

DESIGN AND IMPLEMENTATION OF IP EDUCATION IN THE PYTHON COURSE

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Abstract

This article integrates the teaching content of Python programming course with Ideological and political (IP) education, and carries out the overall design of IP education In the Python course. Taking the turtle library, Jieba library, and Wordcloud library In the Python course as examples, a detailed design of IP education In the Python course is also carried out. Through the teaching design of IP education in this article, not only have the knowledge goals, ability goals, and emotional value goals of the python course been achieved, but also a way of thinking for other courses reforms and reference for other courses' teachers to integrate IP concepts into their teaching.

Keywords: Python, Ideology and Politics, turtle; Jieba, Wordcloud, word frequency count, Instructional design

1. INTRODUCTION

Ideological and political (IP) education in the curriculum is the integration of theoretical knowledge, value concepts, and spiritual pursuits of IP education into the curriculum, subtly influencing students' ideological consciousness and behavior. It can cultivate students' political identity, national consciousness, cultural confidence, and shape correct worldviews, outlooks on life, and values.

In May 2020, the Ministry of Education of China issued the "Guiding Outline for the IP Construction of Curriculum in Higher Education Institutions"[1]. The core content is to comprehensively promote the IP construction of curriculum as a strategic measure to implement the fundamental task of cultivating morality and cultivating people. In October 2022, the report of the 20th National Congress of the CPC [2] pointed out that "education is the national and the party's major plan. The fundamental issue of education is who, how and for whom to train people. The root of education lies in building morality. Fully implement the party's education policy, implement the fundamental task of building morality and cultivating people, and cultivate socialist builders and successors with all-round development of morality, intelligence, physique, beauty and labor".

According to the Guiding Outline of IP Construction of University Curriculum and the requirements of the report of the 20th National Congress of the CPC, in order to answer the fundamental questions of education and implement the fundamental task of building morality and cultivating people for the party and the country, it is necessary to deeply integrate the three aspects of value shaping, knowledge inheritance and ability cultivation. In the teaching of Python programming course, students are the center, combined with the content of offline courses, refine the knowledge, humanity and timeliness of the course, tap the IP resources of the python course, follow the simple to deep, step-by-step method to integrate the IP elements, design the IP teaching cases from easy to difficult, and use the task driven method [3] and the Case method for practical teaching, Stimulating students' interest in learning while guiding their thinking, deeply and naturally conveying IP connotations In the Python course, allowing students to subtly receive education on patriotism, traditional Chinese culture, scientific ethics, and responsibility in the learning of professional knowledge, achieving IP education in the curriculum.

This article uses the overall design of IP education In the Python course, as well as examples such as drawing with turtle, Using the Jieba and Wordcloud library for word frequency statistics, etc. to conduct a detailed design of IP education In the Python course. It showcases the ideas of IP education In the Python course, provides a way of thinking for other course reforms, and provides reference for other course teachers to integrate IP concepts into their teaching.

2. Analysis of learning situation and course objectives

Python Programming course is a public compulsory course for non-computer major freshmen. Students come from all over the country, and due to the influence of the Chinese college entrance examination, there are significant differences in the implementation of information technology courses in high schools in different regions, which results in uneven computational thinking literacy among first-year college students. We adopt a "low floor, high ceiling" solution to address this issue. The low floor is reflected in choosing the Python programming language that ranks first on the programming leaderboard, allowing students to quickly start teaching. The high ceiling is reflected in Python's 270 built-in standard libraries and 120000 third-party libraries, which have excellent scalability and can meet the needs of students with high programming abilities to deeply learn different fields.

After conducting IP education In the Python course, the course objectives are designed based on three dimensions: knowledge objectives, ability objectives, and value objectives. The knowledge goal is to enable non computer major students to master the basic theories and methods of programming. The ability goal is to master programming skills in computer programming languages, cultivate and train students' computer programming and computational thinking abilities, effective communication and teamwork abilities, and improve their ability to correctly understand, analyze, and solve problems. The value goal is to carry out education on love for family, school, and patriotism, as well as education on mission and responsibility, to enhance confidence in Chinese culture, cultivate humanistic care, and cultivate a dialectical thinking and rigorous and realistic scientific attitude. IP education In the Python course is mainly reflected in value objectives.

