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# AIGC and the Evolution of Intelligent Systems: From Content Generation to Adaptive Interaction

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**Abstract:**

With the rapid advancement of Artificial Intelligence Generated Content (AIGC) technology, its integration into education has opened new possibilities for intelligent and personalized teaching. This paper explores the application of AIGC in reforming the teaching model of Python programming courses. First, it analyzes the current challenges in Python teaching, including single teaching methods, insufficient use of third-party libraries, and inadequate practice design. Then, it proposes an AIGC-assisted teaching framework that encompasses case-driven theoretical instruction, personalized learning path generation, intelligent tutoring and Q&A, and real-time learning evaluation. The proposed model enables individualized learning experiences by leveraging AIGC's capacity for adaptive content generation and intelligent feedback, thus improving students' engagement, programming competence, and problem-solving abilities. Finally, the paper discusses the outlook and challenges of applying AIGC in programming education, emphasizing the need to address issues of data privacy, model stability, and content quality. The findings provide theoretical guidance and practical reference for building intelligent, efficient, and inclusive programming education systems in the digital era.

**Keywords:**

Artificial Intelligence Generated Content (AIGC); Python programming; Educational innovation; Personalized learning; Intelligent tutoring; Teaching model reform.

## 1. Introduction

The In recent years, with the vigorous development of cutting-edge artificial intelligence technologies such as computer vision, big data analysis, natural language processing and cloud computing, they have deeply penetrated and reshaped the face of many industries. In this context, China's education departments actively advocate the integration of AI technology into the education and teaching process, which has laid a solid foundation for the innovative application in this field. Among them, the AIGC (Artificial Intelligence Generated Content) as the latest breakthrough in the field of artificial intelligence, once appeared worldwide launched a boom, not only based on context generate smooth dialogue, can also independently create academic papers, advertising copy and all kinds of program code, even auxiliary program code debugging and optimization, greatly promote the progress of the related industry, but also to the industry practitioners put forward new challenges and opportunities.

Python As an object-oriented high-level explanatory programming language[1,2], has become the mainstream programming language, with its grammar-refined, lightweight, efficient and powerful and rich open source scientific computing library. However, there are still many problems in the teaching process of

Python programming course, such as single teaching means and ignoring the use of the third-party library. Therefore, it is imperative to introduce AIGC technology in the teaching practice of Python programming course. The use of AIGC can not only enrich teaching methods, enhance students' interest and participation in learning, but also bring about revolutionary changes to the traditional teaching model. Therefore, exploring the effective application strategy of AIGC in Python programming curriculum has immeasurable value and significance for promoting educational innovation and improving teaching quality.

## 2. AIGC technological development

### 2.1 An Overview of the AIGC

AIGC, namely the content generated by artificial intelligence, refers to the use of artificial intelligence to automatically or assist generate text, image, video, code and other content. At present, it has been widely used in writing assistant, AI painting, dialogue robot, digital human and other products, realizing the application of in text generation, image generation, audio and video creation and generation, film and games, scientific research and innovation, code generation, content understanding and analysis[3].

The main principles are as follows:

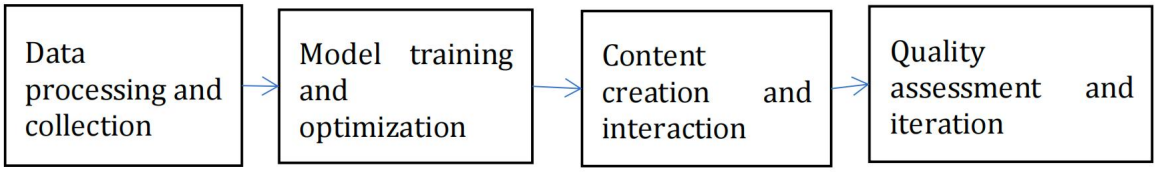


Figure 1. Technical rationale of the AIGC

First, AIGC technology collects and processes data, and collects a wide range of data samples from multi-source channels, which are the key to training efficient AI models. The collection process emphasizes the representativeness and diversity of the data, ensuring the richness of the subsequent generated content. Subsequently, through fine data preprocessing steps, such as weight, error correction, unified format unification, etc., the data quality is improved and lays a solid foundation for model training. Then the model training and optimization are carried out. The processed high-quality data enter the training stage. In this stage, by constantly adjusting the model parameters, it can accurately capture the rules and characteristics in the data, and finally achieve the ideal learning effect. This process is the core of AIGC technology and determines the quality and diversity of the generated content.

The third stage is AIGC content creation and interaction. When the AI model training is mature, users can trigger the generation process of content by entering prompt words or other ways through the intuitive interactive interface. AIGC technology can rapidly produce high-quality content according to user needs, greatly improving the efficiency of content production. Finally, for quality evaluation and iteration, the content generated by AIGC then goes through a rigorous evaluation process to verify its accuracy, rationality and innovation. Based on user feedback or preset standards, the AIGC system may need to fine-tune or retrain the model to continuously improve the quality and satisfaction of the generated content.

