
Research on the Project-Type Teaching of Basic Computer Courses in Medical Schools under the Concept of STEAM Education-A Case Study of the Course Python Programming

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Abstract – For undergraduate medical schools applied talent training problems, build based on Science, Technology, Engineering, art and Mathematics multidisciplinary integration of super discipline education idea (STEAM education concept) project teaching mode, developed into the course ideological elements teaching case, with the help of "online and offline" teaching platform to optimize students' learning process. New teaching mode will be scattered knowledge integration, series into a "project" task as the main line of learning tasks, provide students with more opportunities to independent learning, by setting the quantitative and quantitative evaluation index, from the students' project case study, computer experiment, classroom performance, paper work and the final appraisal five aspects of the students. Extracurricular expansion guides students to apply theoretical knowledge to practice, and further enlighten medical students' thinking and improve their information literacy by participating in various competitions at all levels. By analyzing the advantages of project-based teaching mode, combining with typical ideological and project cases to explore and study relevant knowledge points, it provides reference for the computer basic courses of similar universities to better carry out project-based teaching reform.

Keywords – STEAM Education Concept, Medical School, Project-Based Teaching Mode, Teaching Reform.

I. INTRODUCTION

As the main battlefield of talent training at the present stage, higher education has the most direct and extensive connection with the STEAM education ability training of future talents. In recent years, in order to cope with the epidemic, the Internet and education have been continuously infiltrated and integrated, and the hybrid teaching model has also emerged. "STEAM education idea" is a kind of interdisciplinary comprehensive education form, is the current education to explore the new form ability of important ideas and measures, it by Science, Technology, Engineering, Art, Mathematics word abbreviation, emphasizes the mutual penetration and integration between disciplines [1]. STEAM education can promote the development of college students' interdisciplinary thinking and creativity, cultivate their innovation ability and question-asking ability, and become an internationally competitive talent [2]. In today's society, the impact of multicultural, exquisite egoism and money worship are extremely easy to erode the education circle. General Secretary Xi Jinping has repeatedly stressed that college education should adhere to moral education and ideological education throughout the whole teaching process, so as to achieve the purpose of collaborative education between professional courses and ideological and political courses [3]. Therefore, it is also the need of The Times to integrate ideological and political elements into teaching. The talent training of colleges and universities should keep pace with The Times, and the ideological and political education should be strengthened while cultivating students to learn knowledge. Project-based teaching is a constructive way of teaching and learning. Teachers project students' learning tasks, guide students to understand problems based on real situations, solve problems

through analysis, discussion and practical operation, and display project results. The teaching mode is student-centered and pays attention to the cultivation of students' collaborative innovation ability and practical inquiry ability [4].

The significance of computer basic teaching lies in innovation and application. How to cultivate students' innovative ability is the need of the development of The Times, but also the need to improve the quality of the whole Chinese nation. The basic computer courses of medical schools include theoretical knowledge and practical skills, which are highly practical and applicable, aiming to improve college students' information processing and processing ability, and improve information literacy [5]. The course of "Python Programming Design" is an important link of the basic university computer education, an important teaching link for the medical colleges and universities to achieve the goal of talent training, and an important carrier for cultivating medical students' information literacy and innovation ability [6]. In order to meet the medical professional medical big data analysis, data visualization and medical image processing intelligent medical application needs, course team actively build based on "STEAM education concept" project teaching mode, for the construction of computer courses of medical colleges, teaching reform and talent training to provide theoretical support and practical guidance, so as to inspire medical students thinking, improve medical students information literacy, improve the comprehensive application ability teaching purpose [7].

II. BUILD A PROJECT-BASED TEACHING MODE BASED ON THE "STEAM EDUCATION CONCEPT"

The core of the project-based teaching mode is to be students-centered and transform the teaching process from the teacher's teaching to the students' independent learning and discussion [8]. Using the "STEAM education concept", the use of health care or specific cases related to the actual life, can not only make medical students understand what they have learned, but also make them more intuitively feel the feasibility and convenience of Python language application in this major, and greatly stimulate students' interest in learning. Table 1 shows the guidance of some project cases and the "STEAM education concept" involved in them.

Table 1. Some project guidance cases and "STEAM education concept".

