

From STEM Education to STEAM Education-the New Role of Art Education

Yijie Li

University of Leeds, Leeds, LS2 9JT, UK

Abstract: STEAM is developed from STEM by adding an "A" (Arts) to STEM, which has a richer educational connotation; it is no longer just a cross-integration of science and technology but also a humanistic concern. Moreover, in practice, it not only trains the knowledge of judging, identifying and appreciating beauty from the technical level but also cultivates imagination and creativity from the artistic level and cultivates aesthetic sentiment from the cultural and spiritual levels. As a result, interdisciplinary integration has become more advanced. In the transformation from STEM to STEAM, the addition of arts education (Arts) allows STEM to change the mechanistic view of education and establish an organic view of education, so that the educational concept of STEAM is elevated from "knowledge" to "educating people". This paper introduces the relationship between STEM education and STEAM education, analyzes the significance of STEAM education integration, and proposes strategies for integrating arts education into STEM education for reference.

Keywords: STEAM education; Art education; Integrating

1. Introduction

The international community has become increasingly vocal about the inclusion of arts in STEM education, and the movement from STEM education to STEAM education in the field of science education is gaining momentum, hoping to transform STEM into STEAM by means of educational reform, enhancing students' science knowledge and practical skills while emphasizing their humanistic and artistic cultivation. The UK already released *the Future Generation* report in 2011^[1], which first advocated about the integration of arts courses into STEM education, and then South Korea also emphasized the integration of humanities and arts knowledge in *the Integrated Talent Education Program*. China also released the article *China STEAM Education Development Report* in 2017 and elaborated the goals of STEAM education development and reform in the country based on the actual development of education and national conditions in China. This shows that STEAM education has been unanimously recognized by the international community, but there are still some problems in its daily practice, which means that it is all the more important for primary and secondary schools in China to unite multiple forces to do a good job in curriculum adjustment and its related reform work around STEAM.

2. The Relationship between STEM Education and STEAM Education

STEM education is usually applied to the education and training of mathematical, scientific and technological talents, which not only has an important role in education career, but also provides a boost to national economic construction, employment and so on. Firstly, in years of educational practice, STEM is recognized for its unique educational advantages, but it also has various problems such as insufficient humanities and arts, general attractiveness, etc., which also limit the effect of STEM to a little extent. Secondly, because STEM education itself is closely related to mathematics and science, it places too much emphasis on the guidance of rational and logical thinking and neglects the study of students' independent imagination, creativity and abstract thinking, which cannot fully adapt to the development of the times. Therefore, researchers have begun to explore the relationship between STEM education and creative association, and then proposed the integration of the arts.

As we all know, there are certain differences between art subjects and science subjects in terms of learning content, learning thinking and practice patterns. Art studies not only natural phenomena and principles but also the whole society, which requires students to give full play to each individual's creativity in the process of learning and creating art, and then form a flexible mind. Therefore, the arts

have also become an important direction for STEM education reform and upgrading, which is the reason why the STEAM concept was established. The integration of art also adds more creativity to STEAM education, which not only stimulates more students' interest, but also promotes the unification of science and art and cultivates students' rational and emotional thinking. Science and art are both opposing and unifying, and the goal they pursue is the universality of truth, so STEAM education can help students pursue the truth of the material world while also accomplishing the enrichment of the spiritual world, thus achieving the goal of growth education^[2]. The core idea of STEAM education is shown in figure 1.

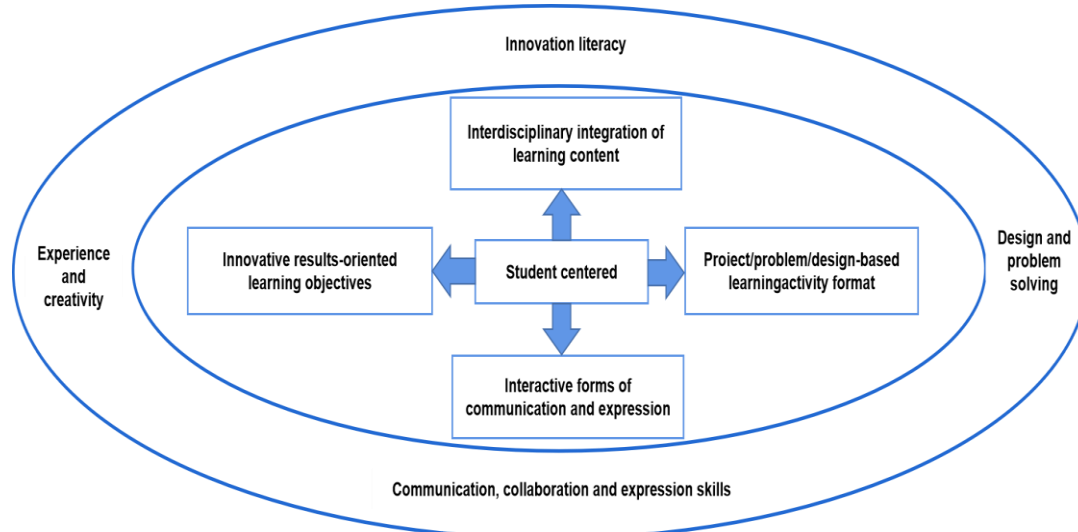


Figure 1: The core idea of STEAM education

3. The Significance of Integrating Art Education into the STEM Education System

The integration of art curriculum content and STEM can bring different thinking angles and perspectives to students, thus improving their thinking flexibility and cultivating their creativity. The STEAM education model is based on the basic learning points while also being able to extend the knowledge of a variety of subjects, further enriching the teaching content, attracting the attention of students, enhancing their interest and motivation in learning, and creating the realization of an efficient classroom. At the same time, the process of STEAM education integration and development has gradually realized the reform of the teaching evaluation system, using the process of assessment to implement the daily education, which can also alleviate the contradiction between the traditional assessment mode and student development, and also overcome the drawbacks of traditional sub-subject teaching and assessment, fully explore the development potential of students, stimulate their learning enthusiasm, and improve the learning efficiency of students. In addition, STEAM education also brings more ways to learn and practice, allowing students to communicate with different groups in interdisciplinary learning, and the exchange and collision of different thinking can also stimulate students' creativity and thinking recognition, enhance students' social skills and adaptability, and lay the foundation for future work development^[3].