3. The overall design of IP education In the Python course

Due to Python programming course being the first programming course in university and the programming language that has dominated the charts for many years, students have a strong interest in learning and strong plasticity. Currently, it is urgent to establish their computational thinking and values, and create an ideological and moral education environment that "follows the wind into the night, moistens things silently".

In the overall design of IP education in the curriculum, it is necessary to focus on textbooks, reference materials, and teaching forms, and pay attention to the organic combination of points, lines, and areas based on the characteristics and advantages of computer science. Pointing refers to the connection between course knowledge points and IP content, and the organic integration of IP content into teaching. Line refers to the need for IP education to run through the entire process of curriculum teaching, organizing and utilizing various teaching links to form effective educational channels and carriers. Face refers to the formation of a trinity of value guidance, knowledge transmission, and ability cultivation in IP education system.

Due to the Python course's blended online and offline teaching approach, which includes three aspects: online students' autonomous learning environment, offline teachers' teaching, and offline students' practical operation on the computer, in the overall design of Python programming course ideology, we fully utilize the online resources of provincial-level double first-class courses[4] to create students' online autonomous learning environment. In the teaching of offline teachers, we adhere to the principle of cultivating morality and cultivating people, with socialist core values as the cornerstone, and

organically introduce relevant content such as patriotism, integrity, responsibility, and innovation to stimulate students' learning motivation. We help students establish correct worldviews, outlooks on life, and values, train students in computational thinking methods, and stimulate their sense of social responsibility and mission to explore the unknown, pursue truth, and bravely climb scientific heights, cultivate students' rigorous and realistic scientific attitude, and implement the educational goal of "value guidance, knowledge impartation, and ability cultivation" in one. It also cultivates students' ability to discover and solve problems through offline computer practice operations, while providing vivid examples for "practice is the only criterion for testing truth".

When preparing offline teaching content, teachers should explore the IP elements of the curriculum, fully extract the value concepts and spiritual connotations of social responsibility, cultural confidence, craftsmanship spirit, etc. contained in the curriculum, and organically embed the IP elements of the curriculum into the curriculum outline, classroom teaching, assessment, and other links, achieving the organic integration of knowledge transmission and value guidance in embedded curriculum IP education. Secondly, it is to expand the breadth and depth of the curriculum, increase its knowledge and humanities, and enhance its leadership, modernity, and openness.

In the Python course, we stimulate students' unity and cooperation through the explanation and analysis of software open source, and everyone is for me, I am for everyone's dedication. By explaining and analyzing the development process of the Python language, we aim to stimulate students' motivation to study hard. Guide students to optimize and save resources by explaining the storage space usage of different types of data. By studying the branch structure, students can adopt different coping strategies according to different situations, adapt to the principles of adaptability, and cultivate their awareness of advocating green travel and protecting nature. By studying the circular structure, students can learn and understand the craftsmanship spirit of "repeating the cycle and practice makes perfect". The modular idea of division of labor and collaboration through functions enables students to experience the concept of win-win cooperation. Let students understand the importance of cooperative learning through the explanation of function knowledge points. Through the transfer of the turtle library, draw the Olympic flag, five-star red flag, Bing Dwen Dwen (BDD) etc. to cultivate students' patriotic feelings and enhance national pride, draw Taiji pictures, sunflowers, etc. to carry forward China's traditional culture and cultivate students' enterprising quality. By calling the Time library, students are subtly guided to cherish time and realize their self-worth. Through the call of the Jieba database and Wordcloud database, the word frequency statistical analysis of the report of the 20th National Congress of the CPC was carried out to understand the development priorities and directions of the country, and strive to learn the knowledge and ability required by society with goals. The overall design of IP education In the Python course is shown in Table 1.

