team division of labour to complete tasks, which can

improve students' grasp and understanding of knowledge, but the cost is too high (Ling, 2023). Therefore, the author believes that the effective integration of Problem-Based and Team-Based Learning models can significantly enhance the effectiveness of music education. In this way, the shortcomings of both sides can be made up, and the advantages of both sides can be maximally played, to achieve the expected teaching effect. Combined with the characteristics of Problem-Based and Team-Based Learning teaching models, this study designs the Problem-Based and Team-Based Learning integrated teaching model applied to the optional courses of musical instrument in universities (see Figure 1).



[Figure 1] Problem-based and team-based learning integrated teaching model

This study is a quantitative study, using a quasi-experimental design and questionnaire for data collection. This study received ethical approval from B University in Shandong Province, China, and was conducted in accordance with the Declaration of Helsinki.

1. Sample

<Table 2> Population statistics

	Experimental group	Control group
Male	18	23
Female	22	17

This study conducted an experiment in the School of Music of B University in Shandong Province and selected 80 dulcimer musical instrument elective students as samples. To ensure the accuracy of the experiment, all 80 students are freshmen who have not been exposed to any teaching models. The dulcimer performance level of 80 students will be tested before the experiment, and the students will be evenly divided into 40 people in the control group and 40 people in the experimental group according to the test scores (see Table 2).

2. Procedure

A quasi-experimental design was employed over one semester. Prior to the intervention, all participants completed a pre-test assessing dulcimer performance skills and musical expression, scored by three university music faculty using the Chinese Music Performance Assessment Criteria. Participants were then assigned to either the experimental group, which received the Problem-Based and Team-Based Learning integrated Model, or the control group, which received traditional instruction, with blinding to minimize bias (Kumbhare et al., 2023). Both groups, taught by the same instructor, received 90-minute classes covering identical content. Post-intervention, participants repeated the performance test, completed a learning interest questionnaire, and participated in interviews.

3. Design of problem-based and team-based learning teaching model in instrumental music elective course (taking dulcimer teaching as an example)

The dulcimer, a traditional hammered instrument, was selected for this study due to its technical demands, which require both individual skill and collaborative practice. As a staple in university music electives, it offers a rich context for testing innovative teaching models, fostering both musical proficiency and cultural appreciation.

To optimize collaborative learning, students are organized into balanced groups of 4–6, based on gender and complementary skills, with group size adjusted to task complexity—smaller for challenging tasks, larger for simpler ones. Instructors assign preset lesson content to group leaders, enabling proactive preparation and targeted inquiry. Learning begins with realistic scenarios (e.g., dulcimer origins or vibrato techniques in ‘Ying Shan Hong’) to contextualize exploration, followed by guided problem identification aligned with course objectives. Groups develop and

implement solution plans, leveraging collective skills and peer support, while instructors provide minimal guidance to ensure accuracy. Outcomes are presented for peer and instructor evaluation, fostering critical reflection, followed by experience sharing to encourage diverse perspectives. Finally, students refine their approaches based on feedback, document shortcomings, and receive instructor summaries to sustain engagement and preview future content.

4. Control group design

The control group adopts traditional teaching models for instruction.

The teacher introduces the dulcimer, covering its origins and development, followed by a detailed showcase of the repertoire and performance techniques to be taught. Randomly selected students demonstrate these techniques on stage, receiving real-time guidance and feedback from the teacher to refine their skills. To prepare for the next class, students are assigned homework to preview and practice the upcoming class.

5. Questionnaire design

This study's questionnaire preparation followed three steps. First, a literature review was conducted. Based on existing research frameworks, it referenced and summarized scale dimensions from studies on "students' learning interests" at home and abroad (e.g., Kew & Tasir, 2022; Ng et al., 2022; Zhao & Wang, 2022). This preliminarily determined the measurement dimensions and elements of students' learning interest, and formed an initial question bank (over 30 items in 5 dimensions).

Second, pre-interviews were held before the survey. Five university musical instrument teachers and 10 musical instrument elective students were interviewed, and the number of questions was adjusted. During teacher interviews, researchers introduced the preliminary questionnaire's dimensions and items; teachers provided valuable opinions based on actual teaching situations, which laid the basis for the preliminary questionnaire.

Third, expert argumentation was held in July 2023. Invited experts included 2 doctoral supervisors and 3 doctoral students. They discussed the initial questionnaire's dimension division logic, content appropriateness, question wording accuracy, and potential data analysis issues, and put forward feasible revision suggestions.

