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Teaching Reform and Practice of the "Python Language Basics" Course Integrating Curriculum Ideology and Politics and Computational Thinking - A Case Study of Taishan University

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***Abstract*—To align with the talent development goals and vision of cultivating students with distinct abilities, applied undergraduate colleges and universities should focus on nurturing students' capacity to solve complex engineering problems creatively. This hands-on education approach should be guided by Emerging Engineering Education principles that emphasize experiential learning, combining with the development trend and characteristics of big data subject, taking into account the local economic and social demand for applied talents and the differences in students' individualized development. the Ministry of Education issued the Guideline for the Construction of Civics and Politics in the Curricula of Higher Educational Institutions. In June 2020, the Ministry of Education issued the Guideline for the Integrating Curriculum Ideology and Politics in Higher Education Programs, which emphasizes the implementation of the fundamental task of cultivating morality and promoting the construction of Course Integrating Curriculum Ideology and politics. It can be seen that the new engineering subject and the ideology and politics of the curriculum are the new trend of the ability cultivation and moral education of college students. The purpose of this paper is exploring the teaching reform of Python language foundation course, designing the course objectives with the guidance of "student-centered and output-oriented", and reforming and practicing the teaching of "python language foundation" based on the cultivation of computational thinking under the guidance of the concept of course ideology and politics.**

***Index Terms*—Computational Thinking,student-centered, output-oriented.**

I. Introduction

Python is a concise, easy-to-learn and powerful programming language. Since its birth in 1991, it has been widely used in the fields of cloud computing, Internet of Things, mobile Internet, big data, artificial intelligence, etc., and has been ranked in the top three of the IEEE Spectrum Programming Languages List for consecutive years. Taishan College has opened the "Python Language Fundamentals" course for the big data specialty of school-enterprise cooperation, and has adopted a hybrid teaching mode combining online and offline. However, at present, the course only focuses on teaching at the syntax level, neglecting the cultivation of program design ability and practical problem solving ability[1]. This paper argues that the course should focus on the cultivation of computational thinking, programming ability, and the ability to link theory to practice from the perspective of the talent cultivation objectives of big data professionals, and integrate the elements of course ideology and politics in order to improve the quality and effect of the course.This paper analyzes the relationship and development trend among Computational Thinking, Course Integrating Curriculum Ideology and Python Programming Education by searching the Chinese Social Sciences Citation Index, and finds that Computational Thinking is more and more widely used in Python Programming Education, and there are 398 related papers in the past five years alone, which reflects the importance and necessity of Computational Thinking in the field of Programming and Artificial Intelligence, and at the same time, Course Integrating Curriculum Ideology Construction is a hotspot of current education research, with 27235 related papers from 2020 until now, reflecting the role and significance of curriculum thinking in cultivating students' core values and social responsibility, and the combination of curriculum thinking and Python programming education is still a blank research field, with only 109 related papers, reflecting the research needs and potentials in this field[2]-[4].

This paper contends that integrating curriculum ideology, fostering students' computational thinking skills, and promoting Python programming education have become inevitable trends in educational reform and development. These trends warrant exploration and innovation by educators and scholars alike. To illustrate this, the paper presents an example of course teaching reform in Classes 1 and 2 of the 2021 Big Data Science and Technology Major (Mining Direction) and the 2021 Big Data Science and Technology Major (Development Direction) at the School of Mathematics and Statistics, Taishan university. This example adopts a project-based assignment teaching approach and integrates curriculum ideology with computational thinking.

II. Background and Importance

A. *Need for computational thinking*

With the rapid development of information technology, education should equip students with the ability to solve problems using future technologies that have not yet been invented in order to prepare them for the future. To this end, Professor Zhou Yizhen [5] introduced the concept of computational thinking, which involves applying foundational computer science concepts and practices like

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problem solving, system design, and understanding human behavior across a wide range of disciplines. Since then, computational thinking is no longer just an ability required to be a high-level programmer, but an applied attitude and skill that everyone should learn and use. As early as 2011, the U.S. CSTAK-12 Standards (2011 Revision) included computational thinking. Subsequently, in 2013 and 2015, the new curriculum plans and programs released in the UK and Australia also included computational thinking as an important element of the new IT curriculum.

