

The Impact of STEAM Education on Basic Education

-- A Perspective of Disruptive Innovation

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Abstract

Steam education has been introduced by many primary and secondary schools and educational institutions in China. This combination of new teaching model and technology has caused a certain impact on the traditional education market and model. Steam education realizes the innovation of teaching through the characteristics of subject integration, inheritance and innovation, and opens up the market of STEAM education. There are some characteristics of destructive innovation. Based on the destructiveness and innovation of STEAM education, this paper proposes the inspiration of STEAM education and development path formulation in basic education, which has both theoretical and practical significance for promoting the reform of China's basic teaching model and the sustainable development of education, as well as optimizing the education and teaching structure.

Keywords

STEAM Education; Disruptive Innovation; Basic Education; Instructional Innovation; Business Models.

1. Introduction

STEAM education uses a multifaceted, interdisciplinary approach to enable students to adapt to a rapidly evolving, ever-changing society. With the development of science and technology and the continuous injection of new elements, STEM education has developed from the initial to STEAM, adding art to science, technology, engineering and mathematics, which is conducive to broaden students' perspectives and increase the humanistic and artistic atmosphere. The ability to read/write, or STREAM, is added to this. The "13th Five-Year Plan for Educational Informatization" issued by the Ministry of Education clearly points out that in order to improve students' information literacy, innovation consciousness and innovation ability, educational institutions should actively explore the application of information technology in new educational modes such as mass maker space, interdisciplinary learning (STEAM education) and maker education. At present, primary and secondary schools have joined the education craze of STEAM one after another, and many kindergartens have also "introduced" STEAM education. Even though many do not know much about STEAM, they still think that brand introduction is a trend. Through the equipment (technology), elements and materials (science) provided in STEAM course, the powerful business operation model and high-end service can be reflected. However, the quality of the process and educational output is still to be discussed.

The way STEAM education is run must depend on funding, and among paid institutions STEAM education depends on venture capital, and whether the return on investment is ideal determines the position of STEAM education in these institutions. STEAM in the future the development direction of education is not sure, but STEAM education in primary and middle school development has opened a door to education reform, and encourage people to re-examine the development of the traditional teaching mode and STEAM education role in the development of primary and secondary school education, influence and ecological development,

including: STEAM education in primary and secondary school education in a what kind of position? Does STEAM Education revolutionize the traditional teaching landscape, reform the teaching activities, threaten the existing teaching model, or replace the traditional teaching model? What is its commercialization and marketization mechanism? How can we reform to respond to new changes in this field? For these problems, we can think from another Angle and seek a breakthrough from theories outside the field of education. The theory of disruptive innovation provides a good entry point for the research on STEAM education development. Destructive innovation research mainly focuses on the demand satisfaction and influence of the target market, and then discusses the process of a product, service or material carrier with a certain function slowly climbing from the existing business or mode and threatening or replacing the existing mode. Steam education also has this similar feature. The United States has made STEAM education a priority because it is not only a matter of national security but also a way to address some of the economic problems facing the country. In the era of China's rapid development, STEAM education develops with the situation of discipline integration and comprehensive innovation, forming a new form of teaching and learning, which has a great impact on the traditional teaching model and the primary and secondary school education market. Steam education is in the midst of a slow climb. What impact will it have on existing education? Using the theory of destructive innovation to analyze the phenomenon of STEAM education is helpful for us to understand the STEAM education in China and its influence on the teaching of primary and secondary schools.

2. Theory of Destructive Innovation

Christensen (1997) studied the rise and fall process of many industries such as disk drives, mechanical excavators and iron and steel smelting, successfully integrated technological innovation with market innovation, and put forward the theory of destructive innovation. Govindarajan and Kopalle [3] believe that disruptive innovation is a continuous variable with four characteristics: (1) it is at a disadvantage in terms of traditional attribute performance; (2) Provide new value propositions to attract new users or price-sensitive mainstream users; (3) the products offered are sold at lower prices; (4) Penetrate from niche markets to mainstream markets.

