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Article

The Status Quo and Ways of STEAM Education Promoting China's Future Social Sustainable Development

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Abstract: In the process of sustainable development in the future, human society faces problems such as severe population load, economic transition, and lack of educational measures. One of the root causes of these problems is the shortage of innovative talents. Therefore, how to cultivate learners with multi-disciplinary integration and innovation ability is the key point that should be paid attention to in promoting the concept of quality education and coping with the future sustainable development process. This paper uses questionnaire survey method and literature analysis method to analyze the development of many educational institutions with STEAM concept as the core in China since 2017. It is found that the existing STEAM educational institutions generally have the following problems: the lack of team composition、difficulty in independent research and development、single course content and insufficient validation of course effectiveness. In order to more effectively promote the sustainable development of China's future course, STEAM education institutions should focus on strengthening the following development strategy: gradient team building, continuous independent research and development, cutting-edge projects curriculum transformation mechanism and multi-angle course effectiveness verification.

Keywords: Integrating innovative talents; STEAM; multi-dimensional status analysis; cultivating competitiveness

1. Introduction

At present, China's future sustainable development process faces three key issues: the lack of high-level talents、the pressure of economic transformation and the difficulty of education reform. China's sustainable development urgently requires high-level applied talents and innovative talents with knowledge and skills, but China's current talent training situation is out of line with this goal [1]. With the advent of the new era, in order to solve the above problems fundamentally, a new model of talent cultivation that adapts to China's development is needed urgently. However, the contradiction between the university's integrated talent training model and the industry's demand for innovative talents has become increasingly prominent [2]. Therefore, in the spirit of advancing with the times, China needs to further develop and advance, promote teaching, and continuously deepen the reform and innovation of education [3]. At this time, the emergence of STEAM education is like a charity in the snow, providing new strategies and tools for China, and has gradually formed a trend in recent years with its unique curriculum concept, multidisciplinary integration teaching system and teaching methods.

The predecessor of STEAM Education is STEM education originated in the United States. STEM education is a national development strategy proposed by the United States to cope with future social challenges. STEM is an abbreviation for Science, Technology, Engineering, and Mathematics, focusing on the integration of science and technology [4]. In the process of development, art is integrated into science, technology, engineering and mathematics curriculum, expanding students' thinking ability, activating students' innovative consciousness and imagination, and cultivating

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more future innovative talents, thus forming STEAM education [5]. STEAM education was first proposed by the University of Virginia Tech scholar Yakman in the study of comprehensive education, in order to strengthen the US K12 education on science, technology, engineering, art and mathematics, specifically for the establishment of hands-on creative courses [6]. STEAM education is an initiative of the US government and is known as the "quality education" of the United States [7]. At present, STEAM education has become the leading and research hotspot of science education policy in many countries, and has been gradually applied in the science and technology education curriculum at the basic education stage [8].

Innovative talent is the key to the core competitiveness of the country in the current era. Although the United States ranks first in terms of comprehensive innovation capability, it is still in danger and puts forward a STEM education strategy that is committed to improving citizens' innovative practice. China has ushered in a rapid economic development since the reform and opening up but there has been a huge gap in innovative talents with the developed countries. China needs to learn from STEM education to improve the quality of citizens. With the help of STEM education integrated into Chinese culture, it helps China's innovative talent training reform and Transforming the plight of the lack of innovative Chinese talents [9]. In recent years, China has also introduced STEM education to train the innovative talents needed for future social development to promote sustainable development. At the same time, the combination of Chinese traditional culture and STEM education will promote the reform of China's innovative talent training model and help improve the lack of innovative talents. In 2007, China's first article on STEAM education "STEM Strategy for American Education in the Age of Globalization" opened the prelude of the study of STEAM education in China. The article analyzes the reasons for the implementation of the STEM strategy in the United States from the relevant bills and policies of STEM. In 2013, China published the first translation of STEAM education. At the same time, the concept of maker education has also ushered in the golden period of promotion. From the perspective of interdisciplinary innovation, there are many commonalities between Maker Education and STEAM Education, which can complement each other [10]. Maker Education provides a new and effective way to develop STEAM education, and STEAM Education provides the knowledge and ability foundation for the development of talents [11]. The integration of STEAM education and Maker Education will promote student innovation in an all-round way. The ability to develop high-level thinking skills, develop advanced skills, and establish connections with real life to make up for the lack of single subject education [12]. While analyzing the difference between the two, the researchers also explain the necessity of developing STEAM concept in China. Through the investigation of existing institutions, it is found that STEAM education has encountered many problems in China due to restrictions on team, curriculum and course effectiveness verification. Although some important projects and institutions have emerged in China, they have fallen into a certain predicament more or less in the process of promoting STEAM education [13]. So, what is the current status of the development of STEAM educational institutions in China? What kind of development trend will there be in the future? What is the way to solve the dilemma of existing problems? These issues deserve deep thinking.

In the process of future development, China is mainly trapped in the three directions of population, economy and education. The first is the population load. Through the state's policy guidance at the population level, one of the key measures to improve the population load is to improve the quality of the working population, especially the creative practical ability and information technology literacy [14]. Through the improvement of the quality of the population, the reduction of the population load on the transformation of the educational model is alleviated. The second is economic transformation. China is mainly faced with the problems of economic structure decline, lack of innovation economy and difficulties in implementing ecological economy [15]. These complex problems are extremely complex and require a multidisciplinary knowledge system to be integrated, but China is in short supply of compound talent reserves. The third is the lack of education. As mentioned above, although China has a large population base, China is facing the test of serious shortage of innovative talents. Because it is impossible to promote students' in-depth

learning, it is difficult to cultivate top-notch innovative talents who can take responsibility for facing future difficulties and challenges and be brave enough to act [16].

