

# Construction of STEAM Education Space in Colleges and Universities

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## Abstract

**STEAM education aims to develop students' ability to transfer knowledge and skills flexibly to solve real-world problems by integrating a teaching approach. The construction of education space based on the STEAM concept is to establish the development and implementation of a school-based curriculum and gradually form the STEAM education ecological environment of the school. This paper will discuss the construction of STEAM education space in colleges and universities from the four dimensions, including construction background, objectives, principles, and plans to provide a reference for the construction of STEAM education space in colleges and universities.**

## Keywords

**STEAM education; Space construction.**

## 1. Introduction

STEAM education space is an essential place for students to conduct STEAM learning. It supports students to study, discuss, explore and practice and directly affects students' learning process and experience. [1] Actively developing campus resources and building student learning space can promote the sustainable development of STEAM education in colleges and universities. Space construction is an important support for STEAM education to take root in the school and provides a physical environment for STEAM education curriculum implementation. What kind of STEAM education space can meet the needs of STEAM education development in colleges and universities? How to build STEAM education Space in universities? This paper will discuss the construction of STEAM education space in colleges and universities from the four dimensions of the construction background, objectives, principles, and plans.

## 2. Background of STEAM Education Space Construction in Universities

In September 2015, the General Office of the Ministry of Education proposed to effectively use information technology to promote the construction of "co-working space" and explore new education models such as STEAM education and Maker education so that students can have a strong awareness of information and develop digital learning habits. In recent years, the Central Committee of the Communist Party of China (CPC) and the State Council have issued a series of documents to make comprehensive plans for strengthening youth innovation awareness and cultivating innovation ability.

Nowadays, the single-subject teaching model is no longer meet the new talent cultivation needs, hence a new teaching model is urgently needed to provide students with valuable learning contents. Under the leadership of the Ministry of Education, STEAM education, with its distinctive features of interdisciplinarity and scenarios, has entered the public eye and gained widespread attention as an effective way to enhance students' interest in learning and develop

interdisciplinary and innovative abilities. STEAM education space are important places to carry out STEAM education and provide powerful support for students to participate in activities, projects, and problem-solving-based learning, making education more intelligent and dynamic. STEAM education emphasizes cultivating students' ability to cooperate. Only by putting students in comprehensive practice activities in the real environment can students better cooperate in learning and exploring practice. The spatial layout of STEAM education, such as hexagonal tables, makes it easy for students to collaborate.

### **3. Objectives of STEAM Education Space Construction in Colleges and Universities**

The goal of building STEAM education space in colleges and universities is to provide students with a physical environment that fully supports their learning in STEAM courses by transforming existing learning space and building new learning space. By integrating core elements such as practical operation and cooperative learning, students will get better conditions for learning and development in STEAM education.

#### **3.1. Transform the Original Learning Space**

In order to provide skills training and a public platform for students, colleges and universities can transform the unreasonable space structure, divide the management system, and making operation rules to ensure the reasonable operation of STEAM education space. In this way, the expenses on funds are saved and the space is fully utilized. In addition to basic facilities, colleges and universities should also consider the needs of STEAM education development and provide corresponding equipment and software services.

#### **3.2. Build A New Learning Space**

The new learning space can break through the boundaries of physical space and use the Internet as a medium to connect with multimedia devices, computers, and smart terminals to provide a platform for teachers and students to communicate and learn. Teachers can record videos in advance to explain the main learning contents and the notes so that students can preview. When students watching the video, they can understand what they are learning in advance and will have a deeper understanding of what they will learn in the next class. At the same time, the new learning space should also have software and hardware systems for data collection, recording, and analysis of teaching and learning processes so that teachers can quickly analyze teaching effects and students' learning outcomes.

The space here includes not only a built-in, virtual space but also a dynamic, open learning space for students, in which students can learn anytime and anywhere, which not only makes space utilization higher but also facilitates students to carry out diversified learning and meets their personalized learning needs. It also opens up a display area for students' works, where students can display and share their works and interact face-to-face on time.

### **4. Principles for the Construction of STEAM Education Space in Universities**

The principles that need to be followed in constructing STEAM education space in universities are the demand-oriented principle, comprehensive analysis principle, service curriculum principle, and green economy principle. The four principles are independent of each other and complementary to each other.

#### 4.1. Adhere to the Demand-oriented Principle

The high-quality design is based on requirements first, and design derived from requirements is the most practical and valuable design. STEAM education space should also be demand-oriented, taking into account the diverse needs of different STEAM education courses and students' individual needs. For example, the space requirements of science courses are tablet computers (for students to study), hexagonal experimental tables, wireless equipment, lab clothes and goggles, experimental equipment, etc. The space requirements of technical courses include an intelligent blackboard, robot suite, 3D printer, wireless equipment, etc. Space requirements for engineering courses include laser cutting machines, chainsaws, knives, drills, hot melt glue guns, welding tools, woodworking tables, etc.

#### 4.2. Adhere to the Principle of Comprehensive Analysis

The STEAM education space in higher education is not a physical space where tools and equipment are placed. When planning the layout of the space, careful consideration needs to be given to various factors such as curriculum construction, project development, teaching practice, curriculum materials, tool placement, space utilization, so that the functional space in each area has the outward characteristics of the curriculum, as well as distinct available elements. Before construction, we need to collect suggestions from all sides. Different people see the problem from different perspectives. We need to do an excellent job of screening, selecting, optimizing, and integrating voices from different aspects, grasping the golden period of construction, comprehensive analysis, and determining the final construction plan.