In China, the C9 University Consortium was the first to propose the development of students' computational thinking skills in a joint statement in 2010, citing the status of a core task in basic computer teaching. The Teaching Committee of University Computer Curriculum for Higher Education Institutions of the Ministry of Education followed suit in 2013, also pointing out the reform of university computer curriculum with computational thinking as an entry point[6]-[8]. In the new versions of the information technology curriculum standards for high schools and secondary vocational schools in 2017 and 2020, computational thinking is mentioned as a core literacy of the discipline.Therefore, it is imperative to cultivate students' computational thinking in both higher education and compulsory and secondary vocational education.

B. Course Integrating Curriculum Ideology and Politics

On May 8, 2020, the Ministry of Education issued the Guideline for the Construction of Ideological and Political Education in Colleges and Universities, clearly stating that comprehensively promoting the construction of ideological and political education in the curriculum is a strategic initiative to implement the fundamental task of cultivating Politics is a brand-new concept of nurturing, aiming at integrating ideological and political education into the curriculum of various disciplines through an all-staff, all-curriculum pattern of nurturing, forming a new mode of ideological and political education that is complementary and synergistic in nurturing people[9].

The construction of curriculum ideology and politics should be guided by Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era. It should fully implement the Party's education policies, fulfill the fundamental goal of moral education, instill socialist core values, improve students' overall qualities, and cultivate well-rounded socialist builders and successors with high moral, intellectual, physical, aesthetic, and labor qualities. The ultimate aim is to develop students who embody socialist ideals, so as to build an all-embracing and all-curriculum pattern of educating people. The concept of ideological and political education in the curriculum lies in the integration of ideological and political education into the curricula of various disciplines, so that the curricula of various disciplines and the political theory courses are complementary to each other[10]. Ideological and political education should be incorporated into the instruction of every academic subject, so as to realize the comprehensive coverage and in-depth penetration of ideological and political education by means of "carrying ideology and politics in the curriculum" and "integrating ideology and politics in the curriculum".

In the practice of ideological and political education in the curriculum, it is necessary for the curricula of various disciplines to cooperate with each other to form the synergy of educating people. Teachers of various disciplines need to deeply explore the elements of ideological and political education in their own disciplines, integrate them into the teaching process, and realize the natural integration and organic penetration of ideological and political education. At the same time, the political theory course also needs to cooperate with other disciplinary courses to form a good situation of synergistic cultivation by complementing and promoting each other[11].

In short, Course Integrating Curriculum Ideology is a brand-new concept of nurturing people, and an important initiative to implement the fundamental task of establishing morality and educating people[12]. Through the all-member, all-curriculum pattern of educating people, ideological and political education is integrated into the curricula of various disciplines, This integration creates a new model of ideological and political education that is complementary and synergistic, laying a robust foundation for nurturing well-rounded socialist builders and successors strong in moral character, intellect, physical health, appreciation of beauty, and work ethic.

III. Course Integrating Curriculum Ideology and Politics and Computational Thinking Approach:

A. Problems with current research

Python Language Fundamentals is a course that focuses on theory and practice, and the big data major of Taishan University has a total of 54 credit hours in Python Language Fundamentals, of which the theory course accounts for 27 credit hours and the practice course is also 27 credit hours. However, this teaching method may need to be adjusted because too many theoretical courses and too few laboratory courses can no longer meet the needs of social development. In today's era when practical operation and project experience are highly emphasized, we need to pay more attention to the cultivation of practical skills. Therefore, increasing the proportion of practical courses and reducing the length of theoretical courses are necessary changes. Doing so can help students better understand and utilize the Python language, enhance their practical ability, and allow them to better adapt to and meet the needs of society. At the same time, the teaching concept of teachers is relatively traditional, for a long time, teachers pay more attention to the teaching of theoretical knowledge and practical ability, lack of awareness to carry out and implement Civic Teaching, and the process lacks the guidance of computational thinking.

