IJMEHD
INTERNATIONAL JOURNAL OF MANAGEMENT AND EDUCATION IN HUMAN DEVELOPMENT

International J. of Management & Education in Human Development

ISSN: 2775 - 7765
web link: http://www.ijmehd.com

Research on Practical Teaching Reform of Engineering Specialty Based on Steam Education

Cong,Xie

Guangxi University Xingjian College of Science and Liberal Arts, Nanning 530005, China;
Jose Rizal University, Philippines

Received: 20/08/2021 Accepted: 26/12/2021 Published: 15/03/2022

Representative e-Mail:2581164251@ qq.com

ABSTRACT

At present, higher education has been popularized, but many students trained by colleges and universities are not suitable for enterprise jobs. This study analyzes the research status at home and abroad, formulates a questionnaire, analyzes the data after collecting the data, and then formulates corresponding measures to improve students' practical ability. Through the reform, students' comprehensive ability has been strengthened. After graduation, they can quickly adapt to the job needs of enterprises. Enterprises can also greatly reduce the training cost and achieve a win-win situation.

Keywords: *STEAM, Engineering, Education, Practical Teaching*

I. INTRODUCTION

From the background of the times, we are in an era of high technological change, from the Internet of things, artificial intelligence to intelligent manufacturing. All these have not only changed our way of life, but also changed our mode of production, especially put forward new requirements for talents needed for future employment and industrial development. In this process, the future talent competition is mainly the competition of knowledge and skills. China attaches great importance to the cultivation of talents. However, their methods and means are different. From international experience, steam education, as a carrier to cultivate students' inquiry ability, critical thinking ability and communication ability, has a very good effect. Steam education realizes interdisciplinary integration through science and technology, pays attention to students' practical application ability, and aims to cultivate compound application talents with scientific thinking methods and can comprehensively use multidisciplinary knowledge to solve practical problems. Finally, it can quickly adapt to changeable enterprises and make itself have a place in the highly competitive workplace.

II. LITERATURE REVIEW

2.1 Related Literature and Studies

2.1.1 Related concepts: Steam Education

Steam refers to science, technology, engineering, arts and mathematics. Steam education is a comprehensive education integrating science, technology, engineering, art and mathematics. Steam is a kind of educational concept, which is different from the traditional one subject, which emphasizes book knowledge. Steam is a kind of interdisciplinary education concept which emphasizes practice. The success of anything depends not only on the realization of a certain ability, but also between various abilities. For example, in the process of building high-tech electronic products, it not only needs science and technology, but also uses high-tech means to innovate product functions, but also needs good-looking appearance, and is also an integrated ability in art, So the application of single skills cannot support the development of future talents. In the future, we need comprehensive talents in many aspects, and then explore the steam education concept.

The 13th five-year plan for educational informatization issued by the Ministry of education in 2016 proposed that students' innovative awareness and innovation ability should be improved and students' all-round development should be promoted. Therefore, we can integrate all disciplines, guide students to explore, dialogue and critical thinking, which is conducive to eliminating the phenomenon of students' isolated view of knowledge of each subject and forming a complete world view; It is helpful for students to explore the memory relationship between the

knowledge of each subject and find new knowledge; It is helpful to cultivate students' broad cognitive vision, improve their ability of knowledge integration, and make them learn to solve problems comprehensively.

2.1.2 Review of the current situation of domestic research

a) Current Situation of Foreign Research

In the 1990s, the National Science Foundation of the United States began to propose steam education strategy. At the same time, in developed countries, such as Germany, Britain, Finland and other countries, steam education has been studied, and the theory is relatively mature. In the aspect of theoretical research, the steam related articles published by foreign researchers are mostly conceptual and empirical. In the early stage, brown (2012), henderson., beach, Finkelstein (2011) and Henderson (2011) etc. reviewed the teaching reform of steam undergraduate course. In the later period, Kim, Sinatra, seyr ani an (2018), and according to Margot and Kettler (2019), the researchers have different views on the cross disciplinary integration and talent training mode of steam education, and points out many challenges teachers face in the process of steam education practice.