Based on the above analysis, it can be seen that the core pain points of the three major problems of population, economy and education exposed in the current social development process in China are the lack of innovation ability, the lack of innovative talents, and the low level of scientific and technological literacy of a large number of industrial workers. Therefore, the introduction of an interdisciplinary innovation ability training model based on multidisciplinary integration is particularly important [17]. Through the improvement of population quality, we can reduce population burden and promote the transformation of educational mode. Therefore, this study hopes to analyze the above three major problems, and combine the current situation of STEAM education in China and the problems faced by STEAM education institutions at present to propose strategies and ways to promote the development of STEAM education institutions in China.

2. Materials and Methods

STEM (Science, Technology, Engineering and Mathematics) education, which has aroused widespread concern around the world, originated from the "integrated" national development strategy proposed by the National Science Council in 1986 to address the challenges of future social development [18]. Through literature search, we can find that the first STEM education translation" the STEM Project Student Research Handbook" published in 2013. Since then, Zhao Zhongjian's team has translated and published many related works such as "Integration of Engineering and Science in the Classroom", "Design, Production, and Games: Cultivating the Next Generation of STEM Innovators", "Project-Based STEM Learning: A Way to Integrate Science, Technology, Engineering, and Mathematics" in 2015 [19]. He is also responsible for the selection of the "STEM Education Policy Progress in the United States."

With the continuous development of education, STEM education gradually joined the humanities, art, society and other elements to evolve into STEAM education. STEAM education takes project learning as the main learning method. This is a new educational model based on STEM education. It is a fusion of technology and engineering education and artistic humanities education, aiming to promote technology-driven teaching innovation [20]. In recent years, China has introduced the STEAM concept to cultivate and integrate innovative talents, and has gradually become a fashion. The survey data shows that STEAM education has a more efficient performance in terms of creativity and participation in literacy. The integration of "Act" and STEM has further promoted the cultivation of learners' ability [21]. STEAM teaching focuses on the cultivation of students' practical skills while integrating knowledge of multidisciplinary courses. Different from previous courses designed by teachers, it is a learner-centered, comprehensive approach to design and problem solving, emphasizing scientific inquiry, engineering design and problem-based open learning, which can promote students' enthusiasm for learning. To further understand the characteristics of the STEAM concept and its advantages in promoting the future of China，this paper summarizes the STEAM literacy and curriculum types, the relationship between various disciplines and the specific teaching implementation process by summarizing the research results in the field of STEAM at the present stage.（Figure 1）

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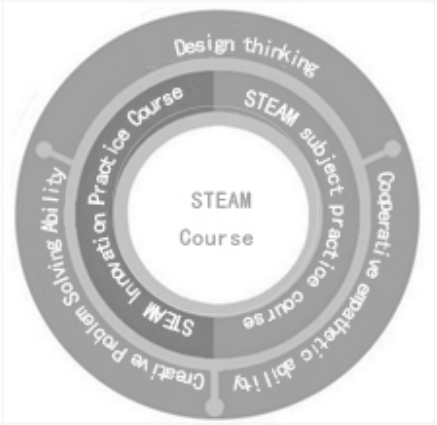

Figure 1. STEAM literacy and course type

The goal of curriculum reform in the basic education stage of China is to promote the comprehensive and individual development of students through the construction of the curriculum system and the curriculum platform. At this stage, most schools are based on basic courses, extended courses and research courses [22] and the school curriculum is combined with national fixed courses and local courses to form their own independent curriculum system [23]. At present, the curriculum reform of the school is to integrate innovative literacy training on the basis of retaining the original curriculum knowledge system to meet the needs of sustainable development talents. From this perspective, this paper summarizes two forms of the STEAM curriculum when entering the school curriculum system: STEAM Innovation Practice Course and STEAM Subject Practice Course.

1) By drawing on Zhou Haiwei's research findings in the practice and exploration of general education research, the STEAM Innovation Practice Course can be described as an independent course, belonging to research, innovation or specialty courses [24]. Different from emphasizing the independent status of physics, chemistry, mathematics, engineering, et al., it completely breaks the boundaries between disciplines, and uses the STEAM concept [25] to integrate the content of each subject around different themes into a new unified learning. In the field, an independent course learning unit is formed. In the learning of the course, the engineering design project is the core of its learning, and the creative products designed by the students are used as the basis for evaluation.

2) The STEAM subject practice course is based on the national curriculum and belongs to the subject expansion course [26]. The difference from the STEAM Innovative Practice Course is that its subjects are courses in physics, chemistry, mathematics, biology, etc. Basing on a subject, which is linked to other subject content, methods, tools, etc. through unit themes to achieve the purpose of student STEAM study [27].

