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Exploring the Integration of STEAM Education in Senior High School Chinese Language Teaching-taking "Yiwu Mechanical and Electrical Technician High School" as a Case Study

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Abstract

This paper explores the integration of STEAM (Science, Technology, Engineering, Arts, and Mathematics) education into senior high school Chinese language teaching, using Yiwu Mechanical and Electrical Technician High School as a case study. The study investigates how the incorporation of STEAM elements enhances students' engagement, critical thinking, and language skills by embedding creative and interdisciplinary approaches into traditional Chinese language curricula. By adopting project-based learning, digital storytelling, and interactive activities, the program seeks to foster a deeper appreciation for Chinese language and literature while promoting skills relevant to the 21st century, such as problem-solving, collaboration, and innovation. Qualitative data, including classroom observations, teacher interviews, and student feedback, reveal that integrating STEAM education in language arts encourages students to view language as a dynamic tool for exploration rather than a static subject. The study showed that many teachers were willing to participate in relevant training even though they were unfamiliar with STEAM education concepts. Chinese language teaching in senior high schools based on the STEAM concept significantly enhances students' interest and learning outcomes, and promotes the cultivation of interdisciplinary thinking and innovative abilities. Therefore, it is important to continue to improve this teaching model to promote the reform of Chinese language teaching.

Keywords

STEAM, High school Chinese; Education quality, Teaching model, Innovation ability

Introduction

In recent years, there has been an increasing focus on integrating interdisciplinary approaches into education, aiming to equip students with a well-rounded skill set that prepares them for the demands of the 21st century (Hadzieva et al., 2021). STEAM (Science, Technology, Engineering, Arts, and Mathematics) education, an evolution of STEM that emphasizes the arts and creativity, has gained attention as an effective educational model that encourages critical thinking, problem-solving, and innovation. While traditionally applied in science and engineering contexts, STEAM

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education is now being explored in humanities subjects, including language arts, as a means of enriching students' learning experiences. This study investigates the integration of STEAM education in senior high school Chinese language teaching, with a specific focus on the case of Yiwu Mechanical and Electrical Technician High School.

In recent years, China is facing the challenge of a serious shortage of innovative talents. China's "13th Five-Year National Science and Technology Talent Development Plan" (Ministry, 2017) released in April 2017 pointed out that it is estimated that the aerospace talent gap will be about 48,000, and the energy shortage and new energy automobile industry will have a talent gap of about 250,000 by 2025. There will be a large supply gap for high-level talents, high-end research and development talents, and highly skilled talents in China's future science frontiers. Therefore, exploring new educational philosophies and teaching models has become an inevitable trend of educational reform. With the rapid development of information technology, various regions have established school-based educational platforms, providing strong support for the implementation of modern classrooms(Batra et al., 2021). These platforms not only enrich teaching resources but also promote the innovation of teaching models.

Requirements of the new curriculum reform: The new curriculum reform emphasizes the subjectivity, practicality, and innovation of students, requiring teachers to focus on cultivating students' comprehensive quality and innovative abilities in the teaching process(Stohlmann et al., 2012). The STEAM philosophy is highly consistent with the philosophy of the new curriculum reform, providing new ideas for senior high school Chinese language teaching.

Current state of STEAM education research abroad: STEAM education has become an important direction for educational reform. Scholars have conducted in-depth research on STEAM education from multiple perspectives, including its theoretical basis, practical models, and evaluation systems. These research results provide valuable references for this study (Zhu et al., 2021; Leong, 2024a; Leong, 2024d).

Current state of STEAM education research in China: In recent years, domestic scholars have also begun to pay attention to STEAM education and have achieved certain research results(People's Republic of China 2019). However, compared to abroad, there is still a certain gap in the practice and application of STEAM education in China. Especially in the humanities and social sciences fields such as senior high school Chinese language, the application research of STEAM education is still insufficient (People's Daily 2023).

This study aims to fill the research gap of STEAM philosophy in senior high school Chinese language teaching(Jeffrey et al., 2017), providing new ideas and methods for the reform and innovation of senior high school Chinese language teaching. At the same time, this study is of great significance for promoting the improvement of students' comprehensive literacy and the cultivation of innovative abilities. In particulats, the Yiwu Mechanical and Electrical Technician High School serves as an ideal case study for this exploration due to its innovative curriculum and commitment to interdisciplinary education. By blending traditional Chinese language instruction with STEAM concepts, the school aims to develop students' linguistic skills alongside their creativity, collaborative abilities, and technological literacy. Through project-based learning, digital storytelling, and interactive classroom activities, the school has incorporated elements of science, technology, engineering, and the arts to create a unique and holistic language learning environment.