From the development of steam education, steam has shown a strong system and structure since it was proposed. From the expansion of the disciplines included, from undergraduate to primary and secondary schools, the attention of the government to all kinds of schools reflects the rapid development and the tremendous vitality of steam education. In the future, steam Education will grow up in various countries more rapidly.

b) Current Situation of Domestic Research

The domestic research is relatively late, only in 2008 began to appear related research, in recent years began to emerge a number of scholars' research results. In April 2017, zhongbinglin, head of the Chinese Academy of education, said in the "general meeting of the founding of the science and Innovation Education Alliance of the Chinese Educational Association and the International Forum on science and technology education", said: "teaching reform must pay attention to providing diversified choices to students. We can try to set steam as a special elective course, which provides different opportunities for students with different interests and interests to participate in different projects, Stimulate students' interest and creativity in learning; It can also try to integrate steam education into the daily teaching of the school, and let them understand the relationship and cross disciplinary relationship in the course teaching process, and provide students with the opportunity to explore independently ". In July 2017, the Central People's government issued Article 6 of Chapter 5 of the new generation artificial intelligence development plan, which states that "implementing the national intelligent education project, setting up courses related to artificial intelligence in primary and secondary schools, gradually promoting programming education, encouraging social forces to participate in the development and promotion of programming teaching software and games with music"“ Support the development of artificial intelligence competitions and encourage the creation of science popularization of artificial intelligence in various forms ". The plan clearly requires that it should actively explore the application of information technology in steam education, namely interdisciplinary learning, maker education and other new education modes, and strive to improve students' information literacy, innovation awareness, innovation ability and comprehensive application ability.

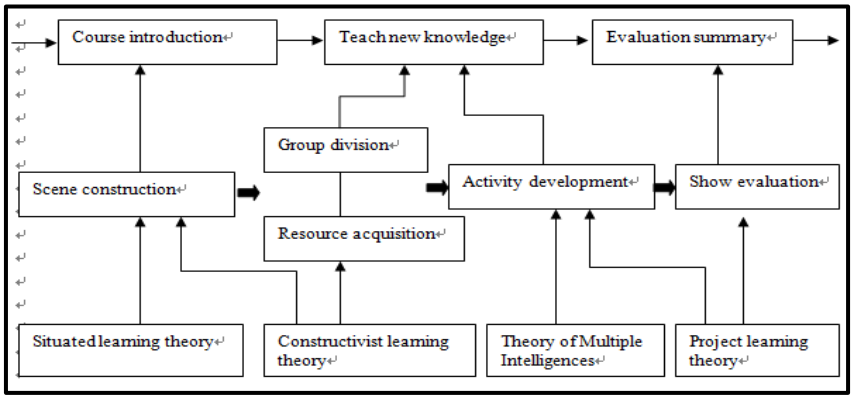
2.2 Relevance of Related Literature and Studies to the Current Study

Through the research of this topic, I hope that more people will realize the important role of steam education in training innovative and complex talents and the practical significance for promoting social development, and hope that the first-line teachers can deepen steam education into the classroom, and use the method of applied practice to study. Secondly, it is hoped that schools and teachers pay attention to interdisciplinary education, This paper attempts to find a teaching mode suitable for engineering specialty education, so as to improve students' practical application consciousness and innovative practical ability.

Secondly, through the literature research of steam education, the essence, connotation and educational framework of steam education are expounded, and the characteristics and integration points of steam engineering specialty are summarized, and the new steam education field and research direction are explored, which provides a new development thinking for the engineering specialty in steam education.

2.3 Theoretical Framework

In the design of specific steam curriculum activities, this study uses different educational theories to support the design of corresponding links for teachers' activities and students' activities. Each link and corresponding theory are shown in the figure.



2.4 Conceptual Framework

Firstly, based on the previous research and literature research, this paper combs the current situation of steam curriculum design, implementation and evaluation; According to the actual situation of engineering specialty, steam curriculum design is carried out, including four aspects: determining steam teaching objectives, selecting existing subject experience, organizing steam curriculum content, and evaluating the effectiveness of curriculum design; Next, make the plan of curriculum implementation and carry out the formal curriculum experiment; Finally, steam curriculum evaluation is carried out in various ways.

On the whole, the course is based on the steam education concept, with the integration of multi-disciplinary knowledge and methods as the innovation point. The course content connects with students' core literacy and subject literacy. Core literacy is the goal orientation of steam curriculum implementation, and steam curriculum practice promotes the achievement of core literacy goals. The technical route of this research is shown in the figure.