This paper believes that STEAM education is proposed to solve the problems and challenges presented by the real world, so the following relationships should exist between the various disciplines.(Figure 2)

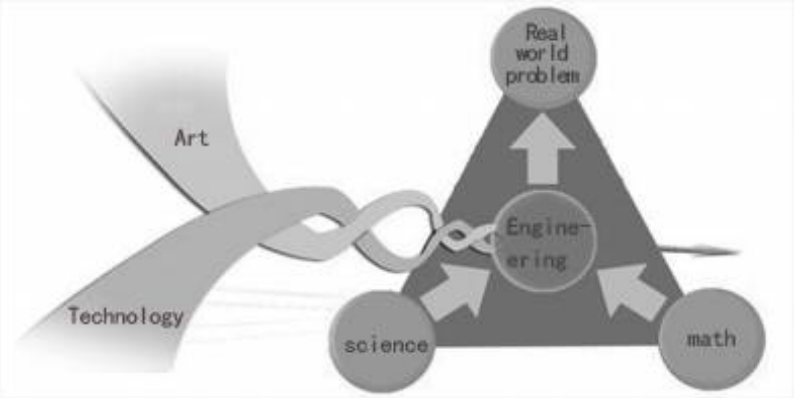

Figure 2. STEAM education various disciplines

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Engineering should be the core of disciplines, Science and mathematics are the two cornerstones and art and technology are accompanied by the whole system, realizing art as a driving force for creativity, design and other technical solutions finally.

Because the STEAM course does not advocate a highly structured instructional classroom designed by the instructor, it is a learner-centered, integrated design and problem-solving curriculum. Therefore, after fully combing the literature and analyzing typical cases, this paper proposes the following specific teaching implementation process . (Figure 3)

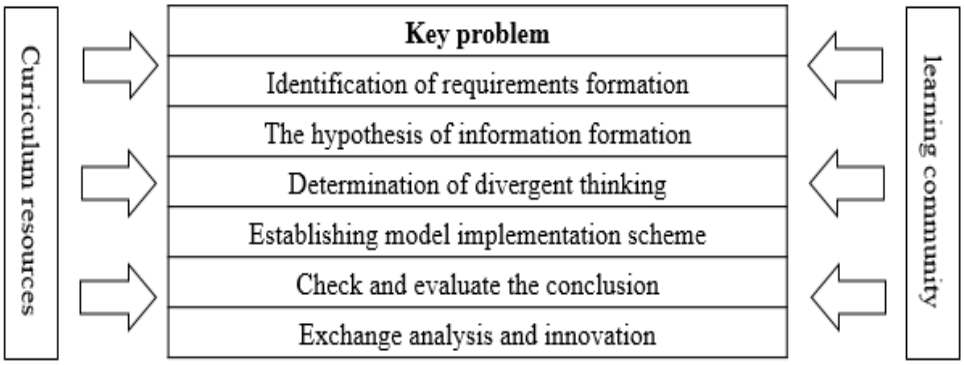

Figure 3. Teaching implementation process

This implementation process is a comprehensive process in the process of teaching implementation, and does not involve the detailed issues of multiple disciplines in the course case. When arranging teaching, the teacher should systematically think about what to do (the purpose of the activity), what to do (equipment, elements and materials, etc.) and what effect (what the student has discovered and what he has gained). After fully combing the literature and analyzing typical cases, this paper proposes the following specific teaching implementation process.

Combining the types of courses, the relationship between disciplines and the analysis of the specific teaching implementation process, the STEAM concept fusion innovation curriculum model formed by taking the dinosaur course as an example is shown below.（Figure 4）

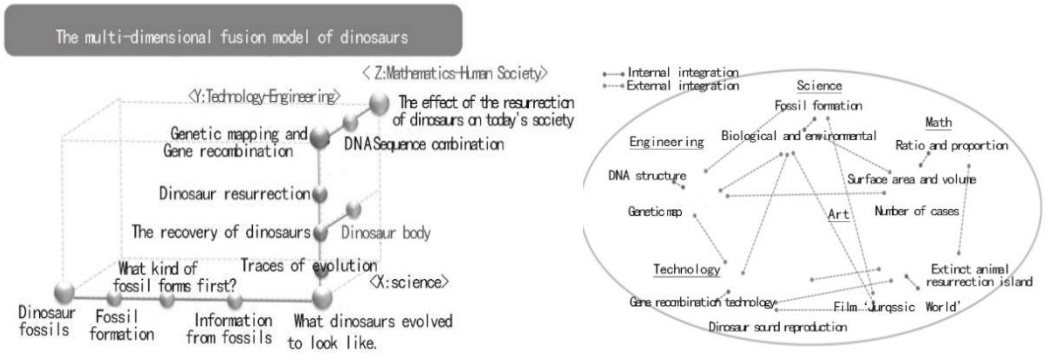

Figure 4. Actual course design display

Through curriculum design examples and practical teaching, students are given the opportunity to apply scientific inquiry, engineering design and problem-based, project-based learning methods to actively participate in real-world work practices. It proves that this is the main task of cultivating students' problem-solving ability and innovative ability rather than unilaterally imparting knowledge, and is in line with the training requirements for innovative talents in China's sustainable development process. At the same time, combined with China's national conditions, we can see the important role of cultural quality training in the entire education and training process [28]. Not only that, with the development of the society, the use of artificial intelligence technology

in the field of education has become more and more extensive. Whether it is big data analysis prediction or image recognition and capture learning state, it reflects the technological innovation to achieve learner-centered education. The huge push generated by the goal. Therefore, on the basis of the STEAM concept, more attention should be paid to the impact of art and technology to better cultivate future talents that meet the needs of China's talent strategy.

