Application of STEM in Higher Vocational Education Curriculum

Wei Song

ABSTRACT

This paper integrates the core concept of STEM education into the teaching reform and curriculum design of higher vocational education. It has carried out bold reforms in the original progressive and progressive education mode of higher vocational education, and proposed a kind of the curriculum division according to disciplines is divided into the curriculum design concepts of higher vocational education courses according to typical work tasks. In the design of higher vocational courses, the courses are taught according to the requirements of how to comprehensively apply the knowledge and skills of various subjects to solve the typical tasks. Design a pattern, comprehensively integrate the original scattered knowledge points into the higher vocational curriculum, improve students' learning efficiency and learning enthusiasm, and save teaching resources for the society.

1. INTRODUCTION

STEM is the abbreviation of the English initials of science, technology, engineering and mathematics. The educational concept of stem was first proposed by the National Science Council of the United States as a technological strength to enhance the United States. A science and technology strategy with the goal of encouraging students to major in science, technology, engineering, and mathematics, increasing the number of students pursuing high degrees in STEM or working in STEM-related occupations, and increasing investment in science, technology, engineering, and mathematics education. Increase the workforce with STEM capabilities. Then evolved into STEAM as the art of art joined. In recent years, the concept of stem education has been continuously developed. The concepts of stem, steam and stem+ have spread rapidly around the world. Many countries in Europe and the United States have raised stems to the level of national strategy and actively promoted and implemented the concept of stem education.

Wei Song, Liaoning Radio and Television University, Shenyang 110161, China
2. OVERVIEW OF STEM EDUCATION CONCEPT

The core of STEM education is to strengthen the education of students in four aspects: First, scientific literacy, that is, using scientific knowledge (such as physics, chemistry, biological science and geospatial science) to understand nature and participate in the process of influencing nature; second, technical literacy, that is, the ability to use, manage, understand, and evaluate technology; the third is engineering literacy, that is, the understanding of the technical engineering design and development process; the fourth is mathematical literacy, that is, students discover, express, explain, and solve mathematics in a variety of contexts. The ability of the problem. Different from traditional sub-disciplinary knowledge education, STEM education is a comprehensive inquiry education, which is based on improving students' comprehensive quality. However, it can not only understand STEM as a course. STEM education must also include teaching strategies that match the curriculum. Only from the three aspects of teaching objectives, teaching content and teaching strategies can we fully grasp and understand the connotation and requirements of STEM education, and implement STEM education scientifically and reasonably. In addition, the comprehensiveness of STEM education has two aspects, one is reflected in the content, and the second is reflected in the form.

In terms of content, STEM is a combination of science, technology, engineering and mathematics. Different from the previous four disciplines, STEM is a synthesis of four disciplines. This synthesis is not a simple collection and patchwork, but a problem-based project that uses multidisciplinary knowledge to solve problems, so it is a comprehensive project learning. In such a comprehensive project learning, through the use of the knowledge of science, technology, engineering and mathematics, the ability to comprehensively apply knowledge in science, technology, engineering and mathematics to solve practical problems is formed.

Formally, STEM is a combination of knowledge, methods, skills, abilities, attitudes and other elements. Without technological knowledge, there will be no technological innovation. Technological innovation has no attitude and emotional guidance, lacks the power of innovation and the value of innovation. Therefore, STEM literacy does not refer to knowledge alone, nor to innovation ability, but to the combination of knowledge, skills, abilities, and emotions.

3. APPLICATION IN HIGHER VOCATIONAL COURSES

Higher vocational education is an educational activity for the society to train talents who can engage in a certain occupational job with professional skills and professional ethics. The essence is also to solve the shortage of national professional and technical talents and improve national productivity. STEM education concept coincides, so STEM's educational thought also has a certain guiding role in higher vocational education.
Problems in the current design of higher vocational courses

At present, the higher vocational education in China is not highly recognized in society. This is evidenced by the scores of college entrance examinations for higher vocational education students. At the same time, because the current learning ability of high school students is relatively poor compared with the undergraduate students in ordinary colleges and universities, the curriculum design mode and professional curriculum structure of ordinary colleges and universities are not applicable to higher vocational education. However, the curriculum structure of the professional talent training programs of most higher vocational colleges in China is still in accordance with the layer-by-layer progressive mode of basic courses, professional basic courses and professional technical courses in ordinary colleges and universities. This kind of talent training method can lay a solid scientific theoretical foundation for students, and lay a good foundation for students to do scientific research work in the future. However, for students of higher vocational education, the learning effect is not ideal.