Table 1. The overall design of IP education In the Python course

Course knowledge unit	Integration Design of Professional Knowledge Points and IP Points	IP elements	Implementation methods of IP education
Open-source software	In the field of software development, the best way to unite and collaborate is through open source. Open-source software embodies the concept of "everyone for me" and "everyone for me", greatly improving human work efficiency and promoting the progress of social civilization. Software workers should have a broad mind, be willing to contribute, unite, and serve the people of the world.	Unity and cooperation Everyone for me I am for everyone	explain analysis discuss
The Development of Python Language	By guiding students to review the TIOBE programming language ranking, Python language development, and programming development in China, students can understand the "past and present" of this course. Understand the relevant Figs in the development of Python language, learn their innovative spirit, and cultivate students' exploratory spirit of tracing back to the source and bringing forth new ideas. The Python language overview involves the future development direction of computer language and the current situation of China's IT development, guiding students to work hard to build a first-class software power. Guide students to envision the future of artificial intelligence, enhance their confidence and patriotism in the path of socialism with Chinese characteristics etc.	Stimulate students' patriotism and national pride; Guide students to reflect on their outlook on life and values	explain analysis discuss
data type	By explaining the storage space usage of different types of data, discussing why data types should be divided, and then extending to resource optimization and conservation. By explaining the accuracy of data and associating it with China's	Resource optimization and conservation, national pride	explain analysis discuss

	supercomputers, students have a sense of national pride etc.		
Number Types and Operations	By learning the power operation of variables and number types, we can extend it to a person who is constantly striving for progress. Through the accumulation of one year and 365 days of learning, we can feel the power of daily progress and work hard to achieve remarkable results in the future etc.	Perseverance spirit	explain analysis practice
Sequential Structure Programming	By explaining IPO programming methods and techniques, discussing basic problem-solving methods, and guiding students to experience the core ideas of craftsmanship etc.	Craftsmanship spirit	explain analysis
Branch Structure Programming	Learn to adopt different coping strategies based on different situations and adopt flexible principles according to the situation. Based on the case of using PM2.5 input values to determine the branch structure of air quality detection, cultivate students' awareness of advocating green travel and protecting nature, and establish confidence in controlling air pollution etc.	act according to circumstances Green travel Protecting nature	explain analysis practice
Loop structure programming	In the teaching of programming, it is necessary for students to learn the craftsmanship spirit of "repeating and practicing makes perfect". To master a technology, it is necessary to put in a hundred times the effort and practice repeatedly in order to reach the other shore of success etc.	Recurring Practice makes perfect Craftsmanship spirit	explain analysis practice
function	As the premise, core, and purpose of building a community with a shared future for mankind, cooperation and win-win cooperation are necessary if there is division of labor. Only with cooperation can there be a win-win situation among the division of labor. Let students realize the importance of cooperative learning through the modular programming of function division and cooperation etc.	Cooperation and win-win situation	explain analysis practice
The turtle library	By drawing the Olympic flag, five-star red flag, BDD, etc., students can develop patriotism and enhance national pride. Promote traditional Chinese culture and cultivate students' thriving qualities through drawing Tai Chi diagrams, sunflowers etc.	Cultivate patriotism; Promoting Traditional Chinese Culture	explain analysis practice
the time library	By calling the Time library module to design a case of countdown for the Universiade, we urge students to cherish time, realize their self-worth, and warn them not to waste time etc.	Cherish time	explain analysis
The Jieba, Imageio, Wordcloud library	By working together with multiple databases, complete the task of word frequency statistics, and enable students to experience the collaborative thinking of win-win cooperation. Through the statistical analysis of the word frequency of excellent ancient literature works containing Chinese traditional culture, students can feel the essence of China's treasure, strengthen cultural self-confidence, and consciously promote Chinese traditional culture. By analyzing the frequency of current Chinese policies and generating a cloud chart, students can understand the development direction of the country and strive to learn with goals etc.	Promote excellent traditional culture; Firm cultural confidence; Understand the development direction	explain analysis practice

4. Implementation of IP education In the Python course

IP education emphasizes moistening things silently. In teaching practice, it is necessary to pay attention to timely and moderate integration of IP content, using the Python course as an important carrier to carry IP education. It is necessary to avoid separating professional education and IP education, and also to avoid idealizing professional courses. The explicit goal of professional courses is to impart knowledge and cultivate abilities. IP education is implicit, and it is necessary to

use infiltration to organically integrate IP education into teaching, following teaching laws, Highlighting the disciplinary characteristics of the course, while ensuring the value and attractiveness of the course, timely and appropriately integrating IP content in a scientific and reasonable manner plays a finishing touch role, achieving a silent task effect, enhancing the breadth and depth of the teaching content, and implementing the fundamental task of teaching and educating people through IP education in the course!