3. Results

3.1. The practical role of the STEAM concept in the future process

Along with the baptism of the second machine age revolution, people's daily behaviors are strongly challenged by information explosion and fissile brain growth. In order to prepare for the rainy day, we must actively seek to cope with the strategy of revitalizing the country and the nation. Since the introduction of STEM education in China in 2007, after more than ten years of research and practice, its connotation has been continuously enriched and interpreted, and it has gradually evolved into STEM+ and STEAM education which suitable for China's national conditions. Although some achievements have been made and a certain foundation has been laid, it is even more difficult to relax. It is necessary to clearly understand the shortcomings in the current STEAM education in China and to clarify the future development direction of STEAM education.

Under the influence of the new world, new literacy, and new education trends, the concept of integrated innovation education plays an important role in the future talent training. As we all know, the new world has brought about a new industrial revolution that can dramatically change the curve of human history. While providing new impetus and means for the advancement of the human civilization process, it also brings social development into a stage driven by technological innovation. The origin of the fourth industrial revolution was the “Industry 4.0 Strategy” first introduced by Germany in 2013 [29]. In 2015, China also issued the first 10-year action plan “Made in China 2025” to implement the strategy of manufacturing a strong country [30]. When the founder of the World Economic Forum, Klaus Schwab, spoke about the industrial revolution [31], unlike the revolution in the steam, electrification and information ages, the fourth revolution was the number and the rationality. The interactive integration of various fields such as chemistry and health will not cause multiple challenges such as energy, ecological environment and climate change. This revolution not only has intelligent interconnected machines, but also has created breakthroughs and innovations in many fields such as gene sequencing, nanotechnology, renewable energy, and quantum computing [32], which has made the entire social system enter a high-speed development. At the stage, the relationship between technology and human symbiosis has been unprecedentedly reflected. It can be said that the fourth industrial revolution not only brought about tremendous changes in human life, but also triggered a change in the way human beings live and the structure of the social industry, so that the demand for talents in the future will also change.

China is also actively responding to the future process, and in 2015 introduced the first 10-year action plan “Made in China 2025” on the implementation of the strategy of manufacturing a strong country. At the same time, it can be seen from the statistics of the growth rate of China Mobile Internet users that with the rapid development of artificial intelligence technology, the way of human survival has begun to move from network to intelligence.（Figure 5）

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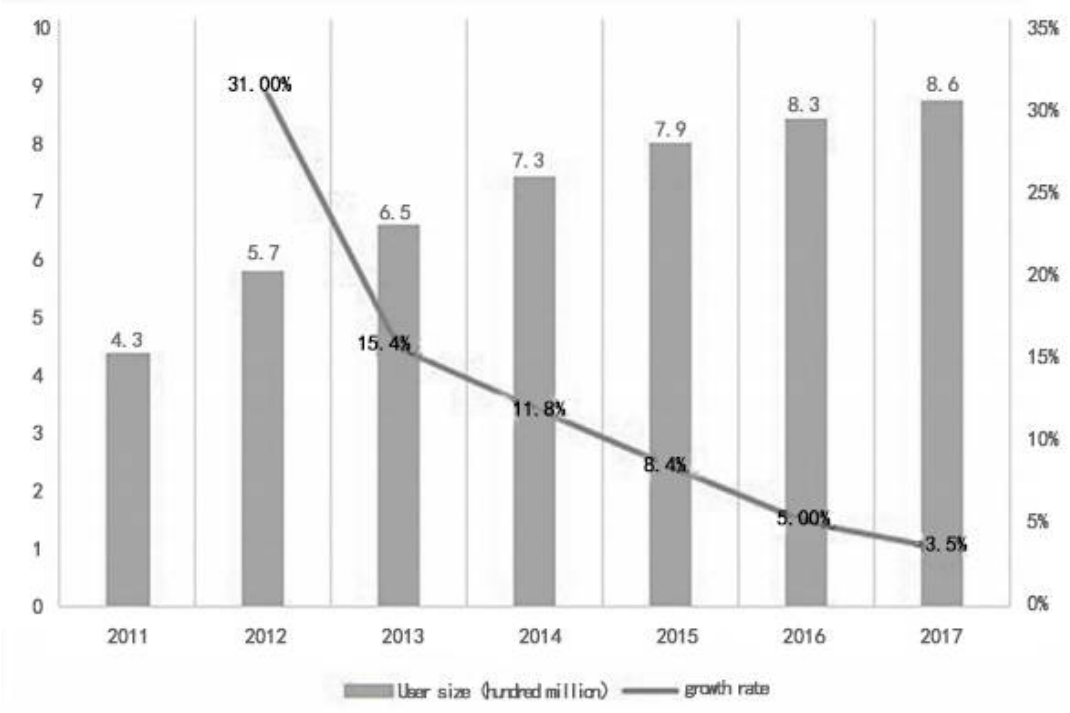

Figure 5. Internet user size and growth rate statistics
Data source: https://wenku.baidu.com/view/4867e8f9cfc789eb162dc83e.html，（Analysis think tank）

At the same time, the deeper digital technology and the higher degree of integration brought about by the development of the New World have also triggered the transformation of the social industry structure. Through Klaus Schwab's research on adapting to the talents of the future society and interviewing the chief HR officers of some large companies on the demand of the 2020 job market, it can be seen that by 2020, compared with only having physical strength and Individually skilled person ,people with complex problem-solving skills, excellent social skills, and integrated system skills will have more room and opportunity for development. （Figure 6）