The following sections provide a detailed methodology and analysis, including qualitative data from classroom observations, teacher interviews, and student feedback. By examining the practical outcomes of STEAM integration in Chinese language teaching, this study aims to contribute to the literature on innovative educational practices and highlight the potential of STEAM to transform language arts education.

The roots of STEAM education trace back to the early 2000s with the introduction of STEM as a response to the growing demand for science and technology skills in the workforce (Yakman, 2019). Initially, STEM was championed by educational policymakers and industry leaders to address gaps in technical skills. However, the addition of Arts to create STEAM marked a significant shift, recognizing the value of creativity and critical thinking in enhancing problem-solving abilities. The inclusion of Arts supports the development of holistic skills, bridging scientific understanding with humanistic perspectives and cultural awareness, an essential component in language and humanities education. Research highlights that STEAM integration in language arts provides an opportunity to deepen linguistic skills through creative and analytical methods. Scholars such as Li (2020) and Zhao (2021) argue that traditional language education, which often focuses on rote learning and memorization, may benefit from STEAM's emphasis on innovation and inquiry-based learning. By incorporating STEAM principles, language teachers can engage students more effectively, foster critical thinking, and make language learning relevant to real-world applications (Leong, 2024b; 2024c). Studies on STEAM's application in Chinese language education are relatively recent. Liu (2022) conducted a case study in Shanghai high schools, where project-based learning in literature classes helped students explore classical Chinese poetry using elements of art and technology. Similarly, Zhang and Chen (2023) found that digital storytelling—a STEAM approach combining arts and technology—enhanced students' engagement with contemporary Chinese literature.