We combine the teaching contents and links of Python's programming course, take the learning results as the guide, take the teacher-student interaction as the driving force, guide students to active learning through effective classroom interaction activities, and enable teaching through online and offline hybrid teaching and technology. The classroom teaching adopts embedded methods, the practical stage adopts immersive teaching methods, and the homework after class adopts self-learning, self-education, and timely and moderate organic integration of IP content. We also use QQ or WeChat groups to extend content, allowing IP content to enter our ears, minds, hearts, and industries. In addition to discussing grammar, algorithms, and techniques with students both inside and outside the classroom, IP education on patriotism and traditional Chinese culture will also be subtly carried out, making the content of IP education broad and deep.

We take cultivating morality and cultivating talents as our fundamental task, achieving deep penetration of teaching objectives, deep participation of teaching objects, rule-based teaching methods, visible and controllable teaching effects, and improving students' learning experience. Teachers teach happily, students learn happily, and achieve a "Four Haves Classroom" where the process is interesting, the results are effective, the face is smiling, and the eyes are shining. The following is a detailed design and implementation of IP education, taking the Turtle library drawing and the statistics of Chinese word frequency in the Jieba library, Wordcloud library, and imagio library as examples.

4.1. Detailed Design of IP Education in Turtle Library

4.1.1. The IP Teaching Strategy of Turtle Library

The Turtle library in Python is a very popular graphic drawing function library. The teaching goal of using the Turtle library for drawing is to master the built-in Turtle library in Python and draw various shapes. The teaching focus is on the basic graphic rendering of the Turtle library, while the difficulty is to use the Turtle library to achieve complex graphic rendering.

Turtle library teaching mainly utilizes task driven and case study methods, following the principles of setting task driven elements from shallow to deep and from easy to difficult, to design feasible IP elements, and incorporating them into teaching examples to stimulate students' interest. Assign personalized learning tasks based on students' unique characteristics. For example, for learners with different abilities, tasks of different difficulty levels such as drawing a square, pentagram, sunflower, and BDD are arranged respectively. Personalized learning tasks ensure that students independently gain a sense of learning achievement, enhance their learning interest and subjective initiative, and cultivate their positive, patriotic, and party loving ideological literacy during the teaching process. The detailed design of Turtle's IP education content is shown in Table 2.

Table 2. Detailed Design of Tuttle's IP Education Content

task description	infer other things from one fact	The Value Enhancement of IP Elements	IP Implementation
turtle library	Other thirdparty libraries	In the field of software development, the best way to unite and collaborate is through open source. Open-source software embodies the concept of "everyone for me" and "everyone for me", greatly improving human work efficiency and promoting the progress of social civilization. Software workers should have a broad mind, be willing to contribute, unite, and serve the people of the world.	Analysis and understanding Integrating and integrating
Draw a square	Draw an Nsided shape	“The wood that embraces, born at the end of the grain; A nine story platform rises from accumulated soil; A journey of a thousand miles begins with a single step "comes from Chapter 64 of Li Er's"	Student Practice: Draw a quadrilateral Draw a pentagon
		Laozi in the Spring and Autumn Annals of Chu[5]. Assist students in establishing the basic method of drawing in the Turtle library. To help students experience the current situation, starting from drawing simple shapes, if they persist in practice, integrate, draw inferences from one example, and accumulate over time, they will eventually achieve success.	etc.