Based on the three steps, the original questionnaire was revised as follows: (1) adjusted

question structure; (2) modified wording of some questions. After these revisions, the study's pilot questionnaire was formed.

6. Reliability and validity

In this study, SPSSAU was used as an analysis tool. SPSSAU, also known as SPSS Online, is a web-based data science algorithm platform system (Ma et al., 2023). According to the results of reliability analysis, the Cronbach coefficient of the scale was .855 higher than .8, indicating high reliability. In this study, SPSSAU was used as an analysis tool. According to the results of reliability analysis, the KMO value of the questionnaire was .822, higher than .8, indicating that the study was very suitable for extracting information. And the corresponding relationship between the title and the factor is good, indicating high validity.

IV. Results

1. Problem-based and team-based learning integrated teaching model can improve students' instrumental music learning effect

To ensure the accuracy of this study results, the Mann-Whitney U test was conducted to compare the pre-test scores between the experimental group and the control group.

<Table 3> Mann-Whitney U test result

Pre-test median (P_{25}, P_{75})		Mann-Whitney U	Mann-Whitney z	p
Experimental (n = 40)	Control (n = 40)			
74.50(68.00,79.00)	74.50(67.30,79.00)	799.00	-.01	.99

* $p<.05$ ** $p<.01$

To ensure comparability of the experimental and control groups, a Mann-Whitney U test was conducted on pre-test scores. As shown in Table 3, no significant difference was found between the experimental (median = 74.50) and control groups (median = 74.50; U = 799.00, z = -.01, p = .99). This indicates that both groups had equivalent baseline instrumental performance, allowing for a fair evaluation of the teaching models' effects.

The Wilcoxon Signed-Rank Test was used to assess within-group improvements from pre-test to post-test. For the experimental group (see Table 4), a significant increase in scores was observed (pre-test median = 74.50, post-test median = 79.50; Z = 5.54). This substantial improvement suggests that the Problem-Based and Team-Based Learning model effectively enhanced students' instrumental performance.

Similarly, the control group (see Table 5) showed a significant but smaller improvement (pre-test median = 74.50, post-test median = 75.50; Z = 3.65), indicating that the traditional teaching model also improved performance, though to a lesser extent, possibly due to its focus on direct instruction rather than inquiry-based learning.

<Table 4> Experimental group experimental group result

Name	Paired median M (P_{25}, $P7_5$)		Median M difference (Paired1 - paired2)	Test statistic Z Value	p
	Paired 1	Paired 2			
Pre-test (paired) post-test	74.50(68.00,79.00)	79.50(74.30,83.00)	-5.00	-5.36	.00**

* *p<.05* ** *p<.01*

<Table 5> Control group experimental group result

Name	Paired median M (P_{25}, P_{75})		Median M difference (Paired1 - paired2)	Test statistic Z Value	p
	Paired 1	Paired 2			
Pre-test (paired) post-test	74.50(67.30,79.00)	75.50(68.80,80.00)	-1.00	3.65	.00**

* *p<.05* ** *p<.01*

A Mann-Whitney U test comparing post-test scores (see Table 6) revealed a significant difference between the experimental (median = 79.50) and control groups (median = 75.50; U = 538.00, z = -2.53). This finding indicates that students in the Problem-Based and Team-Based Learning group achieved higher instrumental performance scores than those in the traditional teaching group.

The greater improvement in the experimental group suggests that Problem-Based and Team-Based Learning's emphasis on scenario-based inquiry, teamwork, and peer feedback better supports the development of technical skills, musical expression, and motivation in instrumental music education.

<Table 6> Mann-Whitney U test result

Post-test Median (P25, P75)		Mann-Whitney U	Mann-Whitney z	p
Experimental (n=40)	Control (n=40)			
75.50(64.30,80.00)	79.50(70.80,83.00)	538.00	-2.53	.01*

* *p<.05* ** *p<.01*

In summary, the application of traditional teaching model and Problem-Based and Team-Based Learning integrated teaching model can improve students musical instrument scores, but the application of Problem-Based and Team-Based Learning integrated teaching model has a greater improvement in students musical instrument scores.

