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The Localization of STEAM Education in China: Problems and Improvement

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Abstract: With the progress of the times, the development of China has put forward higher requirements and expectations for education. An educational conception consists of Science, Technology, Engineering, Art, Maths (STEAM) which is the key and worth taking seriously. Many countries have launched STEAM education for many years for the needs of technical developing technology. China also tried to localize STEAM education, opening some STEAM courses and producing scientific research results. Through summarizing relative literature and deducing theory, the localization of STEAM education in China creates some problems which can be divided into research, curriculum, teaching staff and others. To solve these issues, a new framework called Culture, Science, Technology, Engineering, Art, Maths (C-STEAM) which sets cultural heritage as a goal can make a contribution. Based on C-STEAM, research starts with its conception and implementation and analyze its impact. The research also put forward the problems and improvements for C-STEAM. Through modifying this method of education policy localization, the author hopes to discover more comprehensive improvement methods and provide suggestions for other foreign education policies. Establishing a collective system to create a friendly environment for STEAM education is the focus of the next reform. The conclusion also focuses on the implementation of other foreign policies, which need to be combined with China's national conditions, make good use of local resources, and do a good job of connecting with the core education goals.

Keywords: STEAM education, C-STEAM, localization of foreign education policy

1. Introduction

1.1. Origin and Development

An educational conception including Science, Technology, Engineering, Art, Maths (STEAM) is a significant education way in all over the world, which has been implemented for many years and has been proven to be effective in cultivating talents. Firstly, this scientific literacy was aroused by American educational scholars in 1950, then it quickly was taken seriously by the government. Because national development is highly relative to people's scientific literacy. With the change in technology and engineering, technological literacy also entered the public vision. Talking about the origin of STEM, an international conference: In 2007 Innovation America: Building a Science,

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Technology, Engineering and Math agenda can be evidence. Some scholars insist that only the people who possess STEM literacy can success in drastic competition [1]. Students who possess this kind of literacy should use these four disciplines flexibly and turn learning bits and pieces of knowledge and mechanical processes into different abilities to explore real-world interconnections.

So there is no doubt that the arising of STEM is highly relative to social needs. Countries from different parts of the world have the same goal: development and innovation, where STEM education can empower and play an important role.

Gradually, STEM education has more and more research and practise. Research shows that in recent years the number of STEAM literature shows a rapidly increasing trend. It proves that STEAM education research is becoming more and more important internationally [2].

With the process of exploration, some scholars put forward a new model that adds a new dimension: Art, compared to ordinary STEM. That's because Chinese society is not only pursuing science and technology to promote economic development but also emphasizing students' humanistic qualities [3]. Also, STEAM education can better improve student engagement, creativity and innovation.

An early research programme insists that students can learn about character-building skills that are transferable to other real-life contexts during STEAM education [4]. That means STEAM education can bring lots of benefits and help students adapt to the change of society. The high degree of global dissemination of the STEAM education concept is also evidence of its effectiveness.

1.2. China Development

Witnessing the impact of education, China also paid attention to it to adapt to social needs.

Actually, China normally carries out the model of STEAM, which has a tighter connection with Chinese talent training requirements: integrated development. The dimensions include morals, intelligence, physical fitness, work and aesthetics. What's more, China has a strong cultural foundation and has different national conditions from other countries. It will affect the development of STEAM in China.

According to the visual analysis, the amount of literature about STEM started to increase slowly and surged in 2016 [5]. Based on research results, the author finds that relative papers in 2014 focused on STEM and papers in 2016 focused on STEAM. It reflected on the change of education concept. Also, China's STEAM education started to involve core literacy, innovation and curriculum, which is not only limited to traditional STEAM research. However, China's STEM education still has a series of problems that result in national conditions and educational background.

1.3. Research Significance

The process of STEAM localization has a long way, and many scholars strive to put forward a more adaptable model to implement. Through summarizing the problems and educational model in China education, the author tries to discover a new measurement and explore a new direction, which finally improves education efficiency and cultivates talents well.

There are also other external education ways from other countries such as: Preschool Education in Finland, Individualized Education in America, Teacher training and so on. This kind of localization of foreign education policies will more or less cause the implementation effect to fall short of expectations due to various factors. So the author also hopes that this research can be an example to improve other education methods.

2. Problems

Through reviewing Chinese literature about STEAM education, the author divides problems into different dimensions, which can better tease out the reasons.