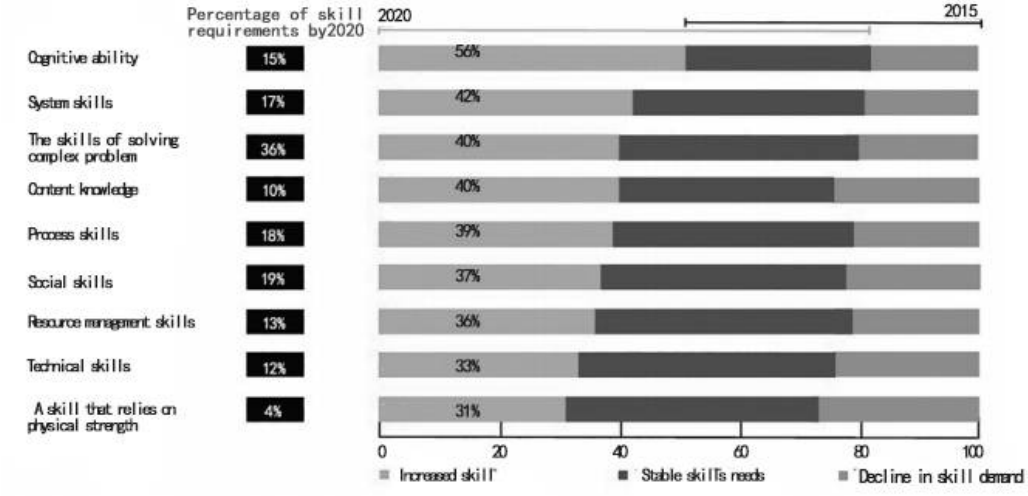

Figure 6. Statistic Analysis of 2020 Skills Needs
Data Source: The Future of Jobs-Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution, 2016

What's more, it can be seen from the statistics on the job growth rate related to STEAM in professional recruitment that the market has a large demand for STEAM talents.（Figure 7）

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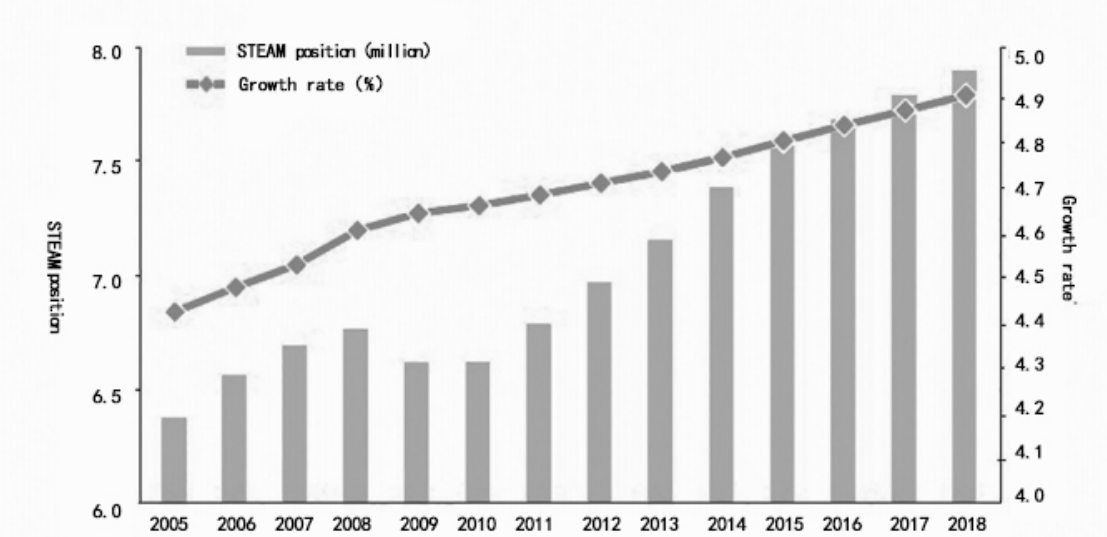

Figure 7. Growth rate of STEAM related positions

Through statistical analysis based on market data, it can be clearly seen that in the face of the rapid advancement of the sustainable development process in the future, China urgently needs a large number of composite talents with knowledge in science, engineering, art, mathematics and other multidisciplinary fields to join the national construction [33]. Nowadays, the demand for single-skilled talents such as skilled workers in the first industrial revolution and electrical automation in the second industrial revolution has gradually decreased. The future sustainable development process brings revolutionary breakthroughs and innovations in various technologies based on information technology. This shows that to a certain extent, human thinking and problem solving methods will change greatly. In order to comply with the trend of the future sustainable development process, the society needs more integrated innovative talents to apply valuable scientific and technological innovations to promote the development of emerging technologies such as artificial intelligence and virtual reality to promote the improvement of interdisciplinary results such as artificial organs and gene sequencing [34]. Based on the demand of social development for innovative talents, it is imminent to change the training mode and export of talents at this stage, and this is the core value of the STEAM concept.

The core element of science and technology as a production tool has also changed the way people live and the social structure of society while promoting the arrival of the four industrial revolutions. Therefore, the demand for talent type in the future social sustainable development process has also changed with these changes. This kind of change directly puts higher demands on the talent training strategies of various countries. The education of each country has begun to pay more attention to cultivating innovative talents with national responsibility, innovative thinking and scientific and humanistic qualities [35]. According to the OECD 21st Century Student Core Literacy Training System and the analysis of the EU's lifelong learning eight literacy(use native language communication、use foreign language communication、mathematics literacy、basic scientific and technical literacy、digital literacy、learning ability、social and citizen literacy、self-awareness and entrepreneurial spirit、cultural cognition and expression), this coincides with the STEAM concept [36].