2. Problem-based and team-based learning integrated teaching model can improve students' interest in learning.

Analysis of questionnaire results and student interviews demonstrates that the Problem-Based and Team-Based Learning integrated mixed teaching model significantly enhances students' interest in instrumental music elective courses compared to the traditional teaching model. Independent samples t-tests (see Table 7) revealed substantial improvements in the experimental group (n = 40) over the control group (n = 40) across all five dimensions of learning interest: course content (t = -14.53), teaching methods (t = -38.87), curriculum objectives (t = -8.39), teacher style (t = -16.07), and learning outcomes (t = -17.53). Supporting these findings, students in the experimental group expressed enthusiasm for the Problem-Based and Team-Based Learning approach. One student remarked that it had been a highly valuable and meaningful learning experience.

The Problem-Based and Team-Based Learning model has ignited our interest in musical instruments. The classroom is no longer dull; we constantly collaborate and problem-solve, increasing interaction with classmates and teachers, making me look forward to weekly classes. Another student added, Communication with classmates and teachers has significantly increased, unlike previous music classes. The weekly challenges requiring collaboration spark our competitiveness and attract our interest. These insights confirm that the Problem-Based and Team-Based Learning model not only stimulates student engagement but also enhances teaching effectiveness in instrumental music elective courses compared to traditional methods.

<Table 7> Student interest questionnaire

	Student interest questionnaire (Mean ± Std.)		t	p
	Control group (n = 40)	Experimental group (n = 40)		
Course content	3.20±.31	4.20±.11	-14.53	.00**
Teaching methods	3.00±.00	4.58±.18	-38.87	.00**
Curriculum objectives	3.08±.44	4.20±.41	-8.39	.00**
Teacher style	2.93±.17	3.91±.21	-16.07	.00**
Learning outcomes	2.47±.44	4.20±.20	-17.53	.00**

* *p<.05* ** *p<.01*

V. Discussion

As for the first question, research shows that a Problem-Based and Team-Based Learning integrated teaching model can improve students' musical instrument performance. The Problem-Based Learning model encourages students to identify and analyze problems, develop strategies to solve these problems, and reflect on the effectiveness of their solutions. This process can help students become more autonomous learners, thus leading to better outcomes in musical instrument learning (Nugroho & Dewi, 2022). This is the same as Ni'mah et al. (2024)'s viewpoint that using the Problem-Based Learning model of teaching in education helps students develop critical thinking and problem-solving skills. The Team-Based Learning model provides a collaborative learning environment where students can solve musical problems as a team, which is also very important for improving the effectiveness of instrument teaching. This is the same as Colsch et al. (2023)'s viewpoint that students can develop communication and teamwork skills and improve learning effectiveness through Team-Based Learning teaching. The Problem-Based and Team-Based Learning integrated mixed teaching model is well-suited for music education, as it can effectively enhance students' creativity and problem-solving abilities in music. Yao and Li (2023) emphasized that music education should not solely prioritize technical skills but also foster students' creativity and critical thinking abilities. Hence, the Problem-Based and Team-Based Learning integrated teaching model aligns with the objectives of music education and can promote holistic student development.

This study innovatively designed and implemented a combined Problem-Based and Team-Based Learning integrated model for Musical Instrument Elective Courses. The application

of Problem-Based Learning effectively reduces the heavy workload on teachers and the need for frequent pre-class preparations that arise when using Team-Based Learning alone. Meanwhile, the use of Team-Based Learning addresses the limitations of Problem-Based Learning, such as narrow teaching resources and limited feedback. The Problem-Based and Team-Based Learning integrated model, when applied to Musical Instrument Elective Courses, significantly enhances students' learning outcomes and fills the gap in the scarcity of new teaching models in this field. This approach also provides a valuable foundation for future innovations in music education teaching methods.

On the second question, compared with a traditional teaching model, a Problem-Based and Team-Based Learning integrated teaching model can improve students' learning interest. This may be due to the interactive and attractive nature of the Problem-Based and Team-Based Learning integrated teaching model, which encourages students to take an active role in their learning. This is the same as Werang and Leba (2022) 's viewpoint that when students are engaged in the learning process, they are more likely to be motivated to learn and become more interested in the course. This also proves that, with the development of the times, the traditional teaching model is no longer suitable for modern teaching (Wu & Chen, 2023). It is necessary to design a teaching model in line with the current era to make students more interested in courses and improve their learning effect (Li, 2022). In the field of music education, traditional teaching models often rely on rote memorization of technical skills and music theory, which can lead to a lack of engagement and interest among students (Dong & Yuxiang, 2025). In contrast, the Problem-Based and Team-Based Learning integrated teaching model can create a more dynamic and interactive learning environment that promotes creativity and problem-solving skills in music. This approach not only enhances students' interest in music but also improves their overall learning outcomes.

