

Exploration of Primary and Secondary School Music Teaching Models under the STEAM Education Philosophy

Zhiheng Cheng

School of Art, Nanchang University, Nanchang, Jiangxi, 330031, China

Abstract: In the context of global talent competition and the era of artificial intelligence, STEAM Education Philosophy has become a vital approach to cultivating interdisciplinary and innovative talents. Its integration with arts education represents a major trend in international educational reform. This paper systematically analyzes the points of intersection between STEAM education and the music discipline in areas such as Science and Technology. To address current challenges—such as Fragmentation of Teaching Content, Traditionalization of Teaching Methods, and Absence of Evaluation System—this study proposes promoting Classroom Practice Transformation through Project-Based Learning, reconstructing curriculum content by integrating Interdisciplinary Resources, and enhancing music instruction through Teaching Improvement Strategies such as the Dual-Dimensional Evaluation System. These strategies aim to strengthen the Interdisciplinarity of music education and provide new approaches for cultivating Compound Art Talents with strong STEAM Literacy.

Keywords: STEAM, primary and secondary schools, music teaching

1. Introduction

Against the backdrop of the 21st-century educational transformation, STEAM education, with its Interdisciplinary Integration advantages, has emerged as a key focus for basic education reform in China. Traditional music education, a core element of aesthetic education, faces challenges such as disciplinary fragmentation and a lack of innovation, and urgently requires reconstruction through the integration of STEAM concepts. It is believed that integrating Science principles, engineering Technology, mathematical logic and artistic aesthetics into primary and secondary school music teaching through Project-Based Learning not only aligns with the national education development strategy but also empowers students to enhance their comprehensive skills and cultivate innovative abilities through creative practice. Teachers, in their practical teaching, should construct a multi-disciplinary integration model, reinforcing students' awareness of comprehensive application, and effectively stimulating their enthusiasm for learning and promoting their all-round development by guiding independent exploration and enriching classroom content.

2. Core Connotations and Characteristics of STEAM Education

STEAM education, as an Interdisciplinary Integration educational paradigm, has evolved from STEM to STEAM through a process of deepening and expansion. This evolution reflects not only a shift in educational goals from a singular focus on scientific and technological literacy towards comprehensive innovation capabilities, but also embodies the globalised era's demand for diverse talent. By analysing its developmental context, we can more clearly grasp the integrative, practical and innovative characteristics unique to STEAM education, and thus understand its core significance

Copyright © 2025 by author(s) and Region - Educational Research and Reviews.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<https://www.front-sci.com/journal/rerr>

in contemporary educational reform.

2.1 Origins and Development of STEAM Education

The conceptual foundation of STEAM education can be traced back to the interdisciplinary education philosophies of the mid-20th century. Its direct predecessor is STEM education, which originated in the United States. In the 1980s, the U.S. National Science Board introduced the concept of STEM in the report "Undergraduate Education in Science, Mathematics, and Engineering"^[1], with the goal of integrating Science, Technology, engineering, and mathematics education to strengthen the nation's competitiveness in science and technology. As society began to place greater emphasis on well-rounded talent development, Arts—functioning as a bridge between Science and the humanities—was gradually incorporated into this educational model. Since the early 21st century, STEAM education has been widely promoted around the world. Developed countries such as the United States, the United Kingdom, and Germany have incorporated STEAM education into their national education strategies. In China, policy documents such as the "Key Work Points of the Educational Equipment Research and Development Center of the Ministry of Education in 2018" explicitly call for the advancement of STEAM education. The transition from STEM to STEAM represents not merely the addition of new disciplines, but a fundamental shift in educational philosophy—moving from a sole emphasis on science and engineering literacy to the integration of Science spirit and humanistic values, from the transmission of knowledge to the cultivation of competencies, and from single-disciplinary thinking to interdisciplinary and systematic thinking.