Throughout the core literacy content developed by international organizations and different countries, when predicting the key competencies and essential characters that students should have when facing the challenges of the future, they basically pay attention to social responsibility, cooperation and exchange, and creative solutions to problems. China emphases on the scientific spirit and humanistic heritage in the cultural fundamental field. These are the foundation for the comprehensive development of people and the core goal of STEAM education. Education is a future-oriented business, so when new challenges strike, as the main battlefield for talent training, more changes need to be made as the future talent needs change. American educator John Dewey

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once said: "If we still use the education of yesterday to train today's children, then we are depriving them of tomorrow."

3.2. Multi-dimensional analysis of the status quo of STEAM educational institutions

This paper uses questionnaire survey and data statistics to analyze the core issues faced by STEAM education in China. Through cooperating with Intelligence Times Big Data Analysis Company to analyze the sources of training content used by more than 1000+ STEAM educational institutions, finding that only 22.88% of institutions are able to conduct research and development of teaching materials completely independently, and 60% of the institutions are external procurement and with the combination of independent research and development, most institutions do not have the ability to independently develop courses. The data includes “the 2016-2017 China Education Industry Blue Book”. (Figure 8)

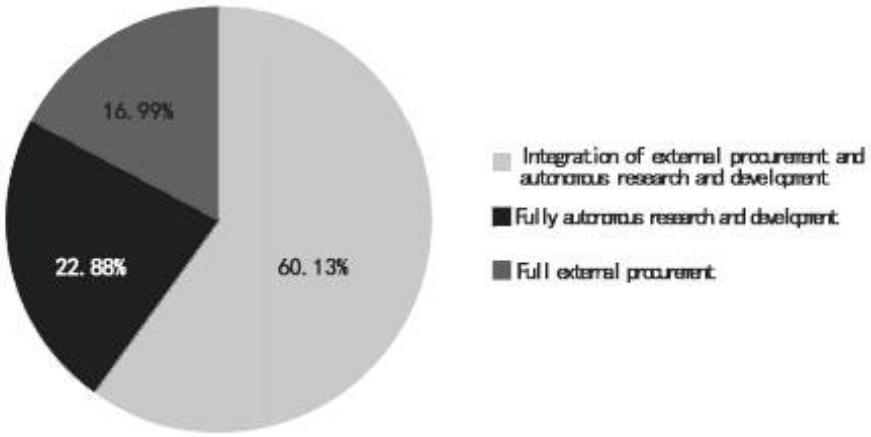

Figure 8. Source of teaching materials used by institutions

Although the country has actively promoted the reform of exam-oriented education in recent years and strived to create a good policy environment for the development of STEAM education, the implementation speed of STEAM education in China is still slow. This paper concludes that there are several main reasons: the reform of China's education system is slow, the market's understanding of STEAM innovative education concept is different, the types of related products are difficult to distinguish, and the content of systematic courses is scarce. Among them, the lack of support for the innovative education content system and the lack of teachers and staff with innovative educational skills have made it difficult for institutions and schools to integrate STEAM innovation education into the original subject content system.

At the user level, a large number of people born in 80 and 90 years have entered the parent community，the characteristics of the user group have changed. Most parents with higher education have a new perspective on the child's growth. It can be seen from the "2017 China Family Quality Education Consumption Report" that more than 60% of families are willing to invest more than 10,000 yuan in children's quality education every year. And the ever-increasing consumer demand has made innovation education more popular. According to statistics, the growth rate of China's quality education market in 2017 is as high as 30%. At the same time, with the upgrading of family education consumption, 80% of parents are willing to support children's extracurricular learning, and their investment in quality education and interest education has increased significantly.

By counting the 2017 consumer search keywords, the “Creator” search heat map in the country was formed, and it was found that the word “creator” has the highest retrieval in the eastern coastal areas and first-tier cities such as Shanghai, Guangdong and Beijing. The search ability of new first-tier cities such as Qingdao and Hangzhou is also relatively high. This shows that people's concept has changed with the development of first-line developed cities. The recognition of STEAM education and robot education is steadily improving, and there is a huge potential user group. (Figure 9)

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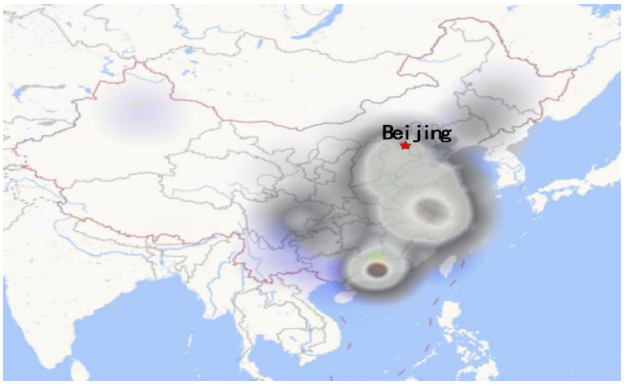

Figure 9. "Creator" 2017 Consumer Retrieval National Regional Thermal Map

In this paper, the use of keyword statistical analysis method in statistical analysis, this method integrates the focus of parents and quality education training institutions curriculum trends, in-depth mining of the focus of parents on the development of children's education. Through statistics on consumers on the PC and mobile, respectively, from 2016 to 2017, consumers' attention to "robots" continues to increase, and cloud statistics on the PC side can also find VR, robots, 3D printing and the like all maintain a high frequency of occurrence. (Figure 10)