The success of the Problem-Based and Team-Based Learning integrated Model relies heavily on instructors' instructors' technological, pedagogical, and content knowledge (TPACK). Teachers must possess strong content knowledge of dulcimer techniques, pedagogical skills to design problem-based scenarios, and technological proficiency to facilitate group activities and provide feedback. For instance, the instructor's ability to guide students in identifying problems and use peer assessment tools reflects TPACK integration, which likely contributed to the significant performance gains (Koehler & Mishra, 2009). Future implementations should ensure teacher training in TPACK to maximize the model's effectiveness. This study has several limitations, including a small sample size (limited to first-year university students), a short duration of

learning, a narrow focus (restricted to instrumental elective courses), and a single research location (Shandong Province). To address these limitations, future research should consider expanding the scope to include other areas of music education, increasing the sample size to encompass students from various academic years, diversifying the research locations, and extending the duration of the study. Such enhancements would provide a more comprehensive understanding of the effectiveness and applicability of the Problem-Based and Team-Based Learning integrated model across different contexts and educational settings.

VI. Conclusion

This study investigated the effectiveness of a combined Problem-Based Learning and Team-Based Learning teaching model in university musical instrument elective courses at B University, Shandong Province, China. The primary objectives were to assess whether the Problem-Based and Team-Based Learning integrated model could improve students' instrumental performance and learning interest compared to traditional methods. Through a quasi-experimental design with 80 freshman students, the findings confirmed that the experimental group, receiving Problem-Based and Team-Based Learning integrated instruction, achieved significantly higher post-test dulcimer performance scores and reported greater interest across five dimensions—course content, teaching methods, curriculum objectives, teacher style, and learning outcomes than the control group.

These results underscore the Problem-Based and Team-Based Learning integrated model's value in music education, shifting from teacher-centered to student-centered learning. By fostering collaboration, problem-solving, and creativity, the model addresses the limitations of traditional approaches, which often fail to engage modern students. Practically, it offers music educators a framework to enhance teaching effectiveness in instrumental courses. Theoretically, it contributes to the scarce literature on innovative pedagogy in music education, demonstrating how blended models can meet the field's unique demands.

However, the study has limitations, including a small sample size restricted to first-year students, a short one-semester duration, and a focus on dulcimer teaching at a single institution. Future research should test the model across diverse instruments, student levels, and cultural contexts, while extending the intervention period to assess long-term effects. Despite these constraints, this study provides empirical support for the Problem-Based and Team-Based

Learning integrated model's feasibility and effectiveness, laying a foundation for its broader adoption and refinement in global music education.

References

Ban, Q. (2023). The role of teacher in the PBL teaching model. *In 2nd International Conference on Education, Language and Art (ICELA 2022)* (pp. 754–763). Atlantis Press. https://doi.org/10.2991/978-2-38476-004-6_92

Colsch, R., Tolcser, K., & Lehman, S. B. (2023). Development and evaluation of the combine, question, apply model. *Teaching and Learning in Nursing, 18*(1), 112-121.

Cuervo-Calvo, L., & Cabedo-Mas, A. (2024). Service-learning and project-based learning methodologies in higher music education: A review of the literature. *Bordón. Revista de Pedagogía, 76*(3), 35-60.

Dong, R., & Yuxiang, H. (2025). Exploration and thinking on the integration of music education and ideological and political course in higher vocational colleges under the background of new era. *Journal of Sociology and Education, 1*(1), 88-95.

da Fonsêca Barros, M. H., & Penna, M. (2022). Problem-based learning (PBL) in music teacher education. *International Journal of Music Education, 41*(4), 585-597. https://doi.org/10.1177/02557614221130526

Fu, L., & Li, X. (2023). Application and research of exploratory music teaching mode in general education elective courses. *International Journal of Education and Humanities*, *8*(3), 20-23.

Herrera, L. F. L., Molina, G. P., Prieto, H. D. H., & Villalba, P. A. G. (2020). TBL through music to foster students' lexical competence. *Enletawa Journal*, *13*(2), 74-93. https://doi.org/10.19053/2011835X.12004

Huang, M., & Zhang, Y. (2021). Design and construction of a PBL based evaluation index system for classroom music education. *International Journal of Emerging Technologies in Learning (IJET), 16*(17), 107-119.