2.2 Three Core Characteristics of STEAM Education

STEAM education is defined by three core characteristics. First, interdisciplinary integration, which fosters systematic thinking by breaking down traditional knowledge barriers. The essence of STEAM education lies in transcending traditional disciplinary boundaries to create an ecosystem where multidisciplinary knowledge is organically integrated. This integration is not a mechanical accumulation of information, but rather the meaningful connection of concepts, principles, and methods from various disciplines through real-world problems or projects, thereby fostering systems thinking for solving complex issues.

1. For example, in the project "Designing a Sound System for a School Music Festival," students are expected to apply acoustic principles from physics (Science), operate audio software (Technology), design spatial layouts for speaker placement (engineering), analyze the structure of musical compositions (arts), and perform volume ratio calculations (mathematics), completing the task through interdisciplinary collaboration. This integration enables students to recognize the intrinsic connections among different disciplines and fosters their ability to analyze problems from multiple perspectives.

2. A practice-oriented approach, involving the cognitive transformation from theory to application. STEAM education emphasizes "learning by doing," promoting the internalization and application of knowledge through hands-on activities. Unlike traditional teacher-centered instruction, STEAM education is driven by projects or problems, enabling students to construct knowledge through practical engagement, experimental exploration, and solution design. For example, in the activity "Making Simple Homemade Instruments," students go through the entire process—from selecting materials and designing structures to acoustic tuning and musical performance—thereby gaining a practical understanding of the principles of sound generation (Science), the physical properties of materials (Technology), the structural functions of instruments (Engineering), the aesthetic evaluation of timbre (Art), and the mathematical patterns of musical scales (Mathematics). This practice-oriented learning not only deepens students' understanding of knowledge but also cultivates their ability to solve real-world problems.

3. The integration of fostering innovation, critical thinking, and creative expression. STEAM education is centered on fostering innovation by encouraging students to ask questions, explore solutions, and reflect on their progress, thereby gradually developing critical thinking and creative expression skills. In STEAM projects, students are continually presented with challenges. For example, when designing an electronic music composition that incorporates programming Technology, they must balance the artistic quality of the music with the technical challenges of Technology implementation, refining their solutions through repeated testing and adjustment. This process fosters a spirit of innovation—marked by independent thinking and a readiness to experiment—as well as the ability to turn abstract ideas into concrete outcomes.

Studies have shown that students who participate in STEAM programs over an extended period significantly outperform those in traditional teaching models in areas such as divergent thinking, problem-solving, and confidence in innovation. STEAM education originated from the STEM concept, which integrates the four major fields of Science (Science), Technology (Technology), Engineering, and Mathematics. Its goal is to enhance students' overall competence and global competitiveness through interdisciplinary learning.

As educational philosophies have evolved, the original framework has been expanded to include the Arts, adding a humanistic and artistic dimension to the foundation of science and engineering. This integration has led to the development of a more comprehensive STEAM education system. The core features of this model include interdisciplinary integration, a hands-on, practice-oriented approach, and a strong focus on fostering innovation. By breaking down traditional subject boundaries and drawing on knowledge and methodologies from multiple fields, learners are guided to apply systematic thinking in addressing complex real-world problems. In practice, STEAM education emphasizes the development of three core competencies in students: innovation grounded in critical thinking, problem-solving skills informed by engineering thinking, and teamwork abilities fostered through collaborative projects. These competencies are intended to equip students with interdisciplinary qualities that align with the evolving demands of future society. This integrated educational model not only upholds the STEM tradition of emphasizing scientific and technological literacy but also strengthens the cultivation of creative thinking through the inclusion of artistic elements, reflecting modern education's commitment to nurturing well-rounded individuals.