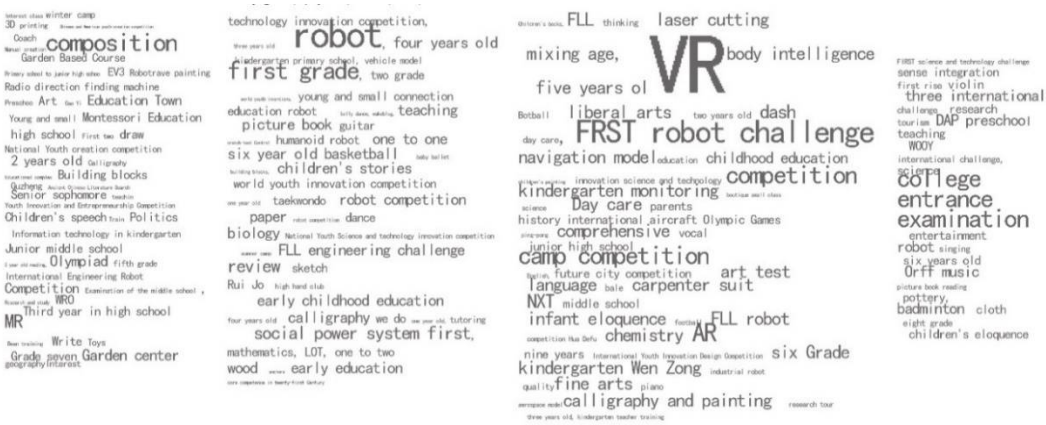

Figure 10. Consumer PC-side product attention word statistics

And in the 2016-2017 related education policy news, early childhood education, online education, family education, et al. have a large increase, especially early childhood education. (Figure 11)

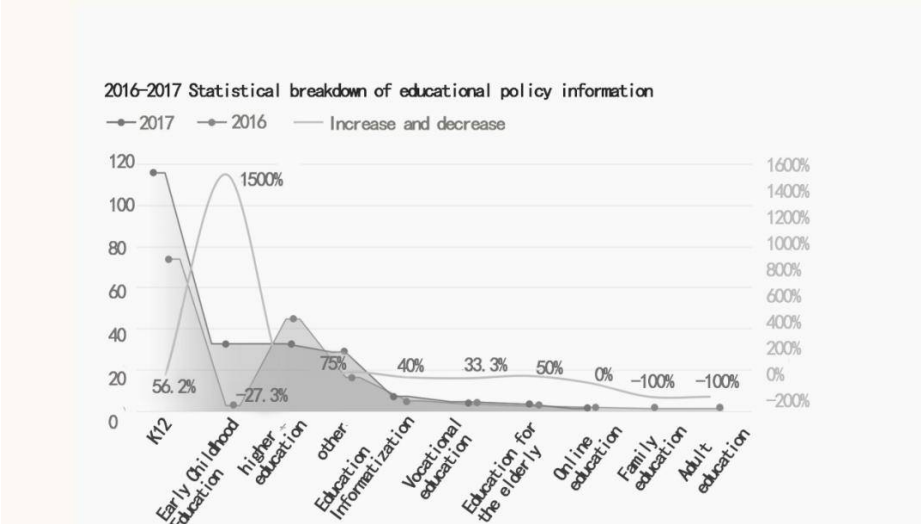

Figure 11. 2016-2017 Education Policy News Classification Statistics

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It can be seen from the above statistics that STEAM education is in the stage of gradual development in China. Through years of exploration and experience accumulation, more and more initiatives have been implemented to provide a good development environment for the localization of STEAM education. However, at present, the development of STEAM education in primary and secondary schools in China is faced with the lack of macro system planning, weak teachers, and the lag of curriculum resources and environmental construction. There are still many areas for improvement [37]. The specific performance is the contradiction between institutional team, curriculum, case accumulation and user expectations, and market demand. This has led to the inability of the organization to establish its own brand, win the mind of the user, and carry out rapid promotion.

4. Discussion

In order to solve the problems of curriculum development difficulties, lack of teaching resources and market promotion difficulties faced by STEAM educational institutions at this stage, this paper proposes four core competitiveness training strategies.

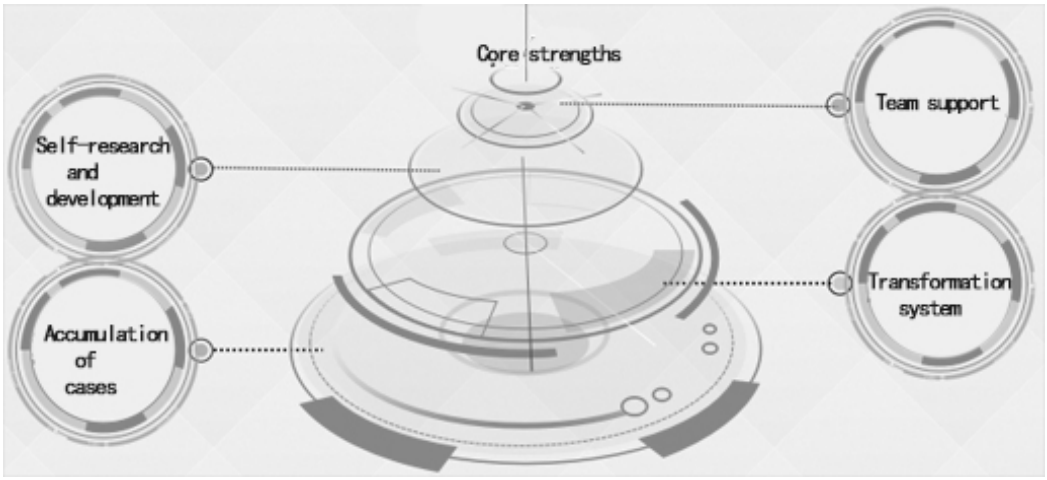

Figure 12. Four core competitiveness training strategies

In order to improve teaching and research capabilities, team building is essential. This paper proposes a gradient team building plan, which needs to reflect the team's integration and development from both professional and senior aspects. Inviting domestic famous integrated innovation education experts as team curriculum research and development consultants to control the progress and direction of research and development from the macro level and professional perspective. At the same time, the R&D team includes from undergraduate to postgraduate covering engineering、science、math、physics、biology and business in order to ensure the thickness of the team development.