3. Destructiveness and Innovation of STEAM Education in Primary

(1) Innovation of practice mode and teaching process of STEAM education

Steam education is primarily project-based learning, problem learning, which guides students through collaboration and time to complete thematic projects and solve life's difficulties. "As a teaching mode that transcends traditional teaching methods, STEAM education can narrow the gap between students' existing knowledge and skills and enhance students' competitiveness in employment" [5]. From the perspective of international development, the main educational research and practice is still in the United States, and China's research on STEAM education is still in its primary stage. The international STEAM education practice is characterized by five characteristics: competency-based, integration-oriented, project leading, inheritance and innovation, and multi-party joint efforts (Figure 1) [6]. In terms of national education concept, it should be based on ability, in terms of implementation strategy and method, it should be integrated, in terms of implementation operation, it should be guided by project, and in classroom teaching, it should reflect inheritance and innovation. The development of STEAM education depends on the joint efforts of various parties.

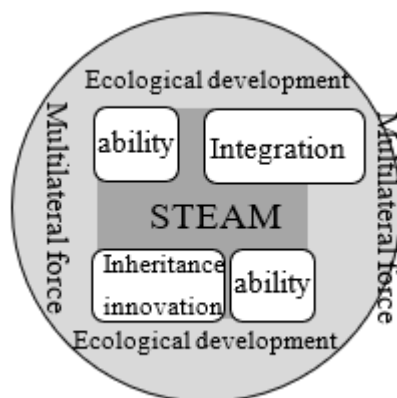


Fig.1 Characteristic model of international STEAM educational practice

(2) Target users and consumption areas of STEAM education

Steam Education has attracted a number of schools and institutions with different goals and expectations. The number of institutions implementing STEAM education programs is increasing. In order to meet the needs of society and parents, STEAM courses have been expanded in the United States, and the number of courses has increased by 25% in some cases [5]. In addition, enterprises and research institutions have launched STEAM education programs, further expanding the target audience of STEAM education. Today STEAM education can be found in schools, kindergartens, after-school tutoring agencies, libraries, science and technology museums, enterprises, colleges, communities and even families. To focus on the cultivation of children's STEAM knowledge and skills, and to provide the society with creative and innovative talents, we have a reason to promote STEAM education. Its potential target users can be divided into managers, educators, students and business organizations (Table 1).

Table 1. Steam Education Target Users and Expectations

The user types	The purpose and expectations of Steam education for different types of users
managers (Education Administration)	Optimize the teaching equipment, improve the teaching quality, improve the teaching experience, and strengthen the construction of staff and teaching staff.
educators (Schools,counseling agencies)	To provide students and educators with better learning experience, increase their own teaching skills, better training of comprehensive quality talents.
students (Primary,Middle and Kindergarten)	Through STEAM education to assist understanding of subject teaching, improve their innovation ability and creativity.
Business organizations (for-profit educational institutions)	Commercial institutions are connected with STEAM education to keep up with the trend of education times, improve the competitiveness of market education and improve their own value.

(3) The particularity and complexity of disruptive innovation in STEAM education in primary and secondary schools

Since the emergence of STEAM education in China, after-school tutoring agencies, kindergartens and other for-profit commercial organizations have vigorously promoted STEAM education and cooperated with major educational institutions to open up the STEAM market. Non-profit organizations, public schools and educational programs have also introduced STEAM education to improve teaching quality and enhance students' creativity and initiative, but at the same time, it has caused a great impact on the traditional teaching model and knowledge chain.

From the perspective of market influence, STEAM education provides a comprehensive learning method, providing multi-level education services for primary and secondary education, and improving students' learning quality and quality level by combining science, technology, engineering, mathematics and art with cheap teaching resources and equipment. Based on this, we have reasons to think that STEAM education has an impact on primary and secondary education, and agree that STEAM education is innovative and destructive to primary and secondary education. From the perspective of teaching effect, STEAM education focuses on students' ability to solve problems, trains students to reflect and question more, enhances students' cognition of problems or project system, and comprehensively grasps the methods to solve problems or projects. However, STEAM education is different from sub-subject education, which is more targeted for more esoteric and professional knowledge. So Steam Education hasn't fully implemented a deep learning experience yet. From the perspective of the whole education ecosystem, the development of education cannot be separated from the guidance of national policy and social development. The Decision of the State Council on the Development of Basic Education issued by the State Council in 2001 clearly points out that "comprehensive curriculum should be strengthened in primary schools, subject based curriculum should be combined with comprehensive curriculum in junior high schools and subject based curriculum in senior high schools". It is in this educational environment that STEAM education creates new opportunities for comprehensive teaching in primary and secondary schools. Many research results also show that the comprehensive education model of STEAM education in primary and secondary schools has significant effects. It can be seen that there is a mutually beneficial relationship between STEAM education and primary and secondary education. Under appropriate conditions, STEAM education promotes the quality of teaching and, to a certain extent, brings opportunities for sustainable innovation of the primary and secondary education ecosystem.