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In addition, the goal of the basic Python language course requires students to master the basic knowledge of the Python language, have the concept of logical thinking to solve practical problems, have the ability to use the tools of application programming language to design and operate the application program as well as debugging and running, and have the ability to use the application program and other application algorithms to solve the practical problems in a comprehensive manner. Teachers correctly guide students to make full use of computational information technology tools to identify and solve specific problems, and "silently" introduced into the curriculum ideology to reflect the development of computational thinking course content is too little.

B. Course Integrating Curriculum Ideology and Politics

Currently there are not many practical cases of project-based development learning of the teaching content of python courses, this study will categorize the knowledge points of the textbook into three categories: basic, advanced, and development (eg., Fig.1), in order to carry out project inquiry-based learning.

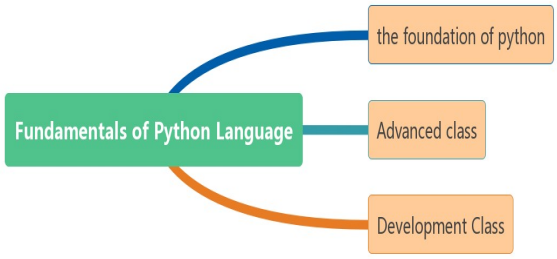

Fig. 1. Categorization of knowledge points in textbooks.

In the design of teaching cases, based on the project teaching method, with "classification" and "step-by-step" as the main line, from easy to difficult, step-by-step planning and design of the experimental content, taking fully into account the varying information technology fundamentals of the students and the different backgrounds of their majors, and cultivating the students' computational thinking and innovation ability.

It is proposed to realize the organic integration of practical teaching and "Course Integrating Curriculum Ideology" through the project teaching method by skillfully applying the "classification" and "progression" methods. Lifelong learning is the basis of education in colleges and universities, and the project content is designed to think about the integration of the course content and "Course Integrating Curriculum Ideology" and to cultivate the students' patriotic spirit, artisanal spirit, innovative spirit, and teamwork spirit.

C. The design of a teaching model based on computational thinking under the concept of Course Integrating Curriculum Ideology

a) Project-based inquiry learning

Currently the project learning method is widely used in the method of computational thinking cultivation, and each complete experimental project requires five steps: release the task, make a plan, project practice, results feedback and project summary. The project teaching method is correctly introduced into the python practice teaching, so that each student participates in a complete project, the project content should be reasonably designed, so as to be able to completely master the knowledge points and structure system in the project. Through the project teaching method, We effectively utilize the methods of classification and progression to seamlessly integrate practical teaching with ideological education in this course. Closely linking knowledge transfer, skill building, and value shaping, we equip students to grasp Python programming's fundamental concepts and design techniques. Through this approach, students develop foundational Python coding abilities, computational thinking skills, and values alignment. In summary, our approach as a whole is composed of 5 parts(eg., Fig2).

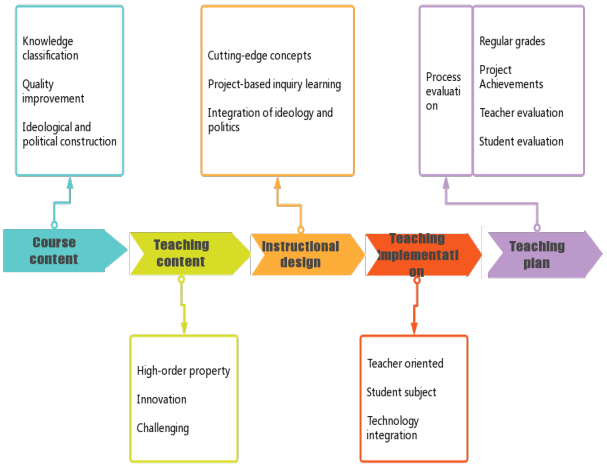

Fig. 1. method subject

Teaching objectives, case requirements, and basics previews are posted with the help of the online Learning Access web platform. Retrieved from http://www.kanunu8.com/book3/6879 All chapters of Animal Farm. According to the data processing process is divided into collection, pre-processing, storage, analysis of the four stages, according to the requirements of the case to inspire students to analyze the case study tasks (see Table 1), the students according to the tasks set out to independently carry out the learning of basic knowledge of the crawler, the functional decomposition of the module, the design of the process and programming practice.