### 2.2 Development course of AIGC

Algorithm, computing power and data are the foundation of AI, and also the necessary prerequisite to support the development of AIGC industry [4]. The common progress of these three technologies has promoted the development of AIGC technology [5]. But, the origin of the AIGC technology dates back to the middle of the 20th century.

### 2.2.1 Early budding stage

Early exploration of the AIGC began in the 1950s. The string quartet, the Ilyac suite,born in 1957, marks the initial attempt of computer art creation and shows the potential of AI in artistic creation[6]. In the mid-80s, IBM researchers using invisible Markov chain model (HMM) developed a called "tangora" voice control typewriter, the innovation not only embodies the AI in speech recognition and natural language processing, also indicates the AI technology to a more practical, interactive direction. However, while these attempts demonstrated the huge potential of AI technology,these projects did not immediately translate into significant economic benefits due to technological constraints at the time, high research and development costs,and low market acceptance.

### 2.2.2 Precipitation accumulation stage

The second stage is an accumulation period of nearly two decades, during which statistical methods and machine learning techniques breed a new chapter of generative models, such as n-gram and hidden Markov models. In 2007, the British writer and the computer scientist RossGoodwin joined hands with the "word.camera" program to create the first AI literature creation and launch the world's first all-AI creation novel [6]. The program is based on a recurrent neural network (RNN), drawing inspiration from massive text, learning the essence of the language, and producing text works close to real people. However, while AI creation is moving from experiment to application, the limitations of the algorithm itself still limit its ability to create diverse and rich content, indicating the direction of future technological breakthroughs.

### 2.2.3 High-speed development stage

In 2022, the two major milestone release of StabilityAI and OpenAI pushed AIGC to a new climax: the former open source text drawing technology based on the potential diffusion model, and users can guide the image generation with text alone; the latter launched ChatGPT. This conversational AI model has triggered revolutionary changes in education, scientific research, art and other fields. Domestic tech giants such as Baidu, Tencent and Alibaba have also invested a lot of research and development resources in the AIGC field, promoting the continuous innovation of algorithms and models. For example, Baidu has launched large models such as Wenxin Yiyan, and Tencent, Alibaba and others have also made significant progress in AI content generation. Together, these developments mark the maturity and expansion of AIGC technology.

## 3. Python Programming course teaching status

Python Is a kind of advanced, explanatory, universal programming language, it has C++ and Java object oriented language encapsulation, inheritance and polymorphic characteristics, and has the characteristics of explanatory language, the biggest advantage is that its open source makes Python has other advanced program language unmatched third party library, very suitable for big data analysis, deep learning, natural language understanding data volume, and need all kinds of scientific computing application [7]. However, there are still many problems in the teaching process of Python programming course.

### 3.1 Teaching means are single, too focused on knowledge explanation

Theoretical teaching adopts the traditional "cramming" teaching method. The whole teaching process, students are in a passive state, and the teaching means are too single to mobilize students' enthusiasm for learning [8]. In the current teaching practice of Python language courses, it generally relies on PPT as the explanation of basic knowledge, while the interaction between teachers and students is mainly limited to the traditional questioning method. Although this teaching mode has its certain teaching effect, it is often difficult

to fully stimulate students' participation and interest. As a result, some students may not be able to fully integrate into the classroom, which affects the overall teaching effect.

### 3.2 Ignoring the application of the third-party libraries

Python Known as the "glue language", one of its core competitiveness lies in its huge third-party library ecosystem, which covers a wide range of fields, from data processing to network programming to machine learning and Web development. However, current teaching arrangements often focus on the teaching of cornerstone content such as the Python development environment, basic grammar, and programming paradigms (such as object- oriented programming), but fail to fully demonstrate and take advantage of this powerful advantage. A direct consequence of this practice is that students fail to establish the awareness and ability to effectively use third-party libraries to accelerate the development and solve practical problems in the learning process. When they enter a more advanced learning stage or actual work environment, they may feel confused by the endless new libraries and frameworks, and even feel frustrated and frustrated by the need to frequently memorize and learn new API, concepts and rules.

### 3.3 The practice link design is not in place

In the teaching system of Python language curriculum, practice plays a vital role, which should be the key bridge for students' ability to transform theoretical knowledge to solve practical problems. However, there are obvious deficiencies in the design of the current practice link, which is mainly reflected in the neglect of the cultivation of students' computer thinking ability and the irrationality of the arrangement of experimental difficulty. Due to the lack of systematic cultivation of computer thinking ability, students often lack effective thinking framework and solutions when facing practical problems, which makes them feel unable to start in the experiment, and even fear of learning tasks, which further affects their interest and motivation in learning. In addition, the difficulty setting of the experiment content lacks a reasonable gradient, either too simple to improve students' abilities, or too complex to go beyond the current level.