Number	Project Case Guidance	The Embodiment of STEAM Educational Concept
1	<p>Project guide: the realization of an animation character portrait that you like</p> <p>Project Description: In the initial stage of learning the Python language, students need to master the interactive or scripted operation methods of learning the Python language. In this project, students are guided to guide the students to understand the operation method and output mechanism of Python.</p>	<ul style="list-style-type: none"> ● Science: The development of the Python language. ● Technology: Installation technology and development environment configuration of the Python. ● Art: The drawing of the cartoon character portraits in the project guide case.
2	<p>Project guidance: How to lose weight scientifically</p> <p>Project Description: Understand the relevant basic knowledge and grammar characteristics of Python language through this case. Weight loss is a concern of contemporary people of all ages, and it is also closely related to medical knowledge. In this project, the weight, height, age, exercise coefficient and food of the input object can calculate the daily calorie consumption of</p>	<ul style="list-style-type: none"> ● Science: The "scientific weight loss" case in the project guidance reflects the ubiquitous science in life. ● Engineering : The computer practice cultivates students' software craftsman spirit, and then links the similarities of engineering subjects.

Number	Project Case Guidance	The Embodiment of STEAM Educational Concept
	the object, and then determine the daily food intake by selecting the daily food intake, so as to achieve the purpose of calorie intake less than calorie consumption and scientific weight loss. Therefore, students can have a preliminary understanding of Python basic knowledge, code specifications, program packaging and other content, and lay a solid foundation.	<ul style="list-style-type: none"> ● Mathematics: Involves the conversion of binary, octal and hexadecimal; Using Pythagorean theorem to solve the side length of any right triangle.
3	<p>Project guidance: Reading and output of information of grade A and above hospitals in each province</p> <p>Project Description: When learning the storage and display of the data in this chapter, you need to first understand the data storage form of the Python, namely the Python container. In this project, the information table of hospitals in each province is opened and stored through programming, and the required information is read from the documents and output. This project not only fits the professional background of medical students, but also encourages students to understand the relevant hospital information in advance to prepare for the future employment. In addition, it also helps students to understand the common container use methods in Python language, and introduces the relevant knowledge points to be mastered in this chapter.</p>	<ul style="list-style-type: none"> ● Technology: The application of computer technology science to quickly read and output the information of the 3 and above hospitals. ● Engineering: The computer practice cultivates students' software craftsman spirit, and then links the similarities of engineering subjects. ● Art: Enlightenment and application of Yang Hui's triangle recursion rule in art creation in the course. ● Mathematics: Introduce the Catalan number in mathematics and the Yang Hui triangle, discover the recursive law, determine the deduction formula, so as to generate the core code.

In terms of course design, according to the syllabus and teaching objectives of basic computer courses, the goal of training professional talents in medical schools and the professional requirements of doctors, the team members fully explore the ideological and political elements contained in them, penetrate China's national conditions and interdisciplinary concepts, and then develop ideological and political cases of the course. The textbook used in this study is the Foundation of Python Programming published by Tsinghua University Press. Table 2 shows part of the teaching cases and related knowledge points designed by the course Python Programming as an example.

Table 2. Ideological and political cases and related knowledge points of some courses.

Number	Ideological and political cases	Knowledge point
1	<p>(1) By introducing Python language to students, understand the current situation of software development in China, compare it with other high-level program languages, analyze its advantages and disadvantages after understanding their characteristics, and then integrate into ideological and political education, teach students to learn to correctly understand themselves and learn from each other's strengths.</p> <p>(2) By introducing the application field of Python language, especially in many applications in the medical field, students can more intuitively understand the feasibility and convenience of the application of Python language in this major, which will greatly stimulate students' interest in learning.</p>	<p>➤ Python Introduction (concept, development history, Python 3.0, Python features, Python application field)</p>

Number	Ideological and political cases	Knowledge point
2	<p>(1) Learn the naming rules of Python basic operators and the priority of common operators to perceive the rules of computer language, and then promote the social norms, so that students understand the importance of rules.</p> <p>(2) The computer experiment of this course is connected with the experimental operation course of medical students. Although the knowledge learned is different, the essence needs to cultivate students' hands-on practical ability and craftsman spirit, so as to improve medical students' professional quality, professional responsibility and sense of honor.</p> <p>(3) Learn the binary, octa-system and hexadecadal system commonly used in computer language, understand its connection with the Yin and Yang gossip in Chinese culture, experience the dialectical philosophy, feel the extensive and profound Chinese culture, and improve national pride.</p>	<p>➤ Python Basic operators (arithmetic operator, string operator, comparison operator, assignment operator, logical operator, member operator, common operator priority)</p>
3	<p>(1) When learning the data types of Python language standards, introduce the Catalan numbers in mathematics to analyze the characteristics of the model, so as to find out the recursive laws, and cultivate students' interdisciplinary consciousness and inquiry spirit.</p> <p>(2) By asking students to program the number and frequency of the "great rejuvenation of the Chinese nation", "cultivating people by virtue" and "education" in general Secretary Xi Jinping's important speech at the National Education Conference, so that students can feel the far-reaching significance of education.</p>	<p>➤ Python Standard data type (Python assignment of variable and standard data type, number, string, list, list, tuple, dictionary, set)</p>

