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Development of STEM Curriculum Resources

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Abstract: ***STEM curriculum is an interdisciplinary integration of science, technology, engineering and mathematics. With the continuous development of STEM concept in recent years, more and more schools in the world have begun to offer STEM courses. Curriculum resources are an important carrier of STEM curriculum implementation. Teachers and students have to teach and learn the curriculum through curriculum resources. At present, the lack of curriculum resources is an obvious bottleneck in the implementation of STEM curriculum. Therefore, this paper focuses on the principles and significance of STEM curriculum resource development, in order to provide schools and teachers all over the world with the experience of STEM curriculum resource development.***

Keywords: STEM, Curriculum resource, Principle**.**

1. Introduction

The corresponding conditions and resources are essential to the implementation of STEM course. Both teachers' teaching and students' learning need appropriate environment, materials, tools and intangible rules, regulations, atmosphere, ideas, ideas and methods, including what we usually call curriculum resources. Curriculum is an important carrier of talent cultivation, and the status of curriculum resources and its practical application level affect the quality of talent cultivation[1]. Without the guarantee of curriculum resources, it is difficult for any curriculum to be effectively implemented, and it is difficult to achieve effective teaching. Only by rationally developing and utilizing curriculum resources can we achieve effective teaching and achieve the established course goals and objectives.

2. Conception of STEM Curriculum Resources

Before defining the concept of STEM curriculum resources, we must first understand what is STEM and what is curriculum resources. First, what is STEM education? STEM education is an interdisciplinary educational concept integrating science, technology, engineering and mathematics. STEM education emphasizes the integration of disciplines. Through project-based teaching, it takes cultivating students' STEM literacy as the core goal, promotes the cultivation of students' teamwork ability and innovative spirit, and prepares for solving complex and real problems. Second, what are curriculum resources? The International Encyclopedia of curriculum also specifically includes it, and defines curriculum resource as a variety of available resources in the process of seeking goals, selecting teaching activities, organizing teaching and formulating evaluation plans[2]. Wu Gangping once divided curriculum resources into material curriculum resources and conditional curriculum resources[3]. Among them, material resources mainly include curriculum standards, teaching materials, reference books, exercise books, examination papers and other texts, as well as corresponding audio-visual materials. Its characteristic is to act on the curriculum, and can become the material or source of the curriculum. It is the object of students' learning and harvest. Conditional resources mainly include human, material and financial resources that directly determine the scope and level of curriculum implementation, time, site, media, equipment, facilities and environment. Its characteristic is that it acts on the curriculum, but it is not the direct source of forming the curriculum itself, and it is not the direct object of students' learning and harvest, but it determines the scope and level of curriculum implementation to a great extent. Therefore, the definition of STEM curriculum resources should be based on STEM education and curriculum resources. This paper defines STEM curriculum resources as the sum of various elements that can be developed and utilized in STEM curriculum activities and are conducive to the realization of the educational purpose of STEM curriculum. This kind of curriculum resources are mainly material resources, supplemented by conditional resources.

3. Principles of STEM Curriculum Resource Development

3.1 The Principle of Openness

The openness principle of STEM curriculum resource development is embodied in the following aspects. First, we must maintain an open mind in the development of STEM curriculum resources. Specifically, we need to explore various types of curriculum resources, break the routine and explore new ways, better develop and utilize curriculum resources, and realize the diversification of STEM curriculum resources. Second, STEM curriculum resources should be able to lead students to invest in education and teaching activities with a positive attitude, promote education and teaching activities with rich emotions, and lead education and teaching activities with active thinking, so as to make education and teaching activities become an inclusive and creative activity with unique charm[4]. Third, the internal forms of STEM curriculum resources should be open. It is this open nature that makes it possible for the developers of curriculum resources to comprehensively develop and utilize various forms of STEM curriculum resources. Fourth, the functions of the same curriculum resource should be open. The same STEM curriculum resource may have multiple functions, and developers should pay attention to mining the diverse functions of the same curriculum resource. Fifth, developers of STEM curriculum resources should always pay attention to draw the external information dialectically, extract the

essence and discard the dross, absorb favorable information from the external environment, and form the creativity of STEM curriculum resources development.

3.2 The Principle of Guiding

The guiding principle of STEM curriculum resource development means that the development of STEM curriculum resources should have a certain direction, which has ensured that the curriculum resources can guide students to develop in the right direction. First, the development of STEM curriculum resources should adhere to the student orientation, that is, the design of curriculum resources should be based on an in-depth analysis of the characteristics of students, so that the curriculum resources can fit the characteristics of students' physical and mental development, and can promote the comprehensive development of students in all aspects. Second, the development of STEM curriculum resources should adhere to the correct track orientation, that is, to avoid the acquisition and demand of resources from deviating from the theme of educational and teaching activities or facing problems and materials, and correct possible factual errors, logical confusion and thinking lag, so that educational and teaching activities can run smoothly along the correct track. Third, the development of STEM curriculum resources should adhere to the internal guidance, that is, for the superficial and formal resource acquisition and demand, we should guide them to strengthen understanding and in-depth exploration, and strive to achieve the connotation and actual meaning of things or problems. Fourth, we should adhere to the unrealistic conditions for the development and effectiveness of the existing curriculum, that is, we must transform the existing resources into the unrealistic conditions for the implementation of STEM, that is, we can not achieve the practical development and effectiveness of the existing resources[5].