Draw a triangle	Draw an Nangle shape	The pentagram has the meaning of victory. Our military rank, national emblem, and national flag all have pentagram symbols. Learning to draw pentagram can cultivate young people's patriotism. Sunflowers symbolize brightness, passion, and prosperity. Drawing them symbolizes the prosperity and prosperity of a country, cultivating students' enterprising qualities.	Student Practice: Draw pentagram Draw sunflowers, etc.
Draw a circle	Draw the Olympic rings Draw BDD	Drawing the Olympic rings, BDD reminds college students of the difficulty of China's bid for the Olympic Games and the hardships of the development of national sports, while adhering to the Olympic spirit of solidarity, friendship, fairness and honesty. The successful hosting of the Olympics gives students a sense of national pride.	Student Practice: Draw a Tai Chi diagram; Draw the Olympic rings; Draw BDD, etc.

4.1.2. Introduction of teaching



Fig 1 . BDD drawn by Python code

Inspire the students' drawing desire by showing the picture of BDD drawn with Python code, as shown in Fig 1. Learn the relevant knowledge of the turtle standard library for drawing BDD in Python.

The Turtle library is one of the important standard libraries in Python. The function is to perform basic graphic drawing. Turtle library drawing graphics is a small turtle crawling in a coordinate system, and its crawling trajectory forms the drawing graphics. The Turtle library contains over 100 functional functions, including functions such as brush state and brush motion. Students need to understand the names, parameters, and functions of memory functions. In order to make the drawn graphics lifelike, it is necessary to use the brush colors of the Turtle library drawing. More colors can be found on the website <http://www.ab173.com/> Query the front-end RGB color table, as shown in Fig 2.

名称	RGB	名称	RGB
Black	0 0 0	PinkTurtle01	187 105 205
White	255 255 255	PinkTurtle02	174 138 230
Yellow	255 255 0	PinkTurtle03	180 200 200
Green	0 255 0	PinkTurtle04	102 130 130
Blue	0 0 255	CadetBlue1	132 147 205
Red	255 0 0	CadetBlue2	142 229 230
Orange	255 165 0	CadetBlue3	132 187 205
Purple	128 0 128	CadetBlue4	83 134 155
LightBlue	173 216 230	Tomato1	240 100 100

Fig 2 . Table of Brush Colors for Turtle Library Drawing

4.1.3. Teaching case analysis, explanation and demonstration ideas

The explanation idea[6] for drawing a straight line in Case 1 is by drawing a square → represented for loop → n-sided; Sunflower → n-point star → pentagram etc., as shown in Fig 3(a). The explanation idea for drawing arcs in Case 2 is from n-sided shapes → drawing circles → semicircles → arcs → Tai Chi diagrams → n circles etc., as shown in Fig 3(b). The Tai Chi diagram implementation in Case 2 uses various programming codes for different functions of the Turtle library, as shown in Fig 4.

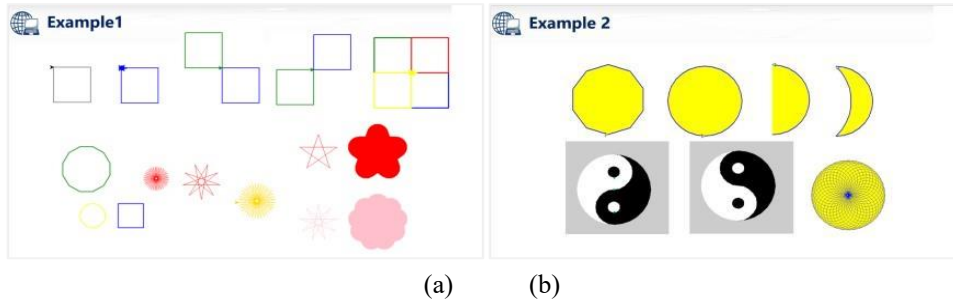


Fig 3. (a)Case 1 explains the idea of drawing graphics; (b) Case 2 explains the idea of drawing graphics