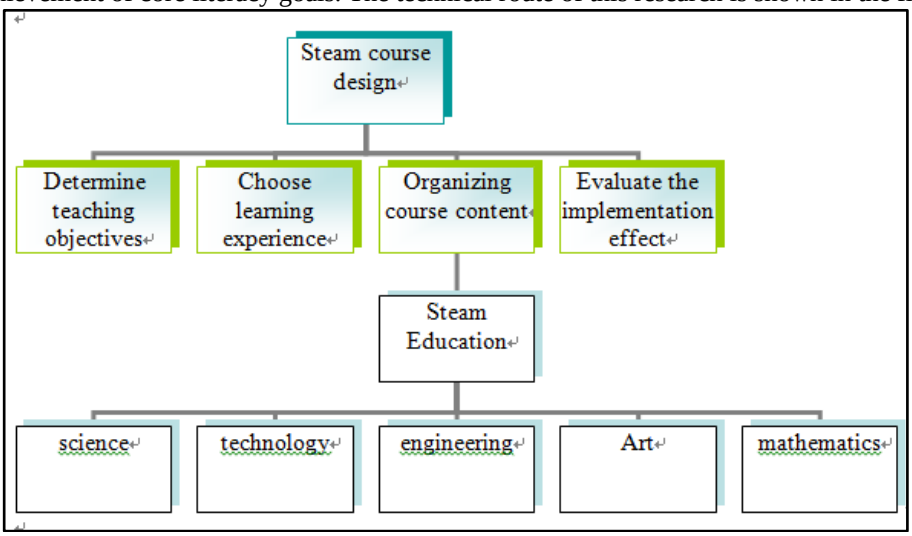


Figure 2. Conceptual Framework

III. RESEARCH METHOD

3.1 Population and Sample

The subjects of this survey are mainly the students of 12 engineering majors in our university.

In May 2021, 170 questionnaires were distributed and 166 valid questionnaires were collected, with a recovery ratio of 97.65%. There are 80 boys and 86 girls.

This questionnaire mainly investigates the current situation of students' comprehensive application ability and knowledge practice ability of multi-disciplinary knowledge. Because students' cognition of subject integration ability is relatively shallow, they use multiple-choice questions in the questionnaire, and use other easy to understand questions in the survey report to replace the elements of subject integration ability. This survey mainly focuses on students' attitude towards science courses, their cognition of experimental courses and their cognition of science on personal development.

3.2 Research Locale

The research place mainly concentrates in me -- Guangxi University Xingjian College of Science and Liberal Arts.

3.2 Research Design

3.2.1. Generation of steam course

This paper mainly expounds the generation of steam curriculum. Steam course is an interdisciplinary education concept which focuses on students' practice. To generate a steam course, it needs to be completed by many forces. All subject teachers in professional education can participate in the course production. For example, the steam course of smart farm under construction in our school is divided into three levels according to the study age of students, and the steam series courses of low, medium and high-level smart farm are produced to let children experience the whole life growth process. In the course, teachers of all disciplines collect knowledge related to smart farm, explore the integration point of this course to integrate knowledge, and generate a steam course. For example, one of the most important aspects of smart farm is automatic irrigation technology. To generate a steam course on automatic irrigation technology, biological teachers should provide how to judge whether plants lack nutrient solution and nutrient proportion; The physics teacher provides how to make the simple and automatic irrigation technology principle and the production plan; Mathematics teachers provide nutrition matching scheme and project implementation steps; Chinese teachers provide report writing template and evaluation of course learning effect.

In a word, a complete steam course should cultivate students' ability of searching knowledge, using knowledge and practice one by one. Therefore, this part mainly seeks the teachers of all disciplines in the school to participate in the production of a complete steam course.

3.2.2. Comparison of the integration ability of steam teaching and traditional teaching

The control group students were taught steam course; Class B students carry out traditional mode teaching, and the knowledge learned in class A and class B are the same. Through the development of colorful evaluation methods, the teacher and students of steam are evaluated in two ways, and the differences between students' understanding and practical ability are analyzed.

a) The evaluation of steam teaching based on students' interest and learning effect

The study interest and the content of concern of the two groups of students are investigated. Combined with the evaluation and analysis of the two groups of teaching, the differences between the two teaching methods are obtained. Combining with the students' learning tendency, the teaching methods that are more suitable for students are found.

b) Conclusions, suggestions and Reflections on the research

Steam education, as an educational way to cultivate innovative talents, has created more practical opportunities for students, and made educational value have a higher platform. But steam education is still in the exploratory stage at home and abroad. It is an attempt to innovate the education mode. The development of each course requires a lot of human and material resources, which has the high difficulty of curriculum development and a long development period. How to develop steam course on the basis of national curriculum and existing laboratory, so as to shorten the difficulty and cycle of development, it is worth further research.