Application of STEM education concept

In the STEM education concept, STEM is a comprehensive course, and its relationship with the sub-discipline course also has two kinds of understanding. One is to replace the traditional mathematics, physics, chemistry, biology and other sub-disciplinary courses with STEM courses. Integrate to form a new STEM course. The other is to use the STEM course as a post-construction course, which is a course set after the sub-discipline. The former replaces science and technology-related sub-curricular courses with STEM courses; the latter uses STEM knowledge to research and solve engineering problems based on sub-discipline courses. For the elementary and junior high school elementary education stage, STEM should be used as a post-sub-course after the sub-discipline course. It is a comprehensive application of the knowledge of the sub-discipline, and carries out technological innovation to solve problems in practice. However, in the higher vocational education stage, the sub-discipline courses are organized by the logic of subject knowledge itself, which enables students to acquire the basic knowledge of the system in a centralized, fast and effective manner, but the disadvantage is that no real problem is the ability to use a subject. The STEM course is based on the comprehensive use of the knowledge of each subject to solve real problems. This is its advantage. Therefore, in the higher vocational education stage, we do not need to systematically explain each sub-disciplinary course as an undergraduate student, thus providing students with future scientific research has laid a solid foundation. We only need to teach students how to use the expertise of science, technology, engineering and mathematics to solve practical problems in their work.

The reason why STEM is a combination of multiple disciplines is not only the need to solve scientific and technological problems, but also the interdisciplinarity and intercommunication between science, technology, engineering and mathematics. We should focus on typical problems, emphasize the use of interrelated knowledge of various disciplines to solve problems, and improve students' practical solutions from the perspective of comprehensive application of multidisciplinary knowledge.

Taking the information security and management major of higher vocational education as an example, in the previous talent training program, students need to learn English, computer mathematics foundation, C language programming foundation, computer network technology, Linux operating system, database
foundation, etc. after entering the school. The basic course, the second year to learn
network management technology, information security technology and
implementation, web design and production, computer virus protection technology
and information security product configuration and application of professional
courses, the third year to participate in corporate practice. In this talent training
mode, although part of the curriculum design in the second year is based on the
employment standards of industry enterprises, it also adopts the method of project-
based teaching. However, in practice, it is difficult to achieve the professional
training of professional requirements for industry enterprises. The goal of talents, a
considerable number of students have lost interest in professional courses after the
first-year theoretical foundation, so the teaching effect is not satisfactory. After
redesigning the professional talent training program using the STEM concept, the
original sub-discipline course was changed to the typical work task of the
enterprise information security post to set the course, network management,
database analysis and monitoring, data backup, optimization of the online server
and Simple tasks such as data backup, support system construction, operation and
maintenance, and monitoring are set up in the first semester, and work tasks that
require certain technical capabilities, such as information security risk assessment,
penetration testing, vulnerability scanning, security hardening, and emergency
response, are opened. In the second semester, the third semester participates in
corporate practice. The design idea of curriculum system is shown in the figure1.