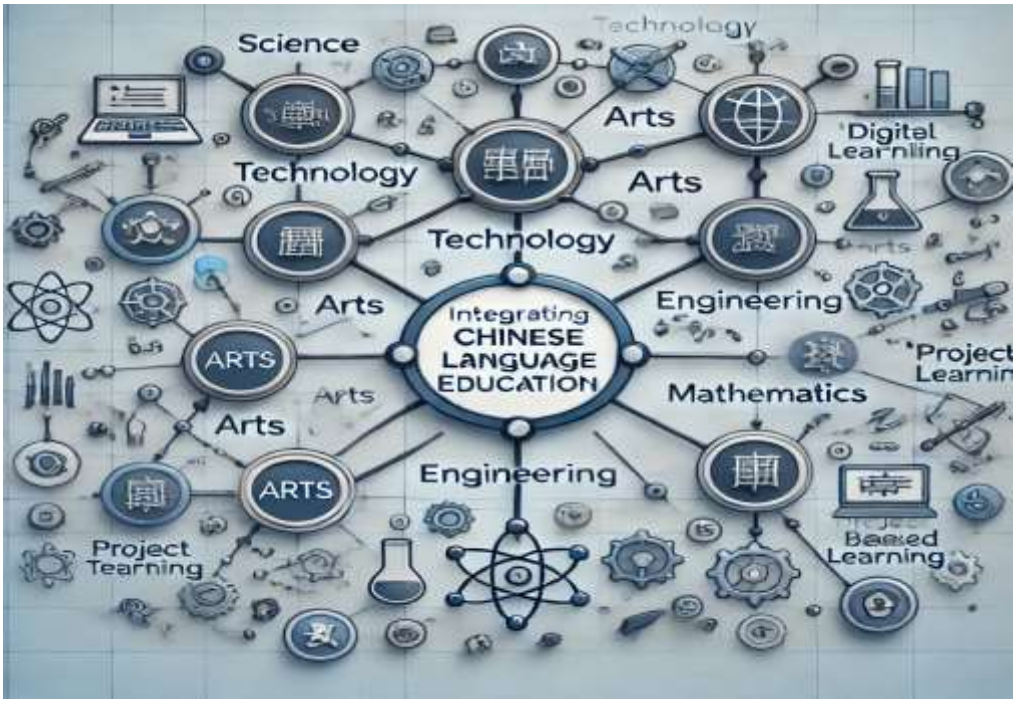


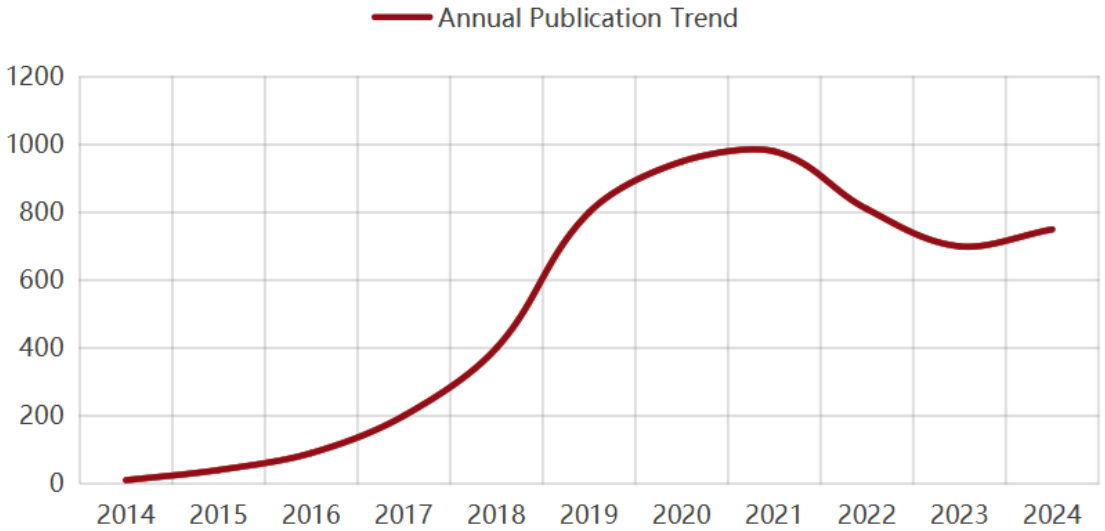
Figure 1. Conceptual Framework for Integrating STEAM in Chinese Language Education

Yakmen (2008) mainly discusses the importance of the STEAM education model and how to create an integrative education model. This article mainly explores the concept and practice of STEAM education, advocates the importance of interdisciplinary integration and comprehensive educational models, and provides beneficial thoughts and insights for the field of education.

Bybee (2010) emphasizes that the goal of STEM education is to cultivate students' interdisciplinary thinking skills, problem-solving abilities, and innovative spirit. He points out that STEM education is not just simply combining various disciplines, but more importantly, it aims to stimulate students' interest and motivation through interdisciplinary integration, and to cultivate their practical application skills and the ability to solve real-world problems. He also emphasizes the connection between STEM education and the real world, stating that STEM education should be integrated with practical applications, enabling students to apply the knowledge they have learned to real-life situations.

Jamil et al (2010) conducted a survey study on teachers with professional development in STEAM education. They selected 41 early childhood education teachers for the survey and conducted interviews with 4 of these teachers. By analyzing and summarizing the survey results, the research team revealed the teachers' perspectives on STEAM education, as well as the implications of these views for teacher education. This study offers valuable insights into understanding the attitudes and beliefs of teachers in the field of STEAM education, which can guide future teaching practices and the direction of teacher training.

China's earliest start in STEAM education dates back to 2008, and it gradually evolved until 2015. Over time, by 2016, research in this field made a qualitative leap, achieving significant progress. The development of STEM education in China has undergone continuous evolution and breakthroughs, bringing new opportunities and challenges to the education system. By 2017, there was an explosive growth. This data retrieval uses the CNIK database as the data source and conducts a literature search with "STEAM education" as the theme for nearly 10 years, up to March 1, 2024, a total of 4,900 documents were retrieved. The search results are shown in Figures 2.



China first proposed STEAM education in 2016 when the Ministry of Education issued the "Opinions on Deepening the Reform of Quality Education and Accelerating the Implementation of the Project," officially incorporating STEAM education into the framework of educational reform in China. This marked the beginning of China's emphasis on an educational philosophy that values interdisciplinary integration, practical experience, and the cultivation of innovative abilities**.**

Methodology

The study aims to explore the integration of STEAM (Science, Technology, Engineering, Arts, and Mathematics) education in senior high school Chinese language teaching, with a focus on how STEAM principles influence engagement, comprehension, and analytical skills (Zhang, 2024a; 2024b). To achieve this, a qualitative research methodology was employed, incorporating classroom observations, semi-structured interviews with teachers, and student surveys at Yiwu Mechanical and Electrical Technician High School. This approach provided a comprehensive view of the program’s impact from multiple perspectives.