Huaru, W. (2019). Application of PBL teaching mode in music and dance compilation in the flourishing Tang dynasty. In *Proceedings of the 3rd International Conference on Education Technology and Economic Management* (pp. 1076-1080). Francis Academic Press. https://doi.org/10.25236/icetem.2019.228

Jacobs, G. M., & Lie, A. (2022). Toward student-centered teacher education programs. *Journal of International and Comparative Education, 11*(2), 93−105. https://doi.org/10.14425/jice.2022.11.2.1205

Jingyi, Z., & Pattananon, N. (2022). The teaching solfeggio in Chinese traditional music, China. *Journal of Modern Learning Development, 7*(9), 387-394. https://so06.tci-thaijo.org/index.php/jomld/article/view/257053

Kew, S. N., & Tasir, Z. (2022). Learning analytics in online learning environment: A systematic review on the focuses and the types of student-related analytics data. *Technology, Knowledge and Learning, 27*(2), 405-427. https://doi.org/10.1007/s10758-021-09541-2

Kolmos, A., De Graaff, E., & Du, X. (2009). Diversity of PBL−PBL learning principles and models. In *Research on PBL Practice in Engineering Education* (pp. 9-21). Brill.

Kong, L., & Zhang, M. (2023). Exploring the challenges and applications of the PBL approach in Chinese high school through a comparison of Chinese and American cases. In *2nd International Conference on Education, Language and Art (ICELA 2022)* (pp. 827-833). Atlantis Press. https://doi.org/10.2991/978-2-38476-004-6_101

Kumbhare, D., Batavia, M., & Dip, P. G. (2023). Methodological issues relevant to blinding in physical medicine and rehabilitation research. *American Journal of Physical Medicine & Rehabilitation*, *102*(7), 636-644. https://doi.org/10.1097/PHM.0000000000002228

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK). *Contemporary Issues in Technology and Teacher Education*, *9*(1), 60-70.

Li, M. Y., & Rodloytuk, P. (2022). Research on the contemporary inheritance of Guangdong Leizhou music in colleges and universities. *Baltic Journal of Law & Politics, 15*(2), 949-959. https://doi.org/10.2478/bjlp-2022-001058

Li, R. (2022). Chinese folk music: Study and dissemination through online learning courses. *Education and Information Technologies, 27*(7), 8997-9013. https://doi.org/10.1007/s10639-022-11003-w

Ling, S. I. (2023). Music technology in the 21st century of global music education: Opportunities and challenges [Paper presentation]. In *Proceedings of the 14th Asia-Pacific Symposium for Music Education Research (APSMER 2023)*(pp. 242−251). Seoul, Republic of Korea.

Ma, H., Sun, X., Lawson, G., Wang, Q., & Zhang, Y. (2023). Visualising emotion in support of patient-physician communication: an empirical study. *Behaviour & Information Technology*, *42*(11), 1782-1800.

Meng, X., Duan, L., Qin, H., & Zhou, R. (2022). Innovative research and practice of goal-problem-oriented blended learning. In *2022 International Symposium on Educational Technology (ISET)* (pp. 157-159). IEEE. https://doi.org/10.1109/ISET55194.2022.00041

Meng, Z., Attapaiboon, T., & Jantharajit, N. (2024). Developing the abilities of music students: A blended teaching approach based on inquiry-based and task-based learning. *Open Journal for Educational Research*, *8*(2), 37-48.

Ni'mah, A., Arianti, E. S., Suyanto, S., Putera, S. H. P., & Nashrudin, A. (2024). Problem-based learning (PBL) methods within an independent curriculum (a literature review). *Sintaksis: Publikasi Para ahli Bahasa dan Sastra Inggris*, *2*(4), 165-174.

Nugroho, A. E., & Dewi, S. E. P. (2022). Implementation of project based learning (PjBL) method on music learning in junior high school Regina Pacis Surakarta. *Jurnal Seni Musik*, *11*(1), 102-111. https://doi.org/10.15294/jsm.v11i1.56645

Nawabi, S., Javed, M. Q., & Bilal, R. (2021). Problem-based learning and team-based learning as a novel package approach. *Journal of the College of Physicians and Surgeons Pakistan, 31*(6), 710–715. https://doi.org/10.29271/jcpsp.2021.06.710

Ng, D. T., Ng, E. H., & Chu, S. K. (2022). Engaging students in creative music making with musical instrument application in an online flipped classroom. *Education and information Technologies*, *27*(1), 45-64.

Obidovna, D. Z. (2023). Adapting teaching methods to modern educational trends: Pedagogical aspect. *International Journal of Pedagogics, 3*(10), 72-77. https://doi.org/10.37547/ijp/Volume03Issue10-14

Parappilly, M., Schmidt, L., & De Ritter, S. (2015). Ready to learn physics: A team-based learning model for first year university. *European Journal of Physics*, *36*(5), 055-052.

Roossien, L., Boerboom, T. B., Spaai, G. W., & de Vos, R. (2022). Team-based learning (TBL): Each phase matters! An empirical study to explore the importance of each phase of TBL. *Medical Teacher, 44*(10), 1125-1132. https://doi.org/10.1080/0142159X.2022.2064736

Rotgans, J. I., Rajalingam, P., Ferenczi, M. A., & Low-Beer, N. (2019). A students' model of team-based learning. *Health Professions Education, 5*(4), 294-302. https://doi.org/10.1016/j.hpe.2018.10.003

Scott, B. (2023). Finding the right tempo: Using music to enhance team-based learning. *SSRN 4380760,* 1-16. http://dx.doi.org/10.2139/ssrn.4380760

Stijnen, J., Nijs, L., & Van Petegem, P. (2024). Instrument teachers' practices, beliefs, and barriers regarding musical creativity: Exploring the creative process of

interpretation. *International Journal of Music Education, 42*(3), 425-441.

Todd, R. W. (2020). Teachers' perceptions of the shift from the classroom to online teaching. *International Journal of TESOL Studies, 2*(2), 4-16.

Taylor, L., McGrath-Champ, S., & Clarkeburn, H. (2012). Supporting student self-study: The educational design of podcasts in a collaborative learning context. *Active Learning in Higher Education, 13*(1), 77-90. https://doi.org/10.1177/1469787411429186

Vasconcelos, M. J., Caspurro, H., & Costa, N. (2023). Problem-based Learning: Composing in the classroom as a music learning challenge. *Revista Electronica De Leeme*, (52), 111-140. https://doi.org/10.7203/LEEME.0.26865

Wu, Y., & Chen, D. (2023). Orff's music teaching method: Application and practice of Ukulele in elementary school music class. *Open Access Library Journal*, *10*(5), 1-7. https://doi.org/10.4236/oalib.1110182

Wen, M. (2024). Interactive online classes in music education: The impact of online technologies on the level of creative thinking of students. *Current Psychology*, *43*(15), 13619-13629. https://doi.org/10.1007/s12144-023-05411-5

Werang, B. R., & Leba, S. M. R. (2022). Factors affecting student engagement in online teaching and learning: A qualitative case study. *Qualitative Report, 27*(2), 555-577.

Xiongjun, X., & Lv, D. (2022). [Retracted] The Evaluation of Music Teaching in Colleges and Universities Based on Machine Learning. *Journal of Mathematics, 2022*(1), 1-7. https://doi.org/10.1155/2022/2678303

Xue, C., Hou, Z., & Ma, R. (2023). Research on the integration of computer aided instruction methods in dulcimer teaching in college music teaching. In P*roceedings of the 2023 IEEE 12th International Conference on Educational and Information Technology (ICEIT)*(pp. 162−166). IEEE. https://doi.org/10.1109/ICEIT57125.2023.10107871

Yin, Y. (2023). Research on modern dance teaching mode based on PBL theory. *Journal of Education, Humanities and Social Sciences, 7*, 247-253.

Yao, B., & Li, W. (2023). The role of a teacher in modern music education: can a student learn music with the help of modernized online educational technologies without teachers?. *Education and Information Technologies, 28*(11), 14595-14610.

Yunikawati, N. A., & Tuanani, M. A. M. (2022). TBL vs. PBL: Which is more effective model in economics learning? *Journal Pendidikan Ekonomi Dan Basins (JPEB), 10*(2), 181-192.

Zhi, Y., & Xie, S. (2022). Exploring medical education models in the post_epidemic era. In *Proceedings of the 2022 5th International Conference on Humanities Education*

and Social Sciences (ICHESS 2022) (pp. 1431–1436). Atlantis Press. https://doi.org/10.2991/978-2-494069-89-3_164

Zhao, Y., & Wang, L. (2022). A case study of student development across project-based learning units in middle school chemistry. *Disciplinary and Interdisciplinary Science Education Research, 4*(1), 1-20. https://doi.org/10.1186/s43031-021-00045-8

Zheng, N. (2025). The Current Status and Optimization Strategies of Popular Music Education in Chinese Universities under the Context of Technological Transformation. *Journal of Contemporary Art Criticism, 1*(1), 40-43.