4. Development Path of STEAM Education

STEAM education carried out in the United States has more than 30 years, in fact in socialism education policy for STEAM education created good conditions, the development of the our country has its own unique history and culture, while the United States by the STEAM education inspiration and influence, but not blindly imitate the experience and development model, according to China's national conditions, suitable for their own development road.

(1) Vigorously develop STEAM education and cultivate new educational users

Compulsory education in primary and secondary schools has been free, and primary and secondary school students are the "non-consumer group" for STEAM education, thus the "consumer group" is shifted to parents and educational institutions, which provides an opportunity to explore new users. In a sense, the potential users of STEAM education are eager to obtain a better level of comprehensive education to meet the needs of comprehensive quality, ability and multi-faceted comprehensive development of learners. To this end, primary and secondary educational institutions should be encouraged to introduce STEAM education, to use

STEAM technology to enhance students' creativity and innovation ability, so that students can use artistic means to improve the real world instead of teaching art to students. Second, develop rural STEAM education to tap potential education users. Finally, commercial educational institutions are an indispensable part of the development of STEAM education. Counseling institutions and kindergartens play an important role in the target users of STEAM education, providing opportunities to cultivate new educational users to a certain extent.

(2) Co-construction and sharing of high-quality STEAM educational resources

The sharing of high-quality STEAM educational resources can not only promote the development of STEAM education, but also promote the development and construction of the national digital education resource platform, which can help adapt to the needs of different learning groups, expand the scope of users of STEAM education, create a new value system, and provide teaching support services. Thus, STEAM education has initially formed its own unique competitive advantage. STEAM education at the core of the users are students, STEAM quality resources are more concentrated in school education, these do not have the marketability and commercial of the education industry, therefore, to education institutions (including for-profit education institutions and public sex education institution) mutual cooperation, constructing the public service platform of Internet teaching, gathered STEAM quality education resources, with cheap high-quality resources to serve the education institutions and learners, promote STEAM education's sustainable development.

(3) Build an excellent team of teachers to ensure the teaching quality of STEAM

As the core of education workers, teachers should actively participate in training and constantly improve themselves. STEAM education cultivates students' literacy in the way of discipline integration, requiring teachers not only to have the professional skills of STEAM education, but also to be able to analyze the interconnection of various disciplines and their application in real life. Therefore, STEAM teachers also need to have the knowledge and skills to integrate teaching.

5. Conclusion

With the characteristics of subject integration, inheritance and innovation, steam education realizes the innovation of teaching, opens up the market of steam education, changes the traditional teaching forms, reforms the current teaching activities, shortens the gap between students' subject knowledge and future vocational skills, meets the new development of educational institutions and the new needs of students in the basic education market, and promotes the innovation of basic education. The discussion and Reflection on the reform have promoted the exploration of new teaching mode, learning mode and business operation mode in basic education. By analyzing steam education from the perspective of disruptive innovation theory, we can see that steam education has some characteristics of disruptive innovation, as well as the complexity and particularity of disruptive innovation in the ecosystem of basic education. Since the new curriculum reform, teaching has changed from "Teacher centered" to "student-centered". Steam education, on the premise of "student-centered", provides new opportunities for basic education to explore new operation mode and reform direction, makes education closer to real life, benefits more educational institutions and learners, and brings new experience to the education market Economic benefits. Disruptive innovation theory provides a useful perspective for the development of basic education organizations and business education institutions. It should be noted that the original framework of disruptive innovation theory can not fully explain education. In the development process of steam education, we should carefully analyze its profit model and advantages and disadvantages in the education system, and carry out localized steam education in combination with the actual situation, because it is only a part of the education system, and also a part of the education reform and development.

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