3.3 The Principle of Integrity

The integrity principle of STEM curriculum resource development requires the developers of curriculum resources to think and grasp higher vocational curriculum resources from an overall perspective. Specifically, first, the developers of STEM curriculum resources should analyze and grasp the teaching characters and teaching objectives, teaching content and teaching organization, curriculum implementation and curriculum development, teaching methods and learning methods, so as to make the curriculum resources fit with the above aspects. Second, STEM curriculum resources should reflect the overall teaching process and closely cooperate with the teaching links. Before the development of curriculum resources, the developers should fully understand the teaching process of the curriculum, deal with the space-time relationship between curriculum resources and classroom teaching links, and make the curriculum resources properly integrate into the classroom teaching structure. Third, the generation of STEM curriculum resources is interdependent. The existence of STEM curriculum resources supports each other. No specific resource form can be generated in isolation, and no specific resource form can exist in isolation without relying on the existence of other resources as an environment. Therefore, developers should develop curriculum resources from a holistic perspective, and should not only stick to the form of a certain curriculum resource. Fourth, integrity is closely related to the systematization of the working process. We must grasp the characteristics of the systematization of the working process as a whole. The holistic behavior of the working process is by no means the mechanical addition of all local behaviors, and can not be judged simply from the local with reductionist thinking.

3.4 The Principle of Development

The developmental principles of STEM curriculum resource development are embodied in the following aspects. First, STEM curriculum resources should conform to the development of curriculum and teaching itself and the development of the times. Therefore, the developers of curriculum resources should update the development concept in time. Second, STEM curriculum resources should be able to promote the development of students' knowledge level and practical ability. Therefore, the developers of curriculum resources should fully investigate the existing knowledge level and ability level of students and develop them on this basis. Third, the development of STEM curriculum resources should be continuously strengthened to continuously improve the quantity and quality of STEM curriculum resources. On the one hand, in terms of quantity, the specific forms of STEM curriculum resources are expanding and increasing. With the further development of society, the birth of professional posts and the application of high technology, people will create more new forms of STEM curriculum resources. On the other hand, in terms of quality, STEM curriculum resource structure is constantly optimized. Fourth, the development of STEM curriculum resources should fit the role development of different educational objects. For example, for vocational schools, the development of STEM curriculum resources should be close to vocational posts and closely combined with social progress, economic development, technological progress, post change and so on. For high school, the development of STEM curriculum resources should be closer to the knowledge and ability requirements of high school students in high school education.

4. Significance of STEM Curriculum Resource Development

4.1 Stimulate Students' Interest and Promote Students' Learning of Practical Skills

STEM curriculum resources encourage students to study independently, provide students with as many mobile phones as possible, and develop students' STEM core skills, namely critical thinking ability, problem-solving ability, innovation ability and teamwork ability, so that students can use their knowledge to put forward new ideas and manufacture new products. Therefore, the development of STEM curriculum resources will make STEM education no longer limited to teachers' monotonous teaching, inject vitality into STEM curriculum[6], and make curriculum resources become a bridge for students to interact with the curriculum itself. In addition, the development of STEM curriculum resources will also change students' misunderstanding of STEM education, create positive learning situations for students, and connect STEM curriculum content with learners' interests and life experience, as well as real-world problems and work. In the

classroom, through hands-on practice, group cooperation and other ways, students use a variety of curriculum resources as tools to complete the construction of knowledge in the process of using tools, which breaks the state of students making cars behind closed doors and makes each student actively integrate into the group.

4.2 Provide Students with a Variety of Learning Places and Improve Students' Initiative in Participating STEM Curriculum

The traditional STEM classroom confines students to the classroom, and many knowledge cannot be given by the school. The development of STEM curriculum resources will make STEM education no longer limited to the classroom, but emphasize the diversity and authenticity of the learning environment. Teachers organize students to study in classrooms, laboratories, workshops, outdoor places, etc., so that students interact with learning situations and build knowledge systems. This kind of out of school conditional curriculum resources is closer to students' real life and more interesting, which also arouses students' interest in learning. In general, the development of STEM curriculum resources can not only directly increase students' participation and enthusiasm in the school classroom, but also build learning situations through a variety of off campus curriculum resources to make students actively integrate into the curriculum.

4.3 Start from the Real Problem Situation and Promote the Cultivation of Students' Comprehensive Ability

The so-called starting from the real problem situation means that the starting point of classroom teaching and learning is the real world, and the whole process of students' application of curriculum resources is also in the real problem situation. The value of starting from real problem situations lies in the ability to create complex, open, flexible and meaningful physical and psychological spaces, and truly promote the cultivation of students' comprehensive abilities. On the one hand, from the perspective of physical space, what students are actually facing are real problems and the curriculum resources needed to solve them. This realistic environment makes students stand on a problem-solving standpoint from the very beginning. On the other hand, from the perspective of psychological space, physical space enables students to establish a problem-solving oriented learning attitude, and strengthen students' belief and confidence in solving problems in the process of students' learning. Finally, under the dual role of physical space and psychological space, students have increased their abilities in all aspects in the process of solving problems.

5. Conclusion

In recent years, with the continuous development of the concept of STEM education, the problem of lack of STEM curriculum resources has received more and more attention. STEM education is an interdisciplinary education integrating science, technology, engineering and mathematics, emphasizing the integration of disciplines. A STEM course may integrate the characteristics of multiple disciplines. Therefore, the development of STEM curriculum resources can not be completed by one or several teachers, and we need to gather various forces. This paper aims to call on more teachers to participate in the development of STEM curriculum resources, and encourage teachers to apply the four principles mentioned in this paper, namely, openness principle, guiding principle, integrity principle and development principle, so as to continuously improve the quantity and quality of STEM curriculum resources.

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