"STEAM Education concept" is consistent with the direction of China's new medical construction. The new medical construction aims to cultivate high-quality medical talents with international vision, local feelings and innovation ability, so as to meet the people's demand for medical and health services in the new era. At the same time, it also emphasizes the intersection of medicine and other disciplines, promoting the innovative development of medical education^[9]. According to the "STEAM education concept", combined with the direction of new medical construction, the curriculum reform from the practical problems, guide students to simplify the solution steps of complex medical problems with computer programming, and cultivate students' interdisciplinary thinking and innovative consciousness. The hybrid teaching mode of basic computer courses based on "STEAM Education concept" is shown in Figure 1: "STEAM Education concept" is consistent with the direction of China's new medical construction. The new medical construction aims to cultivate high-quality medical talents with international vision, local feelings and innovation ability, so as to meet the people's demand for medical and health services in the new era. At the same time, it also emphasizes the intersection of medicine and other disciplines, promoting the innovative development of medical education^[9]. According to the "STEAM education concept", combined with the direction of new medical construction, the curriculum reform from the practical problems, guide students to simplify the solution steps of complex medical problems with computer programming, and cultivate students' interdisciplinary thinking and innovative consciousness. The hybrid teaching mode of basic computer courses based on "STEAM Education concept" is shown in Figure 1:

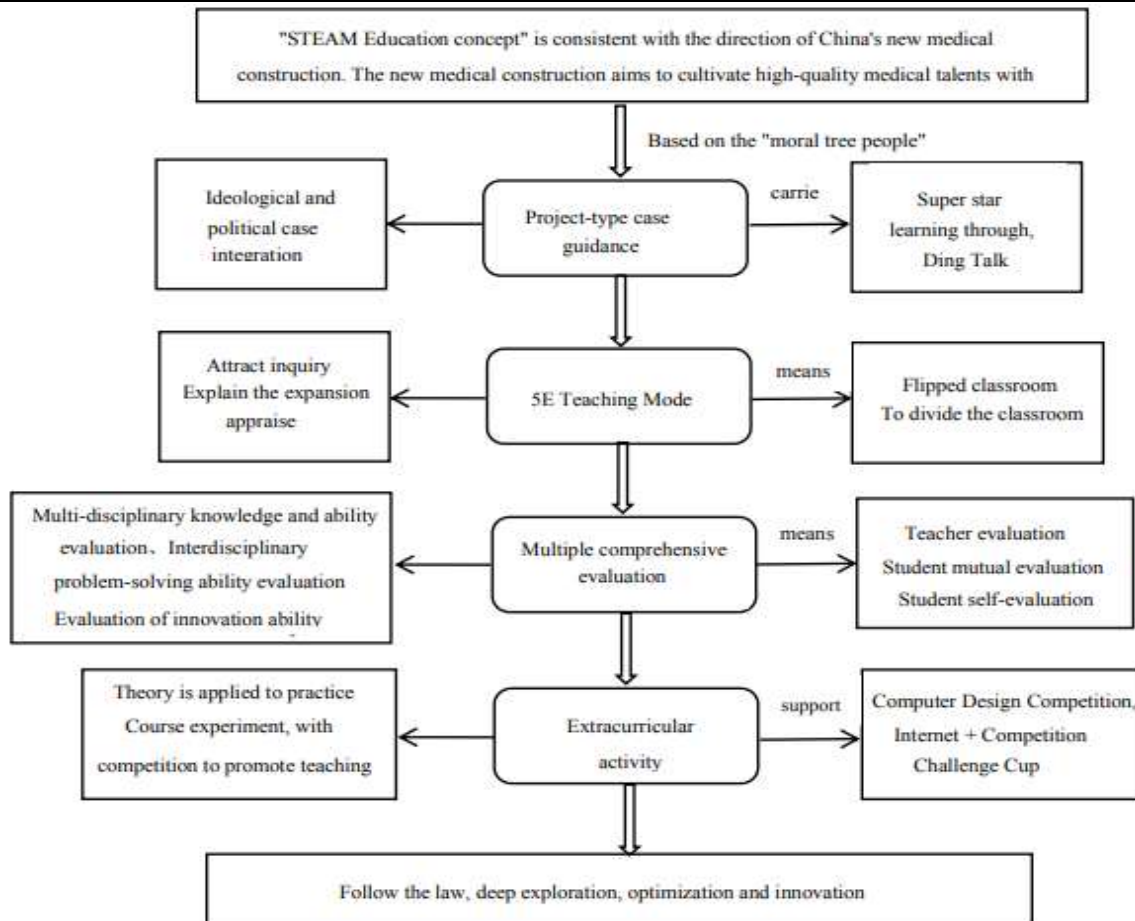


Fig. 1. The teaching mode of basic university computer courses based on the "STEAM Education Concept".

The teaching mode is under "STEAM education concept and new medical construction direction" as the general guidance, and implements the fundamental task of moral education through online and offline mixed teaching. Before the chapter, the project learning case is released through SuperStar Learning to guide students to have an overall grasp of the whole chapter. Ideological and political elements and relevant medical knowledge are integrated into the project case to help students form a correct outlook on life and values. Classroom teaching resources are integrated online, 5E teaching mode is adopted, teaching^[10] through five links of attraction, inquiry, explanation, expansion and evaluation, and using flipped classroom and classroom teaching methods to effectively improve students' awareness of innovation and divergent thinking. Teaching evaluation aims at multi-comprehensive evaluation, combines mutual evaluation with self-evaluation, and conducts multi-disciplinary knowledge and ability evaluation, interdisciplinary problem solving ability evaluation and energy creation ability evaluation. Relying on relevant competitions, such as computer design competition, Internet + competition and Challenge Cup, to guide students to apply theory to practice, better complete course experiments, so as to promote teaching through competition.

III. BUILD TEACHING RESOURCES BASED ON "STEAM TEACHING CONCEPT"

The course team has compiled basic computer courses, such as Python Program Design Foundation and University Computer, published by Tsinghua University Press, independently developed the online examination platform, and completed the final examination of basic computer courses for nearly 4,000 medical students every year. In addition, a number of computer experiments after class, combined with the direction of new

medical construction, the computer technology is applied to medical research. The course team guides students to participate in the National College Student Computer Design Competition: in 2022, they won one national first prize, two national third prizes, three team teachers won the provincial "Excellent instructor"; in 2023, they won two national second prize, and three team teachers won the provincial "Excellent instructor", truly promoting teaching through competition. The project teaching case developed with "Python Program" as an example of the project reflects the "new concept of STEAM teaching", which fully reflects the gender of the national first-class curriculum.

IV. ASSESSMENT METHOD

The course focuses on process assessment, and adopts the method of multiple comprehensive evaluation to test students' learning effect. The project case learning, computer experiment, classroom performance and paper homework are included in the assessment system, and quantitative and non-quantitative evaluation indicators are set to objectively evaluate the overall evaluation of students' learning. The overall course evaluation is divided into normal scores: 30% (project case study 10%, computer experiment 30%, classroom performance 30%, paper homework 30%), and final test scores: 70%. The computer experiment project is completed by forming a study group with the help of flipped classroom, which brings the main body of teaching back to students. The multi-comprehensive evaluation mechanism organically combines self-evaluation, mutual evaluation and teacher evaluation, so as to mobilize students' enthusiasm for learning, cultivate students' interdisciplinary thinking and computational thinking, and improve the depth and challenge of course learning.

V. CONCLUSION

The development goal of STEAM education is to cultivate innovative compound talents^[1] who comprehensively use interdisciplinary disciplines to solve practical problems. Course team adhere to tree, to the student center, with "STEAM education concept" as the theoretical guidance, with "Python programming foundation" course as the carrier, driven by project learning, guide students through contact between different subject knowledge to solve practical problems, and give the medical school computer basic course project teaching mode, follow the integration of online, multiple comprehensive evaluation of teaching idea, do according to their aptitude, so as to improve the learning effect and teaching quality.

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