2.3 Teaching Implementation Framework of STEAM Education

2.3.1 Project-Based Collaborative Learning as the Primary Approach

Project-Based Learning (PBL) is adopted as the central instructional model in STEAM education. Its implementation typically follows the sequence of topic identification, group inquiry, outcome presentation, and reflection and evaluation. In music education, teachers can design projects such as "composing a soundtrack for a campus documentary," in which students are divided into groups to take on tasks like composition, arrangement, recording, and mixing. Through collaboration, students integrate knowledge of music creation, audio Technology, rhythmic mathematics, and other related fields. This learning model has three notable characteristics: first, authenticity, as projects are typically based on real-life problems or needs; second, autonomy, with students having significant decision-making power within the project; and third, collaboration, as group work fosters teamwork skills. In this process, the teacher serves as a facilitator, supporting students' inquiry through questioning and the provision of resources.

2.3.2 Problem Solving Based on Real-World Contexts as the Primary Objective

STEAM education identifies the resolution of real-world problems as a central instructional goal. By designing challenging tasks closely connected to students' everyday experiences, it encourages them to engage in inquiry using interdisciplinary knowledge. For example, in the project "Analyzing the Acoustic Performance of Different Classrooms," students are tasked with measuring the reverberation time of various spaces (Science), simulating acoustic conditions using specialized software (Technology), designing improvement plans (Engineering), evaluating the impact of these plans on music listening experiences (Art), and applying statistical methods to analyze the data (Mathematics). This instructional model stands in sharp contrast to traditional knowledge-based teaching approaches. Conventional education often overemphasizes the transmission of theoretical knowledge while overlooking the development of students' ability to apply that knowledge to solve real-world problems, which hinders their capacity to navigate complex challenges in everyday life. The unique value of STEAM education lies in its ability to translate abstract academic concepts into tangible real-life contexts, allowing students to actively construct their own knowledge systems through engaging and challenging tasks. During the implementation of the project, students are encouraged to independently pose questions and collaborate to find solutions, thereby naturally enhancing their problem-solving and innovative thinking abilities through hands-on learning^[2]. This engaging and experiential approach is far more effective at sparking interest than mere knowledge delivery and more conducive to developing well-rounded skills for the future.

2.3.3 Interdisciplinary and Integrated Knowledge as Teaching Content

STEAM Education Philosophy emphasizes the deep integration of various disciplines. In terms of teaching content, elements from different subjects are thoroughly analyzed, and multidimensional approaches to real-world problems are

developed. Throughout this process, students are expected not only to apply knowledge and skills from multiple disciplines with flexibility but also to demonstrate interdisciplinary and innovative thinking, ultimately aiming for holistic development. This approach forms the framework of STEAM education, which consists of five primary levels: the first level is shaped by the actual curricula of individual subjects; the second level includes the five core domains of STEAM—Science, Technology, engineering, mathematics, and art; the third level involves the infusion of "Art" into the other four domains; the fourth level, known as the "disciplinary integration level," focuses on combining knowledge and skills across disciplines through interdisciplinary methods, thereby reinforcing the connections among the five core areas; the highest level is the general education level, which represents the ultimate educational goal—cultivating students into well-rounded individuals.

3. Intersection of Music and STEAM Disciplines

The integration of STEAM Education Philosophy into music education in primary and secondary schools essentially involves the organic fusion of Science, Technology, engineering, arts, and mathematics, thereby enriching music education with deeper cognitive dimensions and practical significance. This integration is not simply a combination of disciplinary knowledge; rather, it fosters the development of students' systematic thinking by enabling them to discover, analyze, and creatively solve problems from a multidisciplinary perspective within the natural context of music learning. To realize this objective, it is essential to accurately identify the points of intersection between music and each STEAM domain and to design integration pathways that align with students' cognitive development.

3.1 Music and Science

The application of STEAM Education Philosophy in primary and secondary school music classrooms involves the seamless integration of the rigor of Science with the creativity of the arts, thereby enhancing students' overall learning experience. Taking elementary school as an example, the intersection between music and Science can focus on the physical characteristics of sound. Students can be guided to explore fundamental concepts related to the generation, transmission, and perception of sound. Through experiments, they can come to understand that sound waves are transmitted through the air by vibrations, and that pitch is determined by the frequency of these vibrations. In practical teaching, teachers can use portable instruments such as tuning forks and drums to demonstrate how vibrations at different frequencies produce various pitches. Additionally, waveform diagrams can be used to help students visually observe the waveforms of sounds with different pitches, thereby deepening their understanding of the physical properties of sound.