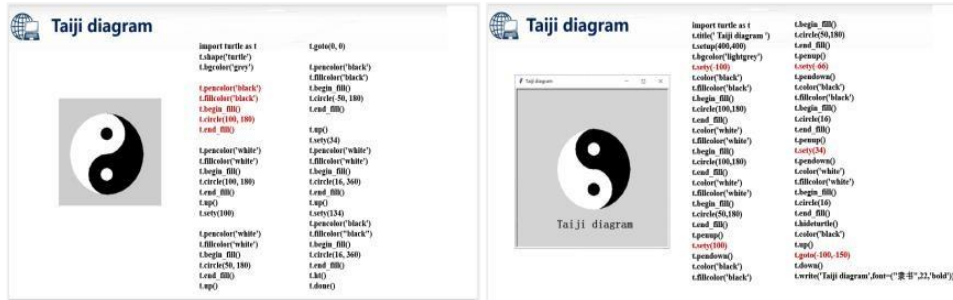


Fig 4. Different programming codes for Tai Chi diagram implementation

Classroom summary: Figs are composed of straight or curved lines. Classmates, if we combine Case 1 of drawing a straight line with Case 2 of drawing an arc, can we draw any shape? The teacher presents a case study by drawing inferences, as shown in Fig 5, and analyzes how the case was drawn? What are the straight or curved lines that make up a graph? Which functions are used to implement and so on?



Fig 5. draw inferences about other cases from one instance

Any Fig is composed of straight lines or arcs. After class, students will combine Case 1 of drawing straight lines and Case 2 of drawing arcs to do a comprehensive drawing assignment - drawing a more complex Fig. In the next practical lesson on the computer, a flipped classroom will be held, using the method of voluntary or random selection of students. Students will be invited to the podium to display the drawn graphics and explain the logical thinking of the drawing code. Students who participate in class explanations will receive extra points for their usual grades. Some of the students' homework works are shown in Fig 6.



Fig 6. Some of the students' homework works

Problem extension: From drawing one graph to regularly drawing multiple graphs, randomly drawing multiple graphs, and then drawing any number of graphs with random sizes, positions, and colors, as shown in Fig 7. The program gradually increases the use of loop statements, loop nesting, functions, random functions, and so on, from the basic drawing statements in the Turtle library to the use of loop statements in the drawing program. It gradually deepens and presents

different graphics, connecting the Python sequence, selection, and circulation of three control structures, functions, and other contents, providing students with an overall progressive program design concept.

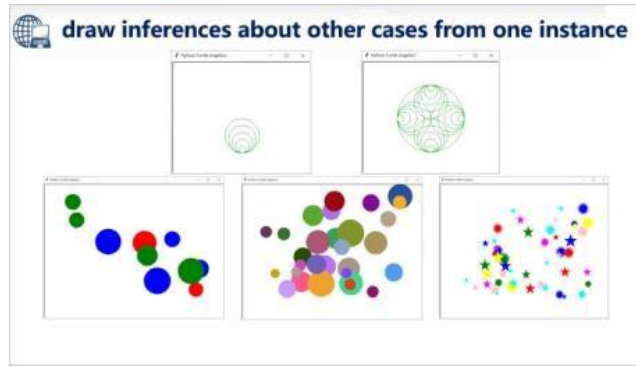


Fig 7. Case Study of Problem Expansion

4.1.4. Teaching Reflection

Through students' hands-on practice and flipped classroom presentations and explanations, students' learning interest and enthusiasm have been fully stimulated. Students have created many excellent works by learning the basic knowledge of applying the Turtle library in Python, and each student's work is different, with obvious personalized characteristics and unlimited creativity. In order to create better works, some students have self-learning a lot of in-depth content by searching for materials, which has improved their learning initiative, enthusiasm, innovation, and selflearning ability.

4.2. Detailed Design of IP Education Based on Word Frequency Statistics

Python's Jieba library is an excellent third-party library for Chinese word segmentation, while Wordcloud library is an excellent third-party library for visual word cloud display. Word frequency statistics first require the Jieba library to segment Chinese text into individual words, and then the Wordcloud library needs to use words as the basic unit to display the text more intuitively and artistically. The Imageio library is used to import images that display the shape of word clouds. Students need to master the operation of generating word clouds through word frequency statistics using the Jieba library, Wordcloud library, and Imageio library.

