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Combining STEAM Concept With Virtual Reality ——Taking Virtual Electronic Blocks Construction as an Example

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ABSTRACT
The kernel of STEAM education is to achieve cross-disciplinary knowledge integration and use interdisciplinary knowledge to solve problems. STEAM education emphasizes practice, but in the process of practice, it is often limited by realistic conditions, and it is difficult to achieve the effect. Virtual reality(VR) technology can make up for this shortcoming. Virtual reality technology has the characteristics of immersion, interactivity and imagination, which just fit the characteristics of STEAM education. Construction of virtual electronic blocks introduced in this article is to allow students to complete the construction of virtual electronic blocks in a virtual environment, so that students can "Doing in Learning" and "Learning by Doing". The interaction between students and virtual scenes can cultivate students' practical ability and scientific literacy, and cultivate students' imagination ability. Combining the STEAM concept with virtual reality aims to achieve interdisciplinary integrated education, guide students' interdisciplinary thinking, and promote students' comprehensive development.
Keywords: *STEAM education, interdisciplinary, virtual reality, electronic blocks*

1. INTRODUCTION

Virtual reality(VR) is the product of interdisciplinary integration, which involves the knowledge of optics, computer science, communication, microelectronics, mechanical engineering and other disciplines. Virtual reality technology has been widely used in many industries, especially in construction, entertainment, military and so on. Although virtual reality has entered into our lives, the application of virtual reality technology in education is still in the exploratory stage within the domestic. With the rapid development of virtual reality technology, how to combine virtual reality with education has become a hot topic[1]. Due to the identity of the STEAM educational concept and the characteristics of virtual reality technology. It has become a hot issue in the current research to integrate the STEAM educational concept into virtual simulation teaching. In the virtual environment with immersion, the learner can be immersed in the study, combing the knowledge repeatedly, and let the learner to consolidate the learned knowledge. At the same time, incorporating scientific principles into the learning process stimulates students' interest in learning while gaining knowledge[2]. Construction of virtual electronic blocks introduced in this article is to combine virtual reality technology with STEAM educational concept. Taking virtual electronic blocks as an example to propose unique design principles and strategies, the purpose of design is to cultivate STEAM thinking and learning interest of school-age children.

2. STEAM EDUCATION OVERVIEW

STEAM is composed of the initials of five disciplines: Science, Technology, Engineering, Arts and Mathematics. STEAM education includes but is not limited to these five disciplines. It also includes the ability to use knowledge and the accumulation and mastery of other related knowledge.

2.1 The origins and development of STEAM education

Origin: STEAM education originated in the United States. Originally derived from the term STEM. In 1986, America National Science Council issued a report that first proposed SMET. After 2001, it was renamed STEM gradually. American professor Georgette Yackman added Arts on the basis of STEM. He defined the STEAM model as: "Science" and

"Technology" are reflected through "Engineering" and "Art". It is believed that all disciplines are based on "Mathematics", thus putting forward the concept of STEAM[3].

Development: STEM theory has been widely concerned in the United States since 2001, which has led to an education reform. However, after the financial crisis in 2008, that other countries began to focus on STEM education in consideration of multidisciplinary talent development. It was not until 2008 that China began to conduct research on STEM education. In 2017, National Institute Of Education Sciences issued the "White Paper on China STEM Education"[4], which proposed that STEM education should be included in the national innovation talent training strategy. After that, China started to try STEAM education reform based on national conditions and STEM ideas.

2.2 The connotation of STEAM education

The target of STEAM education is to cultivate students' comprehensive literacy and practical ability, so that students can have multi-disciplinary thinking. STEAM education emphasizes the interconnection between different disciplines, guides students to use divergent thinking to think and solve problems, and enables students to continuously recognize and progress in the process of learning[5]. The ontology of STEAM education is that mathematics as the "bone", art as the "skin", engineering as the "meat", science as the "blood", technology as the "sinew". Mathematics develops and applies science and technology for people, engineering and art provide thinking methods and application tools, science can help us to understand the objective laws of the world fundamentally, art enables people to understand the world in a better form. Engineering and technology can help transform the world. STEAM education uses multi-disciplinary cross-learning to solve problems by using multi-disciplinary connections to achieve interdisciplinary teaching and improve students' ability to solve practical problems.