4. Strategies to Promote the Development of STEAM Education

4.1 Challenges to the development of STEAM education

Firstly, the challenge facing STEAM education is that front-line teachers are prone to treat STEAM as a simple, mechanical mish-mash of traditional subject knowledge. Some scholars have even criticized that STEAM has in fact become a "hodgepodge" of knowledge. Obviously, the "comprehensive" and "synthesis" of knowledge will not achieve the original purpose of setting up integrated curriculum, curriculum integration, and STEAM education.

Secondly, although STEAM education takes into account the horizontal connection and integration of knowledge among subjects, but in the practical level, it can easily lead to students' shallow learning. How to help students move from superficial to deep learning in STEAM education practice can be a

great challenge for teachers.

Thirdly, many local education administrations and schools are actively involved in STEAM education, but there is a lack of clear ideas on how to carry out STEAM education, and there are few mature experiences and models that can be directly referred to and learned from, which makes STEAM education still in a slow exploration.

4.2 Strategies and Suggestions for Promoting the Development of STEAM Education

(1) Combining multiple forces to build a synergistic system

Whether it is STEM education or STEAM education with humanities and arts, it is an interdisciplinary and integrated education model that aims to expand students' learning horizons and guide them to understand the world from different perspectives. However, to promote the sustainable development of STEAM education, it is necessary to unite multiple educational forces and build a coordinated path of "society-school-teacher" to create a perfect STEAM education system. And the social forces mainly include the government and enterprises. The government shall support education policies and finance, and guide more social capital to enter the education business, while schools shall integrate various educational resources, form an overall plan, and actively introduce management talents who are qualified for STEAM education to lay the foundation for the development of STEAM education; teachers shall actively participate in STEAM education training activities to improve their humanities and arts literacy, as well as participate in curriculum design and discussion activities to create a good integrated learning environment for students and meet their developmental needs. The synergy of multiple parties can promote the development of STEAM education and enhance the learning efficiency of students^[4].

(2) Form a professional team to improve the quality of teachers

Teachers as the main body of teaching, their own ability and quality will directly affect the integration of art and STEM curriculum, so schools should set up professional STEAM teaching team, and constantly improve the overall teaching level. At the same time, teachers of all subjects need to learn about art and improve their humanities while improving their subject matter, so that they can integrate art teaching into their subject matter courses. In addition, schools can also establish STEAM integration teams, organize relevant education experts, teachers, student representatives, etc. as members of the organization, conduct regular seminar meetings, actively summarize the practical experience, listen to the suggestions of each group member, and constantly adjust the content of STEAM education, and eventually form a more complete STEAM education system^[5].

(3) Recording integration data and implementing process evaluation

Unlike the traditional education model, STEAM mainly advocates process and comprehensive evaluation, which requires teachers to pay attention to recording relevant data during the implementation of teaching and learning, using it as the basis for process evaluation, and showing students' shortcomings and potential in various aspects through evaluation and feedback, encouraging students to give full play to their strengths while also making up for their weaknesses. The teaching process data including students' mastery of content, academic achievement, social emotion, teacher effectiveness, classroom environment, classroom culture, etc. can be used as data support. Teachers can also analyze the above process data to fully understand students' mastery of knowledge, students' enjoyment of the course, students' social skills, students' humanistic thoughts and so on, so that teachers can make comprehensive evaluation of students' learning, make up for the shortcomings of the traditional evaluation system, and promote students' overall development^[6].

5. Conclusion

To sum up, the integration of art and STEM education can better promote students' all-round development, which also requires the education body to pay more attention to the improvement of STEAM education model, give full play to the government's policy and financial support power, provide resources for school curriculum reform and talent introduction, build a professional STEAM education team, improve teachers' humanities and arts literacy, and develop students' potential.

References

- [1] Morya Arvind K, Janti Siddharam S, Tejaswini Antarvedi. *Commentary: Screening the future generation: A path to better future. [J]. Indian journal of ophthalmology, 2022, 70(6).*
- [2] Liu Juanjuan. *Research on interdisciplinary integration of fine arts in primary schools under the educational environment of STEAM [J]. Teaching and educating people, 2021(32):55-56.*
- [3] Lin Xiaoling. *Analysis of interdisciplinary integration of primary school fine arts under the education environment of STEAM [J]. New Curriculum Research, 2020(35):71-72.*
- [4] Zhang Nayu, Zhao Huichen. *Methods and paths of art and STEM curriculum integration: promoting the realization of STEAM education [J]. China Education Informatization, 2020(14):1-6.*
- [5] Zhang Zhi, Yuan Lei. *American STEM education policy and its enlightenment [J]. Teaching and Management, 2022(30):101-104.*
- [6] Wu Zihua. *Understanding teachers' cross-disciplinary collaboration for STEAM education: Building a digital community of practice [J]. Thinking Skills and Creativity, 2022, 46.*