TABLE I: TASKS INVOLVED IN THE CASES

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Total mission	Breakdown tasks	Content of the mission
Crawling through chapters of《 Animal Farm》	Task 1	Requests library to fetch web pages
	Task 2	Regular expression extraction
	Task 3	multi-threaded processing
	Task 4	File Operations

b) Project Practice + Problem Solving

Classroom teaching is divided into module theory and comprehensive case practice. This link adopts the project inquiry type, through the creation of problematic situations, interlocking to guide students to set up doubts and solve puzzles, clarify the program module design ideas, so that students in the process of solving problems, cultivate computational thinking, learn to abstract things, deepen the understanding of Python syntax, to realize the realization of the essence of the program implementation and the laws of the program, the formation of their own logical thinking and the use of the knowledge of the structure.

Teaching and learning implementation using the project progression model, from shallow to deep learning knowledge points, with a combination of theoretical explanations and practical case exercises, to the task and knowledge points as the main line, each project in accordance with the task of the knowledge points disassembled.

According to the task knowledge points of the case split, each task is made "interesting" and "material" to mobilize students. "Interesting" means that the task is full of interest; "material" means that the knowledge points of reptiles are learned in a systematic, comprehensive and step-by-step manner, so that the students can learn - practice - reflect - learn again - practice again. -Reflection - learning - practicing again" multiple cycles, to achieve the solidification and deepening of knowledge. [13] proposed a system which is an innovative congestion control algorithm named FAQ-MAST TCP (Fast Active Queue Management Stability Transmission Control Protocol) is aimed for high-speed long-latency networks. Four major difficulties in FAQ-MAST TCP are highlighted at both packet and flow levels. The architecture and characterization of equilibrium and stability properties of FAQ-MAST TCP are discussed. [14] proposed a system in which FASTRA downloads and data transfers can be carried over a high speed internet network. On enhancement of the algorithm, the new algorithm holds the key for many new frontiers to be explored in case of congestion control. The congestion control algorithm is currently running on Linux platform. The Windows platform is the widely used one. By proper Simulation applications, in Windows we can implement the same congestion control algorithm for Windows platform also. The Torrents application which we are currently using can achieve speeds similar to or better than —Rapid share (premium user) application.

In the stage of comprehensive case practice, according to the principle of "it is better to see it once than to tell it once, and it is better to tell it once than to do it once", students are guided to assemble and run the module according to the results of the modules of each group in the early stage, and complete the whole case, and finally the teacher will summarize the guidance of the project. In this process, students can write their own code to optimize the function module under the premise of completing the entire case function.

c) Results feedback + project review

After class, write a document to record the steps and methods of self-study before class, classroom discussions in the process of realizing the case, reflecting on the gains and shortcomings of the project practice, to achieve the goal of "better to speak once than to write once, do once than to review once". The use of learning or learning group to achieve anytime, anywhere can solve the student problem, students on the computer failed to solve the problem, can also be sent to the WeChat group between students to solve each other, or by the teacher to solve the problem at the same time can also increase the relationship between teachers and students,classmates.

d) Project evaluation

The evaluation adopts a multifaceted process evaluation method, in which both teachers and students participate in the evaluation, which is specifically divided into individual self-assessment, intra-group critique, group mutual evaluation, and teacher evaluation (see Figure 3). Finally, the results of the experimental case students.