3.2 Music and Technology

In the deep integration of the STEAM Education Philosophy with music education in primary and secondary schools, digital music production, as a modern teaching method, can significantly broaden students' learning experiences, making music education more open and creative. Traditional music classrooms typically focus on singing, appreciation, or performance. However, incorporating digital music production—particularly through teaching methods centered on Digital Audio Workstations (DAWs) such as GarageBand, Ableton Live, and FL Studio—allows students to gain a hands-on understanding of the entire process of music creation integrated with Technology. These software tools offer user-friendly interfaces and a wide array of features, enabling students across different age groups to explore music in a personalized way based on their interests and skill levels—from basic rhythm arrangement and chord composition to advanced electronic music production, and even the creation of algorithmic music through programming (e.g., Sonic Pi). This transforms music learning from passive reception to active creation. In the teaching practice of digital music production, students not only reinforce their understanding of traditional music theory—such as melody, harmony, and musical form—but also cultivate logical thinking and hands-on skills through Technology tasks like audio editing and mixing. For instance, analyzing the coordination of instrumental parts during arrangement or using mathematical reasoning to accurately calculate rhythmic durations can subtly enhance their overall cognitive abilities.

With the advancement of artificial intelligence Technology, music classrooms have gained more opportunities for Interdisciplinary Integration: students can compose melodies using AI-generated algorithms based on keywords, gaining insights into the relationship between musical styles and Technology by adjusting parameters; they can also use spectrogram analysis software to visualize vocal waveforms, allowing them to intuitively grasp the correlation between acoustic frequencies and pitch. It is worth noting that regardless of how Technology evolves, the core objective of

education remains the cultivation of students' artistic expression and creativity. Educators should make effective use of technological tools while avoiding overreliance, aiming to strike a balance between "technological empowerment" and "aesthetic experience" in order to truly realize the STEAM education philosophy of "the symbiosis of art and technology."

3.3 Constructivism and STEAM

Constructivism emphasizes that knowledge is actively constructed by learners, asserting that cognitive development is not a passive absorption of information but a process gradually internalized through inquiry, practice, and social interaction. This philosophy closely aligns with the core principles of STEAM education—interdisciplinary integration, hands-on learning, and project-based learning (PBL)—all of which highlight the construction of knowledge through problem-driven experimentation, design, and collaboration. In music education, STEAM instruction from a constructivist perspective can follow a "problem-guided + self-directed exploration" model. For example, when teaching musical structure, instructors move beyond one-way explanations and instead design open-ended creative tasks, such as "using GarageBand to produce an electronic music piece with an A-B-A form." In this process, students are required to independently explore the software's features, analyze the relationships between different musical sections, and refine their compositions through repeated listening and adjustments, ultimately gaining a deeper understanding.

This approach not only enhances students' critical thinking and creativity but also cultivates their ability to learn independently. Moreover, the engineering mindset emphasized in STEAM education—namely, the process of "defining the problem → designing a solution → testing and optimization"—mirrors the iterative learning process advocated by constructivism. This model transforms music learning from mechanical imitation into a dynamic process of "experimentation–correction–recreation," enabling students to truly grasp the underlying logic of musical composition.