2.3 Application Strategies for STEAM Education

2.3.1 Enrich the course content

STEAM education combines with emerging technologies to expand the teaching content and teaching methods continuously, and complete the teaching design in the direction of solving practical problems[6]. We should pay attention to interest and openness of the teaching content, and make students complete the transformation from "learning" to "want to learn" and then "know how to learn".

2.3.2 Cultivate students' creative ability

Integrate the knowledge system of STEAM discipline, carry out problem-based learning, advocate multiple ways to solve problems. Be bold in innovation and imagination. Let the students test the innovative ideas through practice, find the deficiencies and make up for the shortcomings[7]. At the same time, students will also find their own "strengths", so as to stimulate their interest in learning, integrate knowledge driven by interest to shape their knowledge system and stimulate creative thinking.

2.3.3 Establish teaching objectives and generalize teaching methods

It is emphasized that the learning process should not blindly pursue results, promote teaching with teaching objectives as the guidance, allow multiple ways to solve problems, and cultivate students' practical ability and thinking mode of interdisciplinary thinking.

3. IMPLEMENTATION OF VIRTUAL ELECTRONIC BLOCK BASED ON STEAM CONCEPT

STEAM concept not only runs through the whole teaching process, but also integrates STEAM concept into the design process of virtual scene. Integrates STEAM concept into the system by project-based design. Make use of different projects, targeted teaching can be achieved for specific aspects.

By analyzing the teaching objectives, students can explore the problems by themselves. At the same time, the teaching standards are set to measure the overall performance of students, and the students' learning results are recorded, and the feedback is returned to verify and improve the whole teaching system constantly.

3.1 Design ideas for the combination of STEAM education and virtual reality

As shown in Figure1, the virtual reality project, which is led by STEAM education concept. To take students as the main body and enables students to acquire knowledge in the interaction with virtual environment under the STEAM education concept. STEAM education concept integrates multi-disciplinary background to provide students with a comprehensive knowledge structure system, and guides students "teaching science, learning technology, doing engineering, seeking art and exploring mathematics". Under the STEAM education concept, the integrated knowledge is transmitted to the students through the virtual scene, and show the abstract knowledge

intuitively in front of the students, thus the more systematic teaching is more conducive to students to learn and master this knowledge.

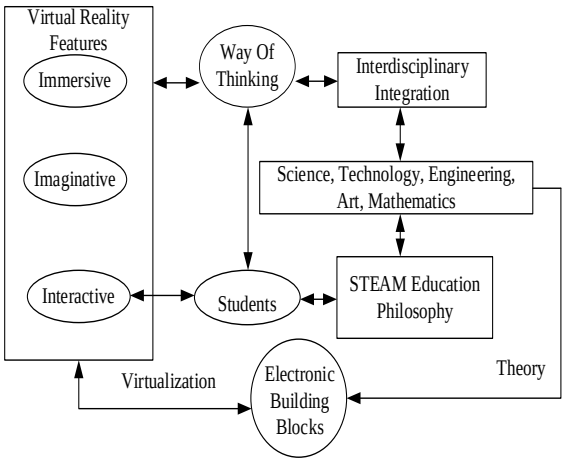

Figure 1 Combination of virtual electronic blocks and STEAM education

The characteristics of virtual reality and the concept of interdisciplinary integration collide with the sparks of thinking, which can stimulate students' interest in learning. The change of thinking mode and the progress of knowledge can feed back to the interactive process between students and virtual environment, form a dynamic learning and improvement process.

