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# Computer Course Integration Mechanism Based on Steam's Educational Idea

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***ABSTRACT.*** *The core idea of STEAM project-based learning is curriculum integration. On the one hand, project-based learning tasks are carefully designed and implemented through the integration of single subject and unit-based subject teaching in the same discipline, which can infiltrate and cultivate comprehensive thinking and problem-solving abilities in daily teaching; on the other hand, more common multi-disciplinary and fully interdisciplinary integrated project-based learning can further expand real problems. Fields, so that students learn authenticity and can experience social life in depth. The practical study of STEAM project-based learning at different levels can provide reference for the integration and innovation of STEAM teaching design in information technology and other disciplines, and for the training of innovative talents.*

***KEYWORDS:*** *STEAM education; Project-based learning; Curriculum integration*

## 0. Introduction

Following the steam technology revolution, the electric power technology revolution and the information technology revolution, the fourth industrial revolution is the industrialization and industry of the Internet. Intelligent, industrial integration as the representative, with artificial intelligence, clean energy, uncontrolled technology, quantum information technology, virtual reality and biotechnology as the main new technology revolution. Innovation and creation have become the label of the new era, and the cultivation of innovative and creative talents has become the strategic needs of national education. In addition, information explosion, knowledge explosion and ubiquitous computing make repetitive, monotonous and lack of innovation work no longer important; the integration and innovation of ideas is the absolute truth. Just as the core of information mining in the

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era of big data is multi-source and multi-dimensional data rather than single-dimensional duplicate data, the core of future education is multi-disciplinary cross-innovation rather than single-disciplinary hard work.

In real life, the solution of a specific problem and the breakthrough of major problems in today's world need to be multidisciplinary and multidisciplinary.

Comprehensive and cross-cutting innovation. Therefore, interdisciplinary is the source of innovation, and STEAM innovative teaching practice is the future-oriented educational development trend. When creating customers, innovation and entrepreneurship become slogans in the streets and lanes, when the Internet plus era has changed many lifestyles, students are not necessarily a geek when the online courses in new media era allow everyone to make their own interests according to their own interests, but they need to have comprehensive thinking that can solve problems or change the future.

Under this background, it is necessary to carry out curriculum integration research based on STEM concept. In this paper, on the basis of summarizing the theory and method of curriculum integration of STEAM concept, combining with my own teaching practice, the author analyses the different levels of STEAM project-based learning, and takes computer science course papers, "Modeling and simulation" elective course, "Computational Imaging and Future Media" research learning field as examples to introduce in detail the curriculum integration based on STEAM concept. With innovative practical experience. The author hopes that the practical research experience and thinking in this paper can provide some reference for the integration and innovation of STEAM teaching design in information technology and other disciplines, and also provide practical reference for the training of innovative talents[1].

## 1. Summary of Curriculum Integration Theory and Method Based on STEM Concept

### *1.1 Three Dimensions of STEM*

#### *1.1.1 Branch*

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American primary and secondary schools have their own curriculum standards. For example, in the field of mathematics, the National Council of Mathematics Teachers of the United States promulgated the American School Mathematics Curriculum and Evaluation Criteria in 1989 and the new edition of the Principles and Criteria of School Mathematics in 2000. The first National Science Education Standard was issued in 1996 by the National Research Committee affiliated to the National Academy of Sciences of the United States. In 2013, it marked a new round of scientific education reform in the United States, the Next Generation Science Standard, which for the first time separately lists engineering and technical education and adds it to the science education standard, and attaches great importance to interdisciplinary learning and learning. Practical participation. In the field of technology, the National Technical Education Standard for Primary and Secondary Schools, Technical Literacy Standard: The Content of Technical Learning, was launched in 2000 by the American Institute of International Technical Education and its affiliated Technical Program for All Americans. The engineering field is composed of the "K-12 Grade Engineering Education Committee" (composed of the National Academy of Engineering and the National Research Committee). The Research Report "Engineering in K-12 Grade Education: Understanding the Present Situation and Improving the Future" is presented, and three principles and seven policy recommendations for the implementation of Engineering Education in primary and secondary schools are put forward[2].

### *1.1.2 Integration*

STEM education, as a strategic integration, is not limited to four separate disciplines, but pays more attention to the significance and value of its "integration". In 2014, the United States launched the "K-12 STEM Integrated Education: Current Situation, Prospects and Research Agenda" and proposed that "STEM integrated education is far from a separate, well-defined experience, it includes a series of different experiences, designed a certain degree of connection. These experiences may occur in one or more class hours, throughout the whole course, reflected in a single subject or the whole school, and included in extracurricular activities. This document gives us three important enlightenments: integration must have clear objectives; support students to learn knowledge of individual disciplines; integration

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is not necessarily the more the better[3].

#### *1.1.3 Extension and extension*

STEM education not only extends geographically from the United States to the rest of the world, but also extends itself to form STEM x, where X represents the knowledge and skills needed by computer science, computational thinking, research, creativity and innovation, global communication and other emerging 21st century knowledge and skills; STEAM model also emerges, where A is art. In addition, the implementation of STEM education is more and more closely integrated with information and communication technology, which provides more experience and methods for the implementation of STEM education. STEM education has gradually extended from the earliest attention to the development of higher education to primary and secondary education and kindergarten activities, from the focus on national competitiveness, talent training to the change of learning methods. Starting from STEAM model, this paper considers curriculum integration and innovation including humanities and arts[4].