3.4 Social Learning Theory and STEAM

American psychologist Albert Bandura's social learning theory posits that human learning is fundamentally a social process, emphasizing the importance of observation, interaction, and collaboration in cognitive development. This perspective closely aligns with the interdisciplinary and inquiry-based approach promoted by STEAM education, together offering both a theoretical foundation and practical guidance for innovation in music teaching models. In the music classroom, STEAM education can effectively integrate the core principles of social learning theory: first, by employing Project-Based Learning (such as film scoring projects) to foster student agency, allowing them to develop independent thinking and problem-solving skills through full engagement in the music production process; second, by promoting interdisciplinary collaboration (such as music programming and interactive multimedia creation) to strengthen observational learning and teamwork, thereby enhancing learning outcomes in authentic, interactive settings; and finally, by encouraging personalized expression (such as original compositions incorporating diverse musical styles), enabling students to build a stronger sense of self-efficacy alongside standardized training. This practical model, which integrates social learning theory with STEAM education, not only enriches the forms of music instruction but also supports the development of well-rounded individuals with innovative thinking and collaborative skills.

4. Necessity of Applying STEAM Education Philosophy in Primary and Secondary School Music Education

The introduction of STEAM Education Philosophy fundamentally breaks down the rigid disciplinary boundaries and the isolated transmission of knowledge that characterize traditional music education, fostering a qualitative shift from single-skill training to the cultivation of interdisciplinary and comprehensive competencies. As the era of artificial intelligence continues to unfold, the growing societal demand for innovative and versatile talent has further underscored the importance of STEAM education. In recent years, this educational model has been widely implemented across various subject areas in China's basic education system, and its innovative applications in music education have demonstrated distinctive educational value. Studies have shown that STEAM education not only significantly enhances the quality of music instruction in primary and secondary schools, but also broadens the scope of music education through interdisciplinary integration, thereby offering an effective pathway for cultivating future talents with innovative thinking and practical skills.

4.1 STEAM Education as a Primary Pathway for Cultivating Innovative Talents

Educational practices in recent years have demonstrated that STEAM education, as an innovative instructional model,

plays a vital role in nurturing interdisciplinary and creative talents and has been widely adopted across China's educational system. Music, however, as an art form rich in emotional expression, remains one of the main avenues for implementing aesthetic education in Chinese primary and secondary schools. From an artistic standpoint, music education at these levels serves as a fundamental step in the inheritance and development of human art and culture. It is not only an essential part of the arts but also helps shape the artistic essence of human life. Primary and secondary schools serve as the "first front" for awakening and implementing this value, playing a crucial role in laying the foundation for students' future development. At the educational level, music acts as a comprehensive medium for art and cultural education, fully reflecting the value of general elementary education. Integrating STEAM Education Philosophy into music education in primary and secondary schools can significantly enhance students' musical aesthetic appreciation and creative abilities, thereby contributing to the cultivation of innovative musical talents.

4.2 Meeting the Requirements for Innovative Teaching in Primary School Music Classrooms under the New Curriculum Reform

The introduction of the new fundamental education concept calls for music classrooms to be dynamic and engaging. In primary and secondary music education, a key area of research has become how to stimulate students' motivation to learn, activate their emotional experiences, guide them in expressing themselves through acquired artistic forms and inner emotions, enrich their learning experiences, and foster their aesthetic sensibilities. The integration of STEAM Education Philosophy into primary and secondary school music education requires teachers to focus on teaching fundamental music knowledge as a foundation, with the aim of further enhancing students' musical aesthetic appreciation and cognitive abilities. By utilizing interdisciplinary learning through Science as a method, this approach can significantly enrich classroom content and offer students a more holistic learning experience. This directly meets the requirements for innovative teaching in primary school music classes as outlined in the new curriculum reform ^[3].

4.3 The Enlightening Role of STEAM Education Philosophy in Primary School Music Education

As an emerging educational concept, interdisciplinary education has been widely adopted across the global educational landscape. For example, the U.S. National Core Arts Standards repeatedly highlight that the ability to address artistic challenges through interdisciplinary thinking and methods is a key competency that contemporary students must develop. In addition, China's Compulsory Education Music Curriculum Standards emphasize the importance of focusing on the unique characteristics of music and promoting interdisciplinary integration. In the context of music education, this integration primarily refers to the seamless blending of various instructional domains within the music curriculum, such as music with poetry, dance, drama, film and television, and visual arts. Incorporating STEAM Education Philosophy into music instruction in primary and secondary schools can enhance students' understanding of the essence, development, and practical application of music education.