3.3 Method or Procedure

1. Literature research method: Based on the previous data collection and data collation, mainly search the literature about steam teaching, summarize the definition of relevant keywords, such as "steam", "innovative education", etc., in addition, use the data of steam teaching for engineering majors in the literature as the basis for research.
2. Investigation method: the students and teachers who participated in steam teaching were investigated by questionnaire, and the following groups were compared: students who accepted steam teaching; A teacher who teaches steam. According to the survey of teachers' teaching situation and students' knowledge proficiency and hands-on ability, the data results are obtained by comparison.
3. Case study method: mainly group research, for teachers, students and other groups, case study on the teaching situation of two groups of teachers and students in steam teaching, understanding the teaching situation of teacher team and steam curriculum generation, and studying whether students adapt to and like steam teaching mode.
4. Experience summary method: summarize the literature, survey data and case observation results, summarize the steam teaching effect and teaching experience, and draw a reasonable implementation plan.

3.4 Instruments

Analysis with SPSS software

IV. DISCUSSION

4.1 Analysis of survey results

4.1.1 Attitude towards science courses

According to the questionnaire data collected, 100% of the junior students think that science is important, and more than 58% think that science is as important or more important as the main subject; More than 83% of senior high school students hope to have three or more science classes a week, and 37.6% of them hope to have four science classes a week. Among them, 86.4% thought science courses were as important as major subjects, and 4.9% thought science courses were the most important; More than 58% of the senior students hope to have seven or more science courses a week, and 9.9% of the students hope to have less than six courses a week. At present, in the second grade, the school implements four courses a week in physics and two courses a week in biology. It can be seen from the data that under the current education system, although science courses do not occupy the main subject status, both the lower and higher grades have a strong interest in science courses and hope to increase the number of science courses on the basis of the current. In terms of the choice of teachers, boys and girls in lower grades choose young female teachers more, while boys and girls in higher grades also choose young male teachers more, which shows that students in lower grades and higher grades generally prefer young teachers with passion, while girls in lower grades prefer young female teachers with strong affinity, The higher grades prefer more rational young male teachers, which shows that the lower grades emphasize emotional communication in class, while the higher grades emphasize rational thinking training.

4.1.2 Cognition of experimental course

Experimental class is the only platform for almost all students to use knowledge and practice. In order to understand students' ability in this field, experimental class is undoubtedly an important research object. According to the collected questionnaire data, in terms of the types of science courses, more than 85% of junior and senior students choose the experimental and production courses they can participate in, and only 7.2% of students choose to watch the teacher's demonstration and listen to the teacher's explanation. In the selection of experimental course types, both junior and senior students tend to choose experiments with less difficulty, which are "simple experimental operation, simple data recording and easy to draw experimental conclusions". Only 11.4% of students choose experiments in senior grades. The experimental operation and data recording are complex and it is difficult to draw experimental conclusions, which shows that students are more looking forward to hands-on, Enjoy the process of experimental exploration and recording, and are not interested in the experimental conclusions. And in the face of more difficult

experiments, they show a very obvious fear of difficulties. 55.3% of the junior students thought they had more mobile phone skills, while 65.4% of the senior students thought they had more mobile phone skills. Among students who think they have more mobile phone skills, more boys than girls. 78.3% of the students will make further consolidation or new exploration after the experimental class, 15.7% of the students will not do it because they can't find available experimental materials, and only 6.0% of the students will not do it because they don't want to do it, which shows that the vast majority of students have the desire to use knowledge to explore. Most students hope to have an experimental class every two classes on average, and only 7.2% of the students hold an indifferent attitude. The survey also found that most students believe that they can learn a lot of scientific knowledge through experiments, improve their practical ability and exercise their ability to comprehensively use knowledge. Most students choose to study science courses and master a lot of scientific knowledge, while the least students choose to complete any experiment that requires the comprehensive application of multidisciplinary knowledge. This shows that most students do not have a clear understanding of the relationship between disciplines, cannot break through the inherent obstacles of discipline thinking, lack of experience in the comprehensive application of knowledge, and have low discipline integration ability. This not only makes students lack the overall perception of things, but also is not conducive to the cultivation of students' scientific literacy and limits the development of students' innovation ability.