Data Collection

Data were collected through classroom observations, teacher interviews, and student surveys. Classroom observations compared traditional Chinese classrooms with STEAM-enhanced classrooms, focusing on student engagement, interaction, and collaborative activities (Zhang, 2024c; Luo, 2024). Teacher interviews were conducted to understand their experiences and challenges in STEAM integration, especially how to incorporate STEAM elements into language instruction (Zhang, 2024d; Li, 2024a). In addition, a questionnaire was administered to students to quantify changes in their interest, engagement, and learning outcomes, using a Likert scale to measure their attitudes toward language learning and STEAM activities.

Table 1 Organization and conduct of observations

Program	Content
Observation	time 40-50 minutes per session in traditional and STEAM classrooms.
Observation Criteria	1)Student Participation: frequency of students' speeches, degree of interaction.
	2)Quality of interaction: communication between teachers and students, students and pupils.
	3) technology use: the use of technology tools in the classroom.
	4)project tasks: students' participation in project-based learning activities.
	5) Integration of STEAM elements: the use of interdisciplinary activities such as art, science, and technology.

Data Analysis

Data from observations, interviews, and surveys were analyzed using thematic coding to identify key themes related to engagement, skill development, and learning outcomes (Li, 2024b). Thematic analysis allowed for an in-depth understanding of STEAM's role in transforming Chinese language education and highlighted the unique elements contributing to the students' learning experience.

Instruments and Tools

Classroom observations use a structured checklist to ensure data consistency and focus on assessing student engagement, quality of interactions, and use of technology. The interview guide contains open-ended questions that allow teachers to provide flexible insights. Student surveys, on the other hand, collect quantitative data on engagement, interest in learning, and perceptions of STEAM activities through Likert scales.

Case Study: Yiwu Mechanical and Electrical Technician High School

Yiwu E&M Technical High School innovatively enhances students' language skills and critical thinking by incorporating a STEAM curriculum into Chinese language instruction. The curriculum combines project-based learning, digital storytelling, interactive art, and technology activities designed to promote students' understanding of Chinese language and literature while fostering creativity, collaboration, and problem-solving skills.

Key Components of the Curriculum:

Project-Based Learning (PBL) uses collaborative projects to explore literary themes through research and multimedia presentations. Digital storytelling allows students to create animated videos based on classical Chinese texts, merging technology, language, and arts to enhance comprehension. Interactive workshops combine art activities and technical exercises, like visualizing literary scenes with digital tools. STEAM-based curriculum benefits include increased engagement, improved language skills, and enhanced critical thinking. Digital storytelling deepened students' understanding of literary themes, while arts and technology integration fostered diverse analytical perspectives (Scott et al., 2013).

Results and Discussion

This questionnaire survey was conducted by distributing 45 questionnaires through the "Survey Website," with 45 questionnaires returned and 45 valid questionnaires, achieving a 100% response rate. The survey questionnaire is catered to Chinese language teachers from three grades of the Yiwu Mechanical and Electrical Technician high school, which has a certain representations To understand the impact of STEAM integration, this study conducted a comparative analysis of traditional and STEAM-based Chinese language classes at the school.
Figure 3 illustrates that teachers in STEAM-based classes demonstrated significantly higher engagement than those in traditional settings. In Figure 4, surveys showed that STEAM activities, especially project-based learning and digital storytelling, were perceived as more enjoyable and motivating.