5. Application Status of STEAM Education Philosophy in Music Education in Primary and Secondary Schools

The integration of the STEAM Education Philosophy into music education in primary and secondary schools has been shown to significantly boost student engagement while effectively nurturing their creative thinking, artistic imagination, hands-on skills, teamwork, and practical communication abilities. For example, by incorporating interdisciplinary elements such as Science (principles of acoustic vibration), Technology (music production software), engineering (creating simple homemade instruments), art (musical expression), and mathematics (mathematical patterns in rhythm and scales), students are able to explore the essence of music through Project-Based Learning. Projects such as "composing electronic music" or "analyzing the acoustic effects of different architectural spaces" help transform abstract musical concepts into vivid and tangible learning experiences. However, the current application of STEAM Education Philosophy in music education in primary and secondary schools in China still faces the following challenges.

5.1 Homogeneity of Teaching Content

Currently, the design of teaching content based on the STEAM Education Philosophy in primary and secondary school music education tends to be overly uniform. This is primarily manifested in the rigid insertion of knowledge from other disciplines into music classes, which fails to realize the intended goals of Interdisciplinary Integration. Music teachers often incorporate mathematical calculations (such as rhythmic patterns) or basic Science concepts (such as the

principles of sound transmission) in a mechanical manner, without a coherent interdisciplinary framework. For instance, during instrument-making activities, students are often guided to assemble components by following fixed procedures, with little engagement in understanding the acoustic principles or structural design behind the process. This formalized integration leads to a superficial understanding of STEAM among students, hindering the development of genuine interdisciplinary thinking. At the same time, the lack of exemplary cases and well-developed teaching resources results in highly repetitive curricula in many schools, with limited innovation.

5.2 Limitations of Teaching Methods

Although STEAM promotes inquiry-based learning, many music classes remain predominantly teacher-centered. Students are given few opportunities for independent exploration and hands-on practice, resulting in limited classroom interaction. For instance, in music programming instruction, teachers typically demonstrate the steps first, with students then replicating the process, rather than being encouraged to identify and solve problems through experimentation and adjustment. Additionally, interdisciplinary activities are often simplified due to time constraints, and the integration of Science, engineering, or art elements tends to be fragmented, preventing the formation of a cohesive learning experience. Some schools have begun to experiment with project-based learning; however, due to limitations in equipment and teacher experience, truly in-depth project-based instruction remains uncommon.

5.3 Lack of Evaluation System

STEAM music education lacks a Science systematic evaluation methodology. Most schools continue to rely on traditional music assessment methods, such as scoring based on singing or instrumental performance, while overlooking the evaluation of students' innovative thinking, teamwork, and problem-solving skills. Although some schools have introduced new evaluation models, such as project presentations or group reports, the lack of clear scoring rubrics often leads to highly subjective assessments by teachers. Furthermore, STEAM learning emphasizes not only the final outcomes but also the exploratory process. However, few schools record or evaluate students' performance during the learning process, such as in experimental design or creative development. The absence of such an evaluation system makes it difficult to accurately assess the actual effectiveness of STEAM education.

6. STEAM Education Philosophy Application Strategies in Primary and Secondary School Music Education

The above analysis indicates that the current challenges in implementing STEAM education in primary and secondary school music instruction are primarily reflected in three areas: superficial Interdisciplinary Integration, limited innovation in teaching methods, and the absence of systematic evaluation tools. This disconnect between practice and theory represents a significant departure from the core principle of constructivist learning theory, which asserts that "knowledge should be actively constructed through interdisciplinary collaboration in authentic contexts^[4]". In light of the explicit emphasis on "creative practice" literacy in the Compulsory Education Arts Curriculum Standards (2022 Edition), the following strategic discussion will focus on three key dimensions: reconstructing an innovative classroom ecosystem through Project-Based Learning (PBL); improving the adaptability of teaching methods by incorporating research on "Arts-enhanced STEM" within STEAM education; and establishing a localized evaluation framework informed by U.S. STEM education quality indicators, thereby fostering reflective improvement through empirical data.