4.1.3 Cognition of science and personal development

According to the collected questionnaire data, most students can vaguely feel that the learning of science curriculum and the learning of other disciplines are interrelated and promote each other. Most of the students in the basic education stage lack the experience of participating in the comprehensive curriculum and the ability to sort out and summarize knowledge. They can only vaguely feel that there is a certain connection between disciplines, but they cannot clearly understand it. Students' awareness of discipline integration is not obvious, and their awareness of cultivating their own innovation ability in science curriculum is not clear. The author believes that students' innovative ability can be divided into three specific abilities: practical ability, the ability to comprehensively use multi-disciplinary knowledge and the ability to gradually deal with complex problems.

4.2 Investigation conclusion

According to the results of the questionnaire, students in the stage of basic education have a strong interest in science courses, and are more willing to take hands-on experimental courses. Although science courses do not occupy the main subject position in the stage of basic education, most students still recognize the importance of science courses and have a clear understanding of the purpose of learning science courses; In the understanding of experimental course, which is of great significance to cultivate students' innovative ability, students also show strong interest in learning. However, according to the front-line teachers and survey data interviewed by the author, some students' cognition of experimental course is still "very fun", and they think less about the essence of experimental principles and scientific phenomena, especially in the lower grades, Moreover, the students' fear of complex experiments is also prominent; Most of the students do not have a clear understanding of the ability of hands-on practice, comprehensive application of multi-disciplinary knowledge, and step-by-step processing of complex problems cultivated in the experimental course. They have serious solidified thinking of sub discipline learning, are not sensitive to the relationship between disciplines, and lack of experience of multi-disciplinary integrated learning. This is not only not conducive to the improvement of students' comprehensive quality, but also far from the innovative education concept pursued by modern education. These phenomena are also the problems that front-line teachers are eager to solve in the process of education reform.

V. CONCLUSIONS

Through this research, firstly, set up corresponding innovation practice courses and set up a product research institute for comprehensive technology application to guide college students' innovation and application practice, so that college students can make full use of what they have learned to jointly develop products, so as to improve the practical application ability level of college students majoring in engineering to a certain extent.

At the same time, through the implementation of this project, students can improve their knowledge structure, consolidate their professional quality, enhance their comprehensive quality and expand their employment adaptability according to the requirements of employers; It can enable the school to adjust the professional training program according to the needs of the market, jointly train high-quality compound and applied talents with employers, and solve the problem of difficult employment.

REFERENCES

Li Qingfu, Wang Jinwei, Liu Chenhui. Discussion on the improvement of professional practice ability of engineering college students [J]. Education and teaching theory, 2016 (50): 141-142.

Zhao Wanzhao, Zhou liuna, Huangjiang. Research on the construction and management of automation training base in Colleges and universities [J]. Jushe, 2017 (30): 165.

Luo Xinhong. Analysis of employability of application skilled talents [J]. Integrated circuit application. 2018 (11): 52-53.

Huang Jingjing, Luo Xingwu, Tian Panpan, Sun Li, Zhang qiaohui. Analysis of current problems in the cultivation of applied skilled talents [J]. Educational observation. the first half of the month), 2017,6 (11): 55-56

Cui Hong, Zhu Jiahua, Zhang Xiuhong. Analysis of steam learning based on Project: Perspective of core literacy [J]. Journal of East China Normal University, 2017 (04).

Li Yichuan. Thoughts on the cultivation of scientific and technological innovation ability of engineering college students [J]. China Adult Education, 2017 (15): 72-75.

Ma Yunxia. Research on robot teaching practice in normal universities under the concept of steam Education [D]. Xi'an: Shaanxi Normal University, 2017.

LV Yanhui. Core spirit of stem Education [J]. Contemporary educational science, 2017 (5): 16-19.

Qin jinruo, Fu Gangshan. STEM Education: interdisciplinary education based on real problem scenarios [J]. China audio visual education, 2017 (4):67-74.