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2.1. STEAM Research

Compared to other countries, China scholars have paid attention to STEAM education field relatively late, as which quality and content of the literature show [5]. At an early stage, Chin scholars started to interpret and extend existing STEAM concepts from 2018 to 2012. Then the amount of relative literature has increased year by year since 2013. However, some research lacks a deep understanding of the concept which brings some flaws. For example, the object lack of research on higher education and vocational education. China still lacks authoritative and efficient STEAM educational assessment. China has not yet established a technical and educational environment. China has an original education system such as compulsory education, so it is unrealistic to follow directly from existing research.

What's more, more than half of the research about STEAM is non-empirical and remains at the theoretical level [6].

2.2. STEAM Curriculum

The curriculum design is the most important key in STEAM education. But a large amount of schools have deficiencies in curriculum resources. Basic resources such as textbooks and teaching materials are not unified, which is mostly explored by individual schools. These resources lack standards and models. Others such as multimedia teaching resources, online teaching platforms, practical resources, and teaching activity cases also need to improve.

In actual education practice, many teachers force series disciplines and neglect the nature of interdisciplinary teaching to complete educational tasks [7]. What's worse, in some real cases, some teachers even abandon traditional teaching methods, which leads to students' independent inquiry without exact guidance.

After classes, the assessment should be taken seriously. However, there is still no professional evaluation system. The ordinary tools, tests and examinations, which are usually used in the compulsory education curriculum system, are actually not suitable for STEAM literacy assessment. That's because STEAM education emphasizes real conditions and problem-solving skills. Students who have STEAM literacy have better performance in various aspects especially in the problem situation under the cross discipline. So scholars still need to explore a reasonable way to assess students' STEAM literacy efficiently and precisely.

2.3. STEAM Teaching Staff

China lacks high-quality STEAM education teacher teams and professional training mechanisms, which can be seen in pre-service education and post-service training [8].

On the one hand, China has normal universities and comprehensive universities to cultivate probationary teachers and provide aimed education majors such as Chinese, Maths, English. etc. However, there are no dedicated STEAM teachers teaching relevant courses. This means most normal students lack systematic learning about how to design the curriculum and implement the teaching. Actually, in many areas, some specific teachers, such as those responsible for the main subject in interdisciplinary teaching, will carry out the teaching on behalf of this responsibility. Once on board, teachers still need further STEA course training, which has yet popularized.

2.4. Others

There are some other factors that finally lead to these problems in the macro aspects. For example, China policies provide inadequate support for the micro aspects such as research, curriculum and teaching staff. In recent years, the Chinese Education Bureau has introduced a series of policies such

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as “A New Round of Basic Education Curriculum Reform” to emphasize the status of interdisciplinary education which is highly relevant to STEAM education. But other sections: higher education or post-service education have not yet benefited from such support. The policies provide a macro planning and clear orientation, which is significant to the developing process.

Compared to developed countries where STEAM education has an effective implementation, China also lacks a cooperative system that consists of many factors in society including government, schools, social institutions, and the public to promote the localization of STEAM education.

3. Measure: C-STEAM for Example

To solve the problem that China’s STEAM research lacks localization consideration, some scholars have taken some measures. The core of these methods is to combine China’s national conditions and educational needs.

3.1. The Conception of C-STEAM

Some scholars put forward a new STEAM education theoretical framework that inherits the Chinese excellent traditional culture as the core orientation and goal. Adding a new dimension called culture, it becomes C-STEAM. The author insists that C-STEAM not only adds the cultural theme to ordinary STEAM but also guides students to appreciate, understand and study traditional culture [9]. China has a long history and ample cultural resources, which can provide support to STEAM education. Also, C-STEAM clarifies the goal and direction of STEAM education: pursuing to foster and develop students’ humanistic spirit and strengthening their cultural identity and self-confidence in the process of the project. It is also a combination of Eastern and Western cultures (scientific spirit and humanistic spirit. This model has a tight connection with China’s existing policies and talent training ideas. The people who receive STEAM education should possess meaningful innovation and make a contribution to the nation.

3.2. Actual Case

The C-STEAM model has been applied for a period of time, generating many actual cases. Some scholars further put forward the exact steps to implement a curriculum. It consists of 6 steps: cultural context experience, cultural context understanding, cultural identity survey, creation of cultural artifact, social connection, and conclusive reflection [10]. These steps can guide the curriculum design and development.