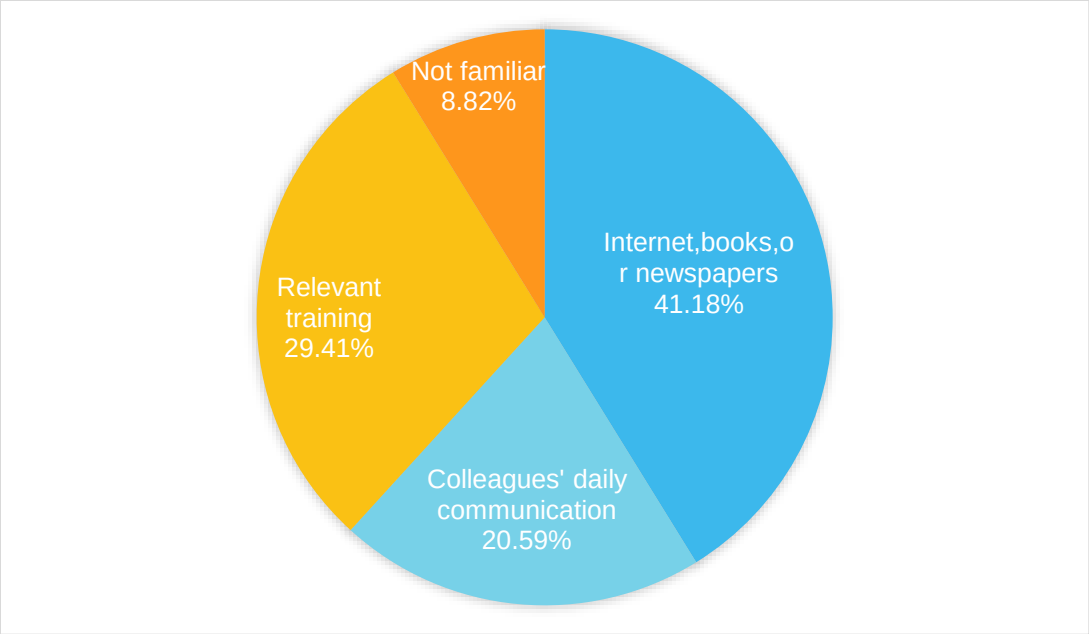


Figure 3. STEAM Education Philosophy Knowledge

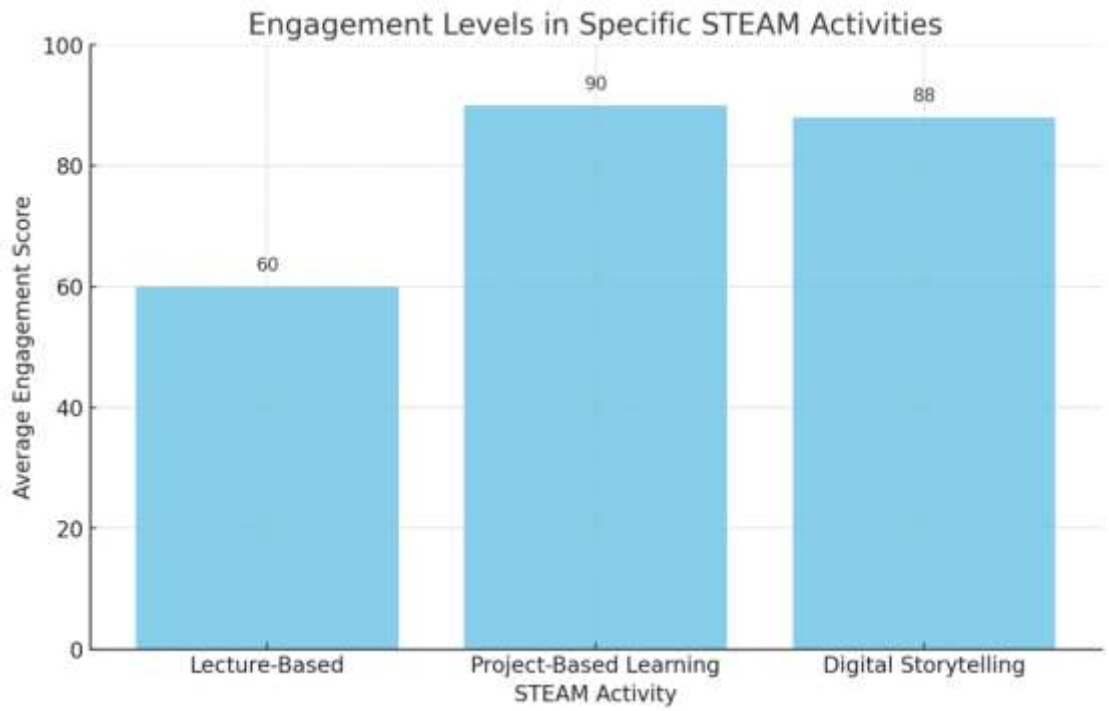


Figure 4. Engagement Levels in Specific STEAM Activities

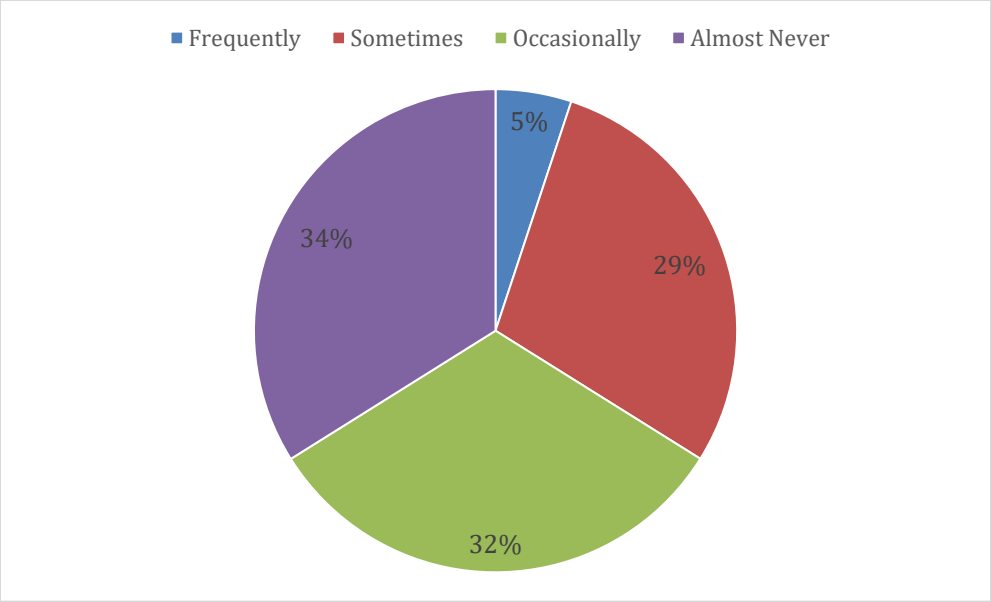


Figure 5. STEAM Concepts Teaching Integration

From Figure 3, the data indicates that the primary means for high school Chinese language teachers to acquire STEAM educational concepts are the internet, books, or newspapers, followed by relevant training sessions. In Figure 5, majority of teachers do not integrate the STEAM philosophy into their regular teaching, some do it occasionally, and only a few are able to consistently infuse the STEAM educational concept within the Chinese language discipline.