### *1.2 STEAM Project-based Learning Development Level*

STEAM project-based learning can be carried out in various forms and levels, and has its own characteristics and modes in different age groups and disciplines. It develops from teacher-led to student-led, and students'participation in various dimensions gradually increases. STEAM project-based learning develops continuously at different levels: traditional hands-on activity laboratories (verification of facts), beginners (factual knowledge), knowledgeable beginners (understanding facts/viewpoints within conceptual frameworks), experts (adapting conceptual frameworks through migration), and researchers (creating new knowledge and/or conceptual frameworks)[5].

### *1.3 Dual Role of Technology in STEAM Project-based Learning*

Technology has two roles in STEAM project-based learning. Firstly, technical education integrated with science, engineering and mathematics. Many skills and

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accomplishments in the 21st century, such as information and communication skills, information literacy, mathematical literacy and scientific literacy, require effective mastery and use of technical knowledge. Secondly, using (educational) technology to promote STEAM project-based learning can bring better results, more efficient and more attractive STEAM project-based learning. Therefore, technology plays an important role in STEAM project-based learning. By using technology in STEAM project-based learning, students can learn to innovate, develop technical literacy, acquire data capabilities, and understand the impact of technology on the environment and sustainability. This paper studies the practice of STEAM project-based learning from the perspective of computer science, which is the first role of technology in STEAM project-based learning. Technology itself has disciplinary attributes, which is a visible aspect of STEAM and an important aspect of training students'21st century skills.

### *1.4 Different levels of integration of STEAM project-based learning curriculum*

Successful project-based learning may not always be interdisciplinary, but different degrees of discipline integration are possible. Teachers can decide to what extent to implement interdisciplinary project-based learning according to the availability of resources and the readiness of teachers and students for project-based learning[6].

## 2. Design, Implementation and Evaluation of STEAM Project-based Learning at Different Levels

### *2.1 Integration and Innovation of Single Subject Courses*

#### *2.1.1 Computer Operating System Communication Drama Performance*

The author takes computer science (A-Level) - the teaching of computer operating system communication as an example. For this part of the computer theory professional content, simple teaching method is difficult to stimulate students'enthusiasm for active learning and let them actively understand the theoretical knowledge to be learned. Students like some interesting, exhibitive and

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performing team activities. Therefore, the author designed a TEAM project-based learning activity which integrates drama elements, so that students can learn through self-learning, mutual discussion, teamwork, exhibition and evaluation, and achieve twice the result with half the effort.

Specific STEAM project-based learning method is to divide students into five groups, each group of 3-4 students, each group is responsible for "performing" a computer communication mode. To be able to perform smoothly, not only need each member of the group to have a deep understanding of the term, but also need the team to design the performance script, role assignment and director rehearsal, and all these tasks need to be completed in a short 10 minutes. This is an interesting task full of novelty and challenge for students, especially students'extensive hobbies and strong creativity can be fully reflected in such curriculum activities. Within 10 minutes of preparation, every student is full of enthusiasm. Teachers also actively participate in group discussions with students and discuss key technical difficulties with them. This single-theme project-based learning will aim at performing in the form of drama. The students'task is to design their own scripts, direct, rehearse and perform in the theatre. The evaluation method of this study is teachers'and students' mutual evaluation and feedback. This series of designs can deeply stimulate students'creativity and imagination, so that they can vividly express ABSTRACT and difficult computer concepts.

#### *2.1.2 Number guessing game: binary search algorithm visualization*

In the teaching of arithmetic and programming, guessing numbers is a classical teaching case of dichotomy. By visualization, students can present dichotomy, which plays an important role in assisting the understanding of arithmetic. We turn such a teaching innovation into TEAM project-based learning with a single theme. This project can be described as: Ask students to think about a number in their minds, and guess by computer. Whether the number guessed by the computer is big or small each time the students feedback, this process is visualized by Python turtle drawing. The visual visualization method of this project is very helpful to the cultivation of students'computational thinking. The specific ways of training computational thinking include the comprehensive application of circular selection, the intuitive concept of dichotomy, how many guesses students need to try to sum up, the

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summary of algorithm rules and efficiency, etc[7].

### *2.2 Unit Theme Course Integration and Innovation*

The integration and innovation of unit subject curriculum takes the teaching of sorting algorithm as an example, which is the expansion part of algorithm and programming under the new curriculum standard of senior high school. This course is designed to solve practical problems as the background and starting point, the actual problems will be carried out in the way of project research. Teachers guide students to think about the application of ranking in more fields, such as "voting electoral list: automatic counting and statistical ranking", "football League scoring-player ranking: automatic ranking of winning and losing playoffs, player data ranking competition", "Tianmao Taobao: intelligent ranking", "scientific experimental data statistical screening and processing: ranking analysis" and so on. Teachers use cases to guide students to think about the application of ranking algorithm in more sophisticated fields, stimulate students'interest in learning, and cultivate students' ability to solve practical problems by using Computational Thinking - ABSTRACTing real world problems into models, defining or optimizing objectives and corresponding constraints, and solving them through appropriate algorithms.

The project-based learning design of this course is guided by the teacher to analyze the actual problem of "Wechat Sports Step Rank" through the method of modeling and simulation: Wechat Sports Those Things - How many steps did you take today, how many rankings in the circle of friends. Course design starts from a popular wearable fitness app in real life: "Friends circle" popular jigsaw steps, so how do we design and implement "how many rows and rows of steps"? This project-based learning runs through the whole process of algorithm learning and cultivates students'ability to solve practical problems through the example modeling and Simulation of "Wechat Motion Step Rank"[8].

Student's project-based learning goal of unit subject includes the following aspects: exploring how to simulate and describe the step ranking of "Wechat Movement"; establishing models to realize three basic sorting algorithms and fast sorting and merging sorting; and comparing the efficiency of algorithms under

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different data scales. The core of project-based learning is to study, compare, apply and practice all the algorithms of the whole unit by solving practical problems.

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