3.2 Construction of virtual electronic blocks

The virtual electronic block is composed of hardware and software. The hardware part is composed of HTC VIVE head-mounted display, positioning rod and operating handle. The software part imports the model into Unity3D through 3DMAX modeling, processes the model in unity3D, and then writes scripts to control the model and scene through visual studio, and finally publishes the whole system on the windows platform for testing The main functions are as follows: Client login, Virtual scene tour, Learning related components and Circuit knowledge, Virtual construction process.

3.3 Introduction of main scenes

An introduction to the overall framework: first of all, complete the login of the client, and then enter the STEAM innovation workshop scene and roam in the scene. From the scene, you can jump to the interface of selecting the experimental project, and click the corresponding project to enter the corresponding scene to start operation. The scene includes component introduction, principle introduction, project demonstration, teaching evaluation, etc.

Figure 2 is a series circuit assembled in a virtual environment. Turn on the switch and click the connection button to switch on the circuit.

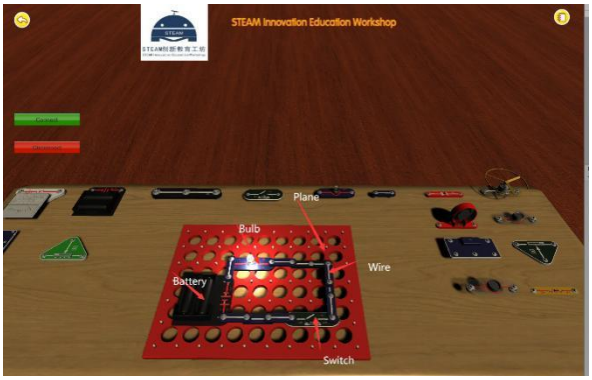

Figure 2 Series circuit of electronic blocks

Figure 3 shows a parallel circuit. When the switch S1 turns off, S2 turns on, the lamp lights on, the fan rotates .When the switch S2 turns off, S1 turns on, the bulb lights off, and the fan rotates.

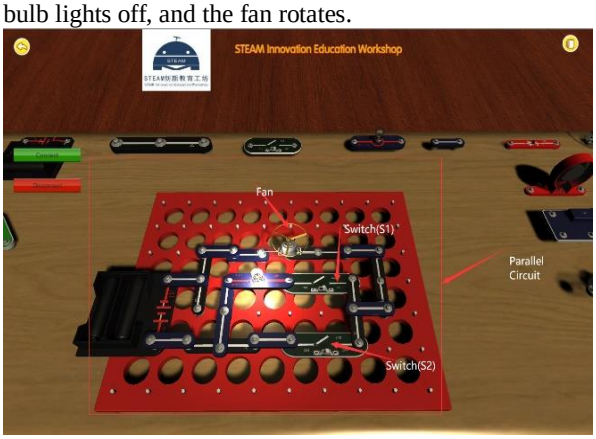

Figure 3 Parallel circuit of electronic blocks

Figure 4 is a comprehensive circuit. Only when S1 is turned on, the brightness of the bulb and the sound of the horn can be changed by changing the resistance value of the sliding rheostat. Different circuits can be formed by changing the states of the other two switches. Other situations will not be introduced in detail here.

Figure4 Integrated circuit of electronic blocks

4. SUMMARY

STEAM education meets the needs of today's society and it has important significance to the cultivation of innovative talents with comprehensive literacy in the future. STEAM education cultivates students' interdisciplinary multiple thinking, and allows students to learn in practice, thinking in learning and seeking innovation in thinking. This ideological concept is also very suitable for the characteristics of virtual reality. With the rapid development of virtual reality technology, due to its superior immersion and interactivity. It has become an inevitable trend to integrate virtual reality technology into future education. Virtual reality technology can use its characteristics to solve the difficulties encountered in STEAM education in practice, and help the promotion and development of STEAM education. The purpose of the virtual platform based on STEAM concept is to promote the all-round development of students. With the modern education concept as the baseline and modern technology as the means, it can cultivate innovative, practical and comprehensive new-type technical talents for the country.

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