4.2.1. The IP Teaching Strategy of Jieba Library and Wordcloud Library

The word cloud of word frequency statistics results is displayed in graphics, which is more intuitive and artistic, and students have a strong interest in learning. The Wordcloud library teaching mainly utilizes task driven and case explanation methods, following the principle of setting task driven from shallow to deep, and from easy to difficult, to design teaching examples that incorporate IP elements. Personalized learning tasks are arranged to ensure that students gain a sense of learning achievement, improve their learning interest and subjective initiative. During the teaching process, cultivate students' positive and patriotic ideological literacy. Through the learning of word frequency statistics in Jieba, Wordcloud, and Imageio libraries, students' computer programming skills, computational thinking abilities, and collaborative and win-win ideas are cultivated, as well as their ability to discover, analyze, and solve problems. By working together with multiple databases, complete the task of word frequency statistics, and enable students to experience the collaborative thinking of win-win cooperation. Through the statistical analysis of the word frequency of excellent ancient literature works containing Chinese traditional culture, students can feel the essence of China's treasure, strengthen cultural self-confidence, and consciously promote Chinese traditional culture. Through word frequency statistics generated by the report of the 20th National Congress of the CPC related to national policies, students can understand the development direction of the country, work hard with goals, and keep pace with the times.

4.2.2. Introduction of teaching

By displaying the word frequency statistics results of the 20th National Congress of the Communist Party of China report using Python code, students' learning desire is stimulated, as shown in Fig 8. Analyze the relevant knowledge of using Python code to achieve word frequency statistics.



Fig 8. The Statistical Results of Word Frequency in the Report of the 20th National Congress of the CPC


```
word-frequency-count.py - C:/Users/zp/w...
File Edit Format Run Options Window Help
1 import wordcloud as w
2 import jieba
3 fname=input("Please enter a file name:")
4 f=open(fname,"r")
5 txt=f.read()
6 f.close()
7 if 65<=ord(txt[0])<=90 or 97<=ord(txt[0])<=122:
8     ce=0
9 else:
10    ce=1
11 if ce==1:
12    ls=jieba.cut(txt)
13    txt=""
14    for i in ls:
15        if i.isalpha():
16            txt+=i+" "
17    w1=WordCloud(background_color="white",
18                font_path="msyh.ttc", mask=pic, stopwords=的 和 是)
19    w1.generate(txt)
20 for i in range(len(fname)):
21     if fname[i]!='.':
22         break
23     else:
24         j+=1
25 w1.to_file(fname[:j]+"WordCloud.png")
Ln: 25 Col: 0
```

Fig 12. Python code for word frequency statistics of heart shape

4.2.4. Teaching Reflection

Master the installation and use of Jieba, Wordcloud, and Imageio libraries through case studies of word frequency statistics, as well as the programming ideas and visual display methods of Chinese and English word frequency statistics, while subtly conducting patriotic education.

5. Conclusions

In the teaching process of Python programming course, through the overall design and detailed design display and case practice of the IP teaching of the course, students gradually master the teaching content in a relaxed and happy way, and complete the course teaching requirements and the training of design thinking ability from concrete to abstract programming. At the same time, in the teaching process, students' patriotism was subtly cultivated, their sense of national pride was enhanced, and traditional Chinese culture was promoted. By carrying out the mission of cultivating morality and cultivating people through IP education in the curriculum, and implementing the fundamental task of teaching and educating people, the construction and practice of IP education in the curriculum have achieved initial results, with students learning to start school and teachers teaching with ease.

Declarations

□ Funding

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□ Conflict of interest

No potential conflict of interest is reported by the authors.

□ Ethics approval

Before we conducted this study, we reported it to the Ethics Committee of the College of Computer Science at Sichuan Normal University and received permission from the committee to conduct the research. All participants were volunteers who gave written informed consent. Furthermore, they knew that they had the right to withdraw from the study at any time during the experiment.

Data Availability

The data is available upon request.

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