Utilizing the way called Problem-Based Learning (PBL), teachers should release relative tasks to help students acquire the necessary knowledge, skills and emotional attitude step by step. For example, in the programme called “Cantonese opera”, firstly students will study the history of Cantonese and its cultural values. Through watching Cantonese opera students can get further understanding and build up cultural confidence. Then in order to complete the task about how to build up the Cantonese opera stage, students should be taught engineering and mathematics knowledge. Each step is linked with theoretical knowledge and practical activities. Other teachers or scholars can mimic this model to design greater courses and improve the quality of China’s STEAM education.

Nowadays the application of C-STEAM does promote the localization of STEAM education and quality education. Expansively, teachers now have more channels to access course resources and achieve a win-win situation of culture and technology cultivation at the same time.

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3.3. Improvement

C-STEAM has some areas worth improving in the implementation process. For example, some teachers often confuse courses that teach knowledge and skills with experiential courses, which is unfavorable to the achievement of training objectives. In other words, teachers should strictly accord with the curriculum standards to arrange the course content, set up the chain of questions and improve the teaching design.

The evaluation of teaching for students in C-STEAM courses is difficult too. The research on how to assess the change in students' cultural identity is the key point, that needs further exploration. It is feasible for scholars to get an idea from an external evaluation scale but the analysis should be combined with the specific situation.

4. Suggestion

The reasons behind STEAM education implementation are complex. The main reasons for the gap between expectation and reality are huge population pressure and deep-rooted traditional educational concepts. Some scholars contend that two factors will finally exacerbate the difficulties of education's ascent and hinder the development of STEAM education [11].

To solve the hard conditions, each factor in society should cooperate and build up a friendly environment for STEAM education.

First and most importantly, the China Education Bureau should improve the document that encourages STEAM to implement the integration of the original policy. In the curriculum standards, the importance of interdisciplinary education, the proportion of courses and the specific way to carry it out need to be further clarified. China's current mainstream training goals: core discipline literacy can be combined with the training goals of STEAM education.

Then establishing a STEAM training system that consists of professional institutions and teaching staff can provide better and more stable teacher resources. It is also necessary to keep track of the status of teachers after entry, and cultivate the interdisciplinary teaching ability of all teachers to maximize the utilization of teachers' resources. In addition, the policy support should also be reflected in the construction of STEAM teachers and the landing practice of courses. Providing more benefits to encourage more and more schools to implement STEAM education.

Curriculum design can continue to follow the teaching concept of C-STEAM. What's more, schools in each region should explore local cultural resources, grasp cultural advantages, and create unique STEAM themes.

After a series of C-STEAM course development and practice, the research focus can be transferred to classroom effect assessment, which can encourage more and more schools to join in the party and constantly improve the teaching level.

In a word, all the factors are dependent and their functions need to be connected. A large amount of teachers insist that the cooperation between teachers can help them implement STEAM education. What's more, they desire more support from local areas including education policies and teaching experience to design high-quality curricula [12].

In the macro aspect, politics provide support and guidance. Social institutions can take responsibility for cultivating STEAM teachers and establish a virtuous cycle. Researchers also need to be close to the first-line classrooms and promote the process of STEAM localization based on reality.

When it comes to the experience of localization of other foreign education policies, the author insists that all the policies should be adapted to local conditions. China has enormous and valuable cultural resources, which led to the proposal of C-STEAM. What's more, the original educational

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policies and objectives should take the main position, and the foreign policies should be auxiliary and integrated into the original framework system.

5. Conclusion

In the process of promoting the implementation of STEAM education, although there are a series of problems caused by differences in system, culture and development needs, there is no denying that STEAM can indeed help improve the quality of education in China and promote the training of innovative talents and economic development. Therefore, it is inevitable to continue to promote the localization of STEAM in China and actively coordinate all parties to jointly solve the above problems.

C-STEAM is an excellent model that can be used for reference, and it is necessary to accelerate the popularization of C-STEAM and accelerate the integration with the original education system, while improving the gaps and omissions.

In the future, there will be other foreign education policies to learn from. Because their wide international application has proven their benefits and effectiveness. However, China's education cannot be simply pieced together, it should be combined with China's national conditions, use existing resources, and promote all-round integration, in order to achieve the role of complementary advantages.

The localization of STEAM education can also start from the establishment of the STEAM literacy assessment system and official teacher teams, both of which are conducive to the formation of a virtuous training cycle, so that generations of students can receive good STEAM education.

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