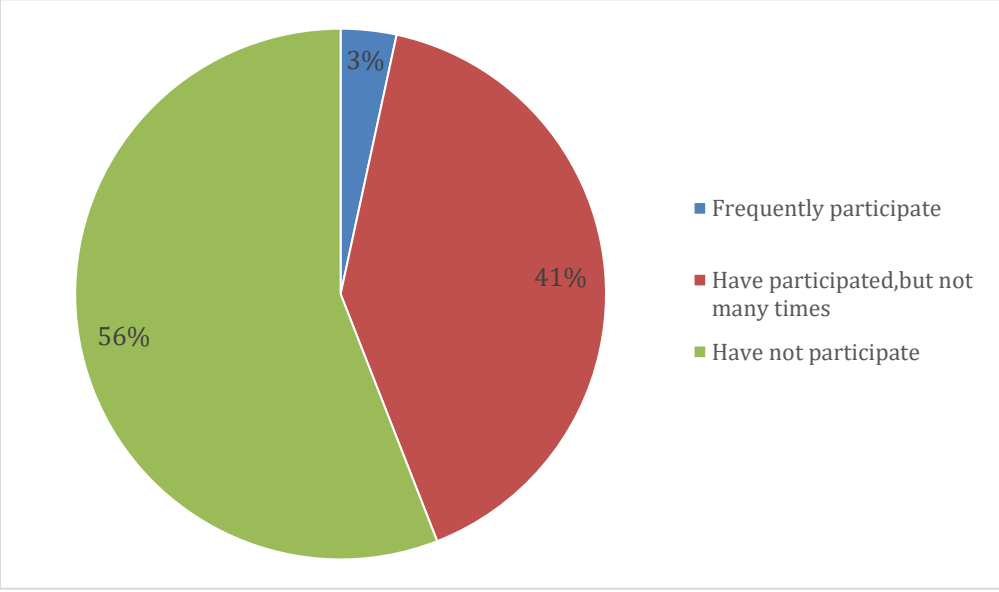


Figure 6. Training on STEAM Educational Concepts

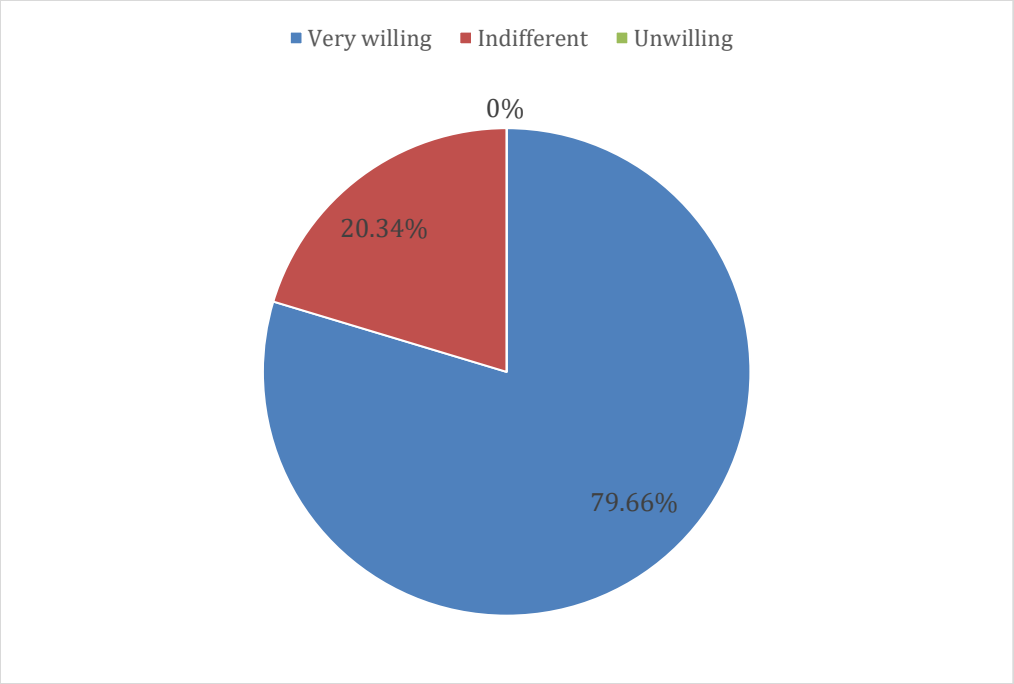


Figure 7. Willingness to Apply STEAM education

In Figure 6, the data shows that more than half of the surveyed teachers have not participated in relevant training, and the proportion of teachers who frequently attend STEAM education concept training is extremely low. As shown in Figure 7, more than 70% of the teachers are very willing to accept further learning and apply it to their own teaching.

The research survey results indicate that the STEAM education concept is still relatively unfamiliar to many teachers, but most teachers are very willing to participate in relevant training on the STEAM education concept, it's just that there are fewer training opportunities available(Lucas et al., 2021). The experimental results indicate that the class taught using a senior high school Chinese language classroom teaching model based on the STEAM philosophy showed a significant increase in students' interest in learning, with learning outcomes clearly superior to those of classes taught using traditional teaching methods. Additionally, this model also contributes to the cultivation of students' interdisciplinary thinking and innovative abilities(People's Publishing House 2020).

In summary, the research on the STEAM-based senior high school Chinese language smart classroom teaching has significant theoretical and practical implications. Although STEAM-based teaching methods have demonstrated significant advantages in improving student engagement and learning outcomes, implementing STEAM programs in teaching Chinese in senior secondary schools faces challenges such as insufficient teacher training, difficulty in curriculum integration, limited time and resources, imperfect assessment systems, and difficulties in adapting for some students. These issues limit the effective promotion and implementation of STEAM education. Future research should continue to explore and improve this teaching model to provide stronger support for the reform and innovation of senior high school Chinese language teaching.

Conclusions

Yiwu Mechanical and Electrical Technical School demonstrates the potential of an interdisciplinary approach by integrating STEAM (Science, Technology, Engineering, Arts, and Mathematics) education into high school Chinese language instruction. The model increased students' engagement, critical thinking and language skills, and expanded their understanding of Chinese language and culture. Research has shown that STEAM education stimulates students' interest in learning, creative expression and deep analytical skills, and helps them acquire 21st century skills such as problem solving, collaboration and innovation. Despite the challenges of teacher training and curriculum adaptation, the STEAM approach provides a strong foundation for language education and promotes a well-rounded learning experience for students.

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