6.1 Cultivating Students' Innovative Awareness through the STEAM Education Philosophy

In the 2022 "Compulsory Education Art Curriculum Standards" issued by the Ministry of Education of China, "creative practice" is explicitly identified as one of the four core competencies. It emphasizes the exploration of creative processes and methods to foster students' innovation and practical skills. The STEAM Education Philosophy encourages teachers to guide students in independently identifying topics of interest and transforming the problems they encounter into engaging and challenging real-world tasks. These tasks are then explored through collaborative group work, thereby enhancing students' creativity and teamwork abilities.

For example, when teaching concepts related to "piano scale construction," teachers can implement theme-based group learning activities to further strengthen students' communication and collaboration skills. Specifically, a teaching scenario centered on "Organizing an Arts Festival" can be designed, incorporating a level-based format to spark students' interest in learning. Through participation in the game, students are encouraged to actively explore the lesson's key

concepts and engage in group discussions on specific topics, such as how to use the keyboard to control the white keys of a piano or how to generate sound from those keys.

Using the production of a single piano key as an example, students can be divided into several groups to stimulate their thinking. Each group is provided with relevant learning materials and assigned corresponding task sheets. The process of creating a single key and its associated scale can be further broken down into two sequential tasks, encouraging students to independently explore scale construction and song composition. The design of this teaching activity strictly follows the principle of "accumulating knowledge through experience and learning theory through practice," with the goal of maximizing students' initiative. Active discussion and communication within groups are encouraged to enhance students' abilities in information acquisition, communication and collaboration, and comprehensive application^[5].

6.2 Emphasis on the Integration of Resources from Different Disciplines

Since the introduction of STEAM Education Philosophy, this innovative teaching model has consistently drawn widespread attention from educators. Its influence has extended beyond traditional educational stages and has been deeply integrated into both primary and secondary education. In primary education, the STEAM model emphasizes interdisciplinary knowledge integration, focusing on fostering students' independent inquiry skills while also enhancing their artistic creativity and innovative thinking. In practical implementation, music teachers should move beyond isolated skill training and instead integrate knowledge from various disciplines into their instruction. This approach transforms the music classroom into an effective platform for developing interdisciplinary competencies.

For example, in the lesson "To Spring" from the People's Music Edition of the primary school music textbook, teachers can skillfully incorporate literary elements from Zhu Ziqing's prose piece "Spring." Vivid descriptions such as "the mountains become moist and bright, the water rises, and the sun's face turns red," along with imagery of tender green grass and blooming flowers across the fields, together evoke the vibrant spirit of spring. The musical piece "To Spring" expresses the warmth of spring sunshine through its melody, creating an artistic resonance with the prose. By guiding students through language and immersing them in the graceful music, teachers can expand their thinking and deepen their emotional engagement. This fusion of music and literature allows students to fully experience the poetic beauty and charm of spring.

6.3 Constructing a Music Teaching Evaluation System

Currently, under the framework of STEAM Education Philosophy, a unified standard for music teaching evaluation has not yet been established. Evaluation plans are generally developed based on specific instructional goals. From the perspective of music education, the STEAM evaluation mechanism can incorporate both component-based assessments and comprehensive evaluations. Specialized assessments focus on challenges students encounter during the learning process, such as gathering materials, selecting repertoire, and receiving real-time feedback during rehearsals. These aspects require teachers to closely observe students' progress in music learning. By considering the course progression alongside students' performance in STEAM-related activities, teachers can ultimately deliver a comprehensive evaluation outcome^[6].