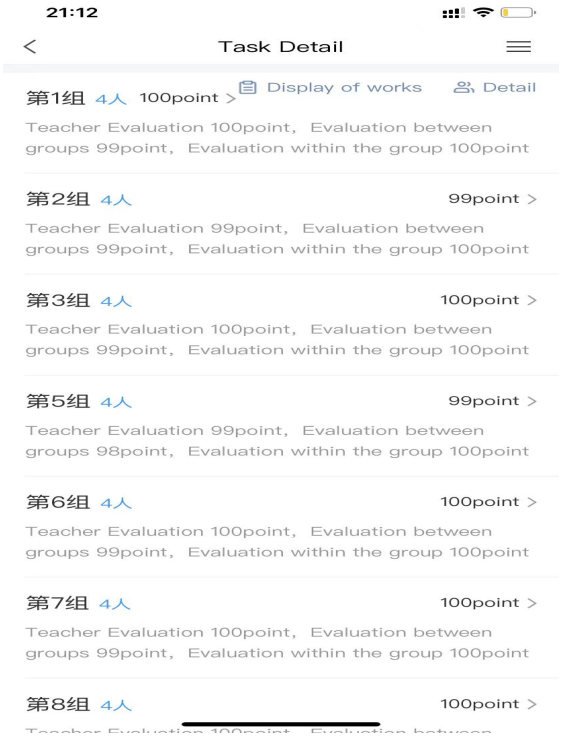

Fig. 3. Mutual evaluation screenshots

This case teaching design determines the teaching content based on the course objectives, focusing on the organic

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integration of fundamentality, higher order, innovation and challenge. The teaching design is based on the teaching content, adheres to the cutting-edge concept and the student's main position, utilizes information technology means, fully mobilizes students' learning enthusiasm, cultivates and enhances students' comprehensive ability to deal with multidisciplinary cross-cutting problems, transforms students from passive listening to active learning, pulls students up through project-based assignments, and cultivates students' innovative spirit and computational thinking ability. Additionally, ideological and political education is incorporated into course learning, enabling students to not only acquire knowledge but also develop proper worldviews, life perspectives, and values through project completion. The model emphasizes cultural confidence by integrating China's esteemed traditional culture into course learning. By engaging with excellent Chinese cultural elements during projects, students gain appreciation for their heritage and build cultural confidence. In addition, the project-based assignment teaching mode also integrates social responsibility into course learning, so that students can understand and assume social responsibility in the process of completing the project and enhance the sense of social responsibility. This teaching mode can not only cultivate students' computational thinking, but also enhance their course ideology and political literacy, so that they can become excellent talents with a sense of social responsibility, cultural self-confidence and correct values.

Finally, the teaching effect is examined through grade assessment comparison and course evaluation to find and solve problems and promote further improvement of teaching quality

Specifically, this study builds a problem-oriented teaching model based on the Python language foundation course and applies it to the teaching of Python programming with project-based assignments. In order to verify the effectiveness of the project-based assignment teaching mode on the cultivation of computational thinking and course ideology, this study will carry out teaching experiments to explore the core question "Can the application of the project-based learning-oriented problem-solving teaching mode significantly improve students' computational thinking in Python programming courses compared with the commonly used lecture-practice teaching mode? "Using the quasi-experimental research method, Taishan College of Mathematics and Statistics will select Class 2021 Big Data Science and Technology Major (Development Direction) 1 and Class 2021 Big Data Science and Technology Major (Mining Class) 1 as the control class and experimental class, respectively, with the control class applying the commonly-used lecture-and-practice teaching mode and the experimental class applying the project-based assignment teaching mode, to carry out the one-semester Python language and programming course for one semester. The experimental class used the project-based assignment teaching mode to carry out a semester-long teaching practice of Python language and basic programming. Data were collected through classroom observation, questionnaire survey, test questions and other methods, and statistically analyzed by SPSS software to analyze and compare the level of computational thinking of the two classes from the three dimensions of computational thinking; to compare the level of comprehensive achievement of the four classes through process evaluation; and to obtain the evaluation of the students of the classes on the course of Civics and Politics in the form of questionnaires.

IV. Conclusion

In the context of computational thinking cultivation, curricular thinking and Python programming, we explored the implementation path and effective methods for computational thinking cultivation and curricular thinking in the foundation of Python language. By adopting the project-based assignment teaching mode and designing projects with practical application background, we guide students to cultivate computational thinking. Furthermore, ideological and political education is embedded within course learning to shape students' correct worldviews, life perspectives, values, and cultural confidence. The implementation path includes clarifying teaching objectives and contents, designing challenging projects, adopting multiple teaching methods and establishing a scientific and reasonable evaluation system. Effective methods include case-based teaching, interactive teaching, online teaching resources and practical sessions. Finally, data were used for experimental statistics and the results showed the effectiveness of our methods. Through these measures, we can effectively promote the teaching development of the basic Python language course and cultivate high-quality applied talents with high professional quality, strong practical hands-on ability, and capable of adapting to the development of the national information technology application and innovation industry.

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