#### 4.3. Adhere to the Principle of Service Courses

The curriculum is the most crucial carrier and bridge for transforming ideas and concepts into school-running behaviors. School space never exists in isolation. It must be a space guided by the top-level idea of the school and space serving the curriculum. The deepening of curriculum reform will undoubtedly promote the change of school space design, presenting the ideal pursuit of campus space design and school curriculum innovation as an integral whole. The perfect space design can serve the diversity, profoundness, and dynamics of the curriculum to bring the comprehensive effect of education into play together. Only by matching the concept and doing an excellent job in top-level design can the school create a scientific and robust vitality space pointing to the future growth of students.

STEAM education space meet in view to explore, experiment with teaching and learning, communication, such as flexible use requirements, carpentry room, gold workshops, and design, form a complete set of the teaching-learning group as a large "experimental base", lets the student from the beginning of the invention, free for group discussion, through research and development, production and practice, finally began to produce their conception of objects.

#### 4.4. Adhere to the Principle of the Green Economy

School funds are mainly used for student development and campus construction. Therefore, every investment needs to be carefully calculated. The purchase of equipment and materials, area appliances all need to be accounted for by dedicated staff, good division of consumables, and reasonable recycling, to achieve greater effectiveness with limited funds and spend the money on edge. STEAM education is ultimately an interdisciplinary approach to innovation, not about introducing high-end drones, robots, or 3D printing equipment. Being able to inspire students to ask meaningful questions and guide them to apply their interdisciplinary knowledge to solve that problem is at the core of STEAM education. In the process, choosing recyclable and eco-friendly equipment as open-source as possible can reduce teaching costs and benefit more students.[2]

Ensuring the health and safety of students is the most critical job of the school. After the construction of the space is completed, environmental monitoring is an integral part of

ensuring the safety of students, and the school must ask professionals to monitor the space to ensure that it is green and environmentally friendly.

## 5. College STEAM Education Space Construction Program

The construction of STEAM education space in colleges and universities needs a practical plan to implement the details of space construction based on the plan, to ensure that the space construction is scientific and reasonable.

### 5.1. Focus on STEAM Education Concept

STEAM education is an approach to teaching and learning that combines science, technology, engineering, the arts, and math to guide student inquiry, discussion, and problem-solving. The construction of STEAM education space in colleges and universities is guided by the STEAM education concept and is established to serve STEAM education. Therefore, the space construction needs to locate the STEAM education concept first.

Bai Yulong, associate professor of Northwest Normal University, points out that Science is the study of the nature of things in the objective world and the laws of motion; Technology is ubiquitous, both as a way for humans to understand the world and as a rational expression of how humans adapt the world to meet real needs; Engineering is the application of scientific knowledge and technical means to solve specific problems that relate to human needs. Arts is a human science that grasps the natural world in an intuitive, holistic way and explores human emotions and intelligence; Mathematics is a cosmic language for understanding and writing about the world.

### 5.2. Division of Functional Areas

According to the needs of the current curriculum of universities and the development direction of the future curriculum, the functions of STEAM education space are mainly about artificial intelligence, robotics, 3D printing, laser cutting, etc. The size of the area is divided according to the area of indoor space, the number of equipment materials, and their functions. The main functional areas are the large granule building blocks area, LEGO WeDo robot area, EV3 robot area, curriculum teaching area, tool storage area, operation desk, and information inquiry area.

### 5.3. Design Drawing and Modification

When building STEAM education space, colleges and universities need to go through several meetings and solicit multiple opinions to determine the construction plan and create design plans according to the construction plan. The designer should have an in-depth understanding of the STEAM education concept and the school's purpose and philosophy and communicate with the teachers to finally reach a harmonious unity of space construction and curriculum, and teaching.

### 5.4. Environmental Construction and Quality Inspection

During the construction phase, the person in charge of the school needs to communicate more with the builder to modify the deficiencies in the design during the construction process and ensure the environmental protection of construction materials and the safety of space construction. According to the relevant provisions of national standard a working group will be formed for acceptance.

Based on the characteristics of diversified STEAM courses, building suitable STEAM education space is necessary for developing STEAM education. However, pursuing the size of the area, the completeness and precision of the equipment, and the uniformity of the area as standard is not an effective practice suitable for the development of STEAM education. The establishment of a creator space should go through a specific development process and based on completing the

basic configuration in the early stage, space construction and curriculum teaching should be carried out simultaneously in order to develop a creator space that meets the requirements of the curriculum, suits the learning needs and creative needs of students, and has its characteristics.[3]

In building STEAM education space in colleges and universities, the design should serve students and meet their needs. The new dynamic space with various forms can meet the needs of students for STEAM course learning and independent cooperative inquiry. On this basis, STEAM education space construction in colleges and universities is gradually promoted, and STEAM education ecological environment is gradually formed. The new dynamic space in various forms can meet the needs of students' STEAM course learning and independent cooperative inquiry. On this basis, the construction of STEAM education space in colleges and universities is gradually promoted, and the STEAM education ecological environment is gradually formed.

## References

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