The second is to develop the ability of independent research and development. Learning the mature teaching courses in the current stage of the market to find out feasible research and development ideas and then combining the advantages of the team and the accumulation of content to carry out the course upgrade. At the same time, we should pay attention to the development of independent curriculum brands in combination with regional development trends, regional unique characteristics and the advantages of the research and development team's university. Take the operation of Qingdao area as an example. The team consists of students from China University of Petroleum (East China) and other top-ranking colleges. In the course of curriculum development, we focus on the curriculum development of "blue-yellow economy" and the topics of petroleum, geology and ocean.

The third is the transformation mechanism. This paper proposes a high-precision project transformation mechanism, that is focusing on scientific research topics transformation. To a certain extent, colleges and universities represent the level of scientific research and development, and

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universities can reach the most advanced science and technology fields in the society, and predict the direction of science and technology development required for social development in the future. In the process of cultivating innovative talents, the cultivation of their vision and pattern is also very important [21]. Focusing on the transformation of scientific research topics, the transformation of advanced technology that is "unreachable" into a cognitive curriculum will help participants understand the development trend in advance and clarify future goals.

Finally, accumulating cases. In the process of curriculum development, we must pay attention to the timely verification of course effectiveness [22]. This paper proposes two major verification channels and methods through practice. The first is the "4:30 public welfare activities". The 4:30 class is an emerging hosting model recognized by the state. Through the joint community to create a 4:30 classroom activities, use the practice to verify the effectiveness of the course, get the course feedback. The second is to cooperate with the school to carry out the integration of innovative education activities. The authors set up "Little Scientists in Action" in three schools in Qingdao. Organizing by school can improve students' attention and participation to obtain better verification data.

5. Conclusions

This paper analyzes three key issues in China's future sustainable development: severe population burden, economic transformation and slow education reform, and put forward their core pain points. Through summarizing and analyzing the core pain points of the three problems, the root causes of the three problems are the lack of innovation ability and innovative talents, and the low level of scientific and technological literacy of a large number of industrial workers. It is concluded that the promotion of the concept of innovation ability based on multidisciplinary integration is imperative in China.

In view of the current situation of China's inadequate innovation, this paper analyzes the deep-seated reasons for the inadequate innovation and the lack of innovative talents by using multi-dimensional analysis of the status quo. Behind the slow implementation of STEAM education in China is due to huge population pressure and deep-rooted traditional educational concepts, which make the changes in educational status face enormous difficulties and challenges.

Combined with literature review and analysis, the STEAM concept plays an important role in the future of China. Through typical case and practice analysis of STEAM concept, this paper summarizes the STEAM literacy and curriculum types, the relationship between various disciplines and the specific teaching implementation process. It is concluded that the STEAM concept is infiltrated with integrated innovation in terms of curriculum, subject integration methods and teaching methods. The concept of training can play an important role in solving the three core issues of China at this stage. In order to spread good ideas faster, more attention should be paid to the importance of technology and humanities in the STEAM concept.

Faced with the contradiction between the slow implementation of STEAM education and the lack of innovative talent training mode in China, this paper puts forward some specific strategies to promote the implementation of STEAM education in China by analyzing the experience and lessons of teachers-led, knowledge-based education mode and education reform in Chinese primary and secondary schools. In order to promote the development of STEAM education in mainstream schools and form the implementation mode of mutual promotion of STEAM education in and out of class, the ecosphere of extracurricular quality education training institutions should be improved by solving the problems of lack of teachers and difficulties in curriculum content research and development.

Finally, in order to verify the status quo of the STEAM concept, this paper combines the future world sustainable development requirements and the survey data to analyze: The existing organization has a single training content, in order to solve this problem, combined with practical experience four core competitiveness training strategies were proposed: (1) Gradient team building. In team composition, we must pay attention to the integration of members in multiple fields and age groups to ensure the team's inheritance. (2) Advantageous independent research and development, we must learn to combine the geographical advantages, academic background advantages, and the professional knowledge of the research team to conduct research and development, and form barriers to curriculum competition. (3) High-precision project transformation mechanism, through

cooperation with university research institutions and high-tech enterprises, master the most advanced technical information of the era development, and carry out cognitive curriculum transformation to ensure the novelty and rapid iteration of the curriculum. (4) Two methods of course verification, through the activities of "4:30 Science Classroom" and "Little Scientists in Action" to verify the effectiveness of the course.

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Author Contributions:

Xingwei Wang and Wenwen Xu make the investigation. and analyzed the data and contributed materials/analysis tools. Liang Guo provided the data resources and make the Supervision. Wenwen Xu wrote the original draft, Xingwei Wang conceived the experiments, reviewed the paper and modified the draft. All authors read and approved the final manuscript.

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