![Figure 1. The design idea of curriculum system.](image)

Taking the typical task of network management as an example, this course is a
new field for students who have just entered the first year of higher vocational
education, but this is the difficulty in teaching and the advantages that teachers can
use. If we still follow In the past, the traditional teaching mode, students who have
just experienced the preparatory stage of the college entrance examination will
definitely lose their sense of freshness and reduce their willingness to learn. But if
we adopt the model of asking questions, analyzing problems and solving problems,
let the students take the initiative to teach the teachers as apprentices. Learning the
practical problems that need to be solved in current social practice, even students
who meet the teacher assessment criteria can directly join the corresponding
practical projects to earn tuition, so the effect of learning can be imagined. For this
course, we proposed how to join the computer network, how to set up a two-
machine internet, how to set up a small office network and other 16 specific work units (as shown in Table I), and then decompose these work units one by one into the computer. The specific content of the basics, computer mathematics foundation, professional English, corporate culture, software engineering and other disciplines, let students learn how to do it first, and then know why.

<table>
<thead>
<tr>
<th>Work unit</th>
<th>Subject knowledge</th>
<th>Class hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>How to join a computer network</td>
<td>Computer Science; English; network technology; operating</td>
<td>6</td>
</tr>
<tr>
<td>How to set up a two-machine internet</td>
<td>Computer composition; English; network technology; operating system</td>
<td>4</td>
</tr>
<tr>
<td>How to set up a small office network</td>
<td>Computer Science; English; network technology; corporate</td>
<td>4</td>
</tr>
<tr>
<td>How to connect the printer to the network</td>
<td>Computer composition; English; operating system; system;</td>
<td>2</td>
</tr>
<tr>
<td>How to plan and assign an IP address</td>
<td>Computer Science; computer mathematics; program basis;</td>
<td>4</td>
</tr>
<tr>
<td>How to divide the network segment</td>
<td>Computer Science; computer mathematics; program basis</td>
<td>4</td>
</tr>
<tr>
<td>How to configure a Layer 2 switch</td>
<td>Computer Science; operating system; network technology;</td>
<td>8</td>
</tr>
<tr>
<td>How to configure VLAN</td>
<td>Computer Science; operating system; network technology;</td>
<td>8</td>
</tr>
<tr>
<td>How to configure one-arm routing</td>
<td>Computer Science; operating system; network technology;</td>
<td>8</td>
</tr>
<tr>
<td>How to configure static routes</td>
<td>Computer Science; operating system; network technology;</td>
<td>8</td>
</tr>
<tr>
<td>How to configure switch port security</td>
<td>Computer Science; operating system; network technology;</td>
<td>4</td>
</tr>
<tr>
<td>How to use a firewall</td>
<td>Computer Science; operating system; network technology;</td>
<td>4</td>
</tr>
<tr>
<td>How to achieve internetworking</td>
<td>Operating system; network technology; English</td>
<td>4</td>
</tr>
<tr>
<td>How to access the Internet</td>
<td>Computer Science; English; computer mathematics</td>
<td>4</td>
</tr>
<tr>
<td>How to set up a small wireless network</td>
<td>Operating system; English; computer composition</td>
<td>4</td>
</tr>
<tr>
<td>How to configure common network services</td>
<td>Operating system; software engineering; corporate culture; English</td>
<td>4</td>
</tr>
</tbody>
</table>

4. CONCLUSIONS

Course design based on STEM concept requires that the learning process of higher vocational education must be an inquiry-based learning model based on typical work tasks, emphasizing practical inquiry and work process, which is different from the theoretical basis of the first study of various subjects in general
higher education. Then use these theories to understand the learning patterns of more complex professional knowledge.

The main reasons for the difference between the two educational models are:

First, the training objectives and orientation of the two are different. Higher vocational education trains high-skilled talents. After graduation, they should be able to have the ability to work in specific jobs in a certain industry, while ordinary higher education trains research-based technology. Talents, what they have acquired in higher education should be a solid theoretical foundation and a good scientific and cultural literacy.

Second, the difference between the two training subjects, the current level of higher vocational education students' learning ability and willingness to learn are generally lower than the average higher education students, they are not suitable for the traditional indoctrinating teaching mode.

There are still many details for the application of the STEM education concept that we need to study. For the problems raised by the typical work tasks, we also need to continuously improve the curriculum design according to the implementation of the curriculum teaching, verify its effects, and make corrections and improvements. This will also be a huge challenge for teachers engaged in higher vocational education.

REFERENCES