## 4. AIGC help Python course teaching mode reform research

Through the analysis of the current teaching situation of Python programming course, it can be clearly found that most students lack the ability of independent learning and design. Therefore, teachers need to mobilize students 'enthusiasm as much as possible in the teaching process, and can conduct different teaching according to students' different ability levels. As shown in Figure.2, the whole process of teaching with the support of virtual laboratory, the case driven theory teaching, at the same time rely on AIGC for each student design personalized learning path, improve students 'learning enthusiasm, and AIGC provide intelligent counseling and answering function, able to students' programming ability intelligent evaluation, finally for the improvement of related content.

### 4.1 Take the case-driven theory teaching

Traditional teaching methods focus on the teaching of basic knowledge, and their high theoretical nature often leads to the weakening of students' interest in learning. Given that cultivating students' ability to solve practical problems using programming and computer technology is one of the teaching objectives, we need to replan the training direction of programming and operational platform related courses according to the needs of big data analysis. To this end, we will comprehensively and deeply update the teaching content, with examples close to real life as the starting point, integrating heuristic, case type and other teaching strategies, aiming to enhance students' hands-on ability and problem solving ability through practice-oriented teaching methods. Students can use AIGC technology to search for interested cases and related source code, and design and implement corresponding programs based on the support of Python's third-party library. In this

case, it can not only improve the learning initiative, but also stimulate the students' internal learning motivation.

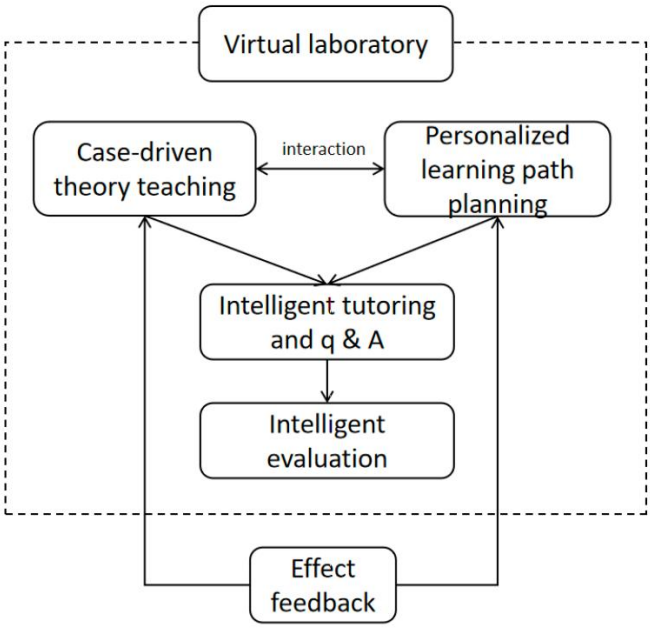


Figure 2. AIGC helps Python curriculum teaching mode reform research framework

### 4.2 Design personalized learning paths

With different levels of basic knowledge, students' programming abilities also vary. Therefore, it is necessary to design different learning methods for different students to provide students with an unprecedented learning experience. By collecting and analyzing the multi-dimensional information of students' learning history, achievement data, online behavior and so on, a personalized portrait of each student is constructed. This portrait not only reflects the students' learning habits and interest preferences, but also accurately evaluates their programming ability level, providing the students with an accurate, intelligent, flexible and practical learning experience.

Based on personalized portraits, AIGC technology can automatically generate personalized learning paths. This path not only customizes the learning content according to the students' current level, but also fully considers their interests and needs to ensure that each student can learn at the best pace and difficulty. In the process of learning, AIGC system will recommend related learning resources and practice, including online courses, video tutorial, programming topics, etc., to meet the needs of students 'different learning, also accurately evaluate their programming ability, provides students with a precise, intelligent, flexible and practical learning experience, not only improve the effect of programming education and quality, also cultivate the students' innovative thinking and problem solving ability.

### 4.3 Intelligent tutoring and q & A

In Python programming, students will encounter various forms of problems, and usually need teachers to check the complete program to answer questions for students, but it is time- consuming and laborious. By using advanced AIGC technology, intelligent tutoring and q & A can provide students with immediate and accurate learning support and answers, so that students can improve their learning effect and experience, and reduce the burden of teachers.

Intelligent counseling system can solve students in the process of programming learning problems, including grammar errors, logic problems, algorithm, etc., students can ask questions through the way of text or voice, system can accurately understand and quickly solve the problem of students, overcome the learning difficulties, avoid interruption and problems in the process of learning, improve the learning efficiency. AIGC can also track students 'learning progress in real time, record students' learning behavior and performance, provide teachers and parents with comprehensive learning situation analysis, and help them better understand students' learning status and needs.

### 4.4 Intelligent evaluation

The IGC technology has the