A diversified assessment approach should be adopted, incorporating both student self-assessment and peer evaluation within groups. Teachers can implement appropriate incentive measures based on students' specific performance in musical activities, thereby enhancing their enthusiasm for participating in music education. From the perspective of optimizing teaching effectiveness, a Science and well-structured evaluation system facilitates the deeper integration of the STEAM Education Philosophy into primary school music classrooms. It highlights the unique value of STEAM education within the music discipline, effectively addressing weaknesses in the teaching process and significantly improving the overall quality of primary school music education.

Practical explorations of the STEAM Education Philosophy in primary and secondary school music education have shown that its value lies not only in the interdisciplinary integration of subject knowledge but also in the transformation of music education through innovative instructional design and evaluation systems, promoting a shift from "skill transmission" to "competency cultivation." International studies have shown that when Arts serve as a bridge connecting Science, Technology, Engineering, and Mathematics, students' learning motivation and creative problem-solving abilities can be significantly enhanced^[7]. China's "Compulsory Education Curriculum Plan (2022 Edition)" also explicitly emphasizes the importance of "focusing on the interconnection among disciplines," which closely aligns with the core principles of STEAM education. Future research should further address three key tensions:

1. The tension between the blurring of disciplinary boundaries and the clarity required by curriculum standards;
 2. The tension between the complexity of formative assessment and the streamlined nature of current teaching management;
 3. The tension between teachers' limited interdisciplinary competence and the high demands of STEAM instruction.
- The reform potential of STEAM education in the music discipline can only be fully realized through the coordinated integration of policy support, teacher training, and school-based practice.

7. Conclusion

In summary, the "holistic development" advocated by STEAM Education Philosophy is not a mechanical assemblage of disciplinary knowledge, but a dynamic educational framework that emphasizes the integration of creative thinking and practical skills. The implementation of STEAM practices in music education must balance the aesthetic integrity of the discipline with the modernity of Interdisciplinary Integration. At its core, this approach is rooted in the fundamental competencies of music education, expanded through interdisciplinary integration, and oriented toward the cultivation of comprehensive abilities.

Specifically, the STEAM-oriented transformation of music curricula should follow two key principles: first, avoiding "formalistic integration," meaning that interdisciplinary elements must enhance the cultivation of musical aesthetic experience and expressive ability, rather than dilute the essence of the discipline; second, establishing a scientifically grounded evaluation system, which can draw on a three-dimensional model comprising performance-based assessment, competency growth portfolios, and project outcome collections to ensure the effective achievement of instructional goals. Music teachers should fully embrace their pivotal role by upholding the core educational mission of aesthetic education while seamlessly integrating the STEAM framework into music instruction. Through interdisciplinary teaching practices, they can help students develop creativity and problem-solving skills, ultimately fostering the holistic growth of their overall competencies.

Reference

- [1] National Science Foundation. Undergraduate science mathematics and engineering education[OL].<<http://www.nsf.gov/nsb/publications/1986/nsb0386.pdf>>
- [2] Ke Tingyuan, Wang Zhijun. Research on Teaching of Junior High School Music Composition under the STEAM Education Concept [J]. Contemporary Music, 2025, (03):31-33.
- [3] Li Yanyan, Qiu Guoming. Strategies of STEAM Education in Primary School Music Classrooms [J]. Taste & Classic, 2024, (07):113-115.
- [4] Cole M, Vygotskii L S. Mind in society :the development of higher psychological processes[M]. Cambridge: Harvard University Press, 1978.
- [5] Xia Xiongjun and Liu Sashuang. From Single-Dimensional to Multi-dimensional: A Contemporary Interpretation of Integrating STEAM Education Concepts into Junior High School Music Appreciation Teaching [J]. Music Education and Composition, 2024, (01):34-36+50.
- [6] Chen Deng. Research on Teaching Strategies of Music in the Context of STEAM Education [J]. College Entrance Examination, 2021, (20):155-156.
- [7] Guyotte, K. W., Sochacka, N. W., Costantino, T. E., Walther, J., & Kellam, N. N. (2014). Steam as Social Practice: Cultivating Creativity in Transdisciplinary Spaces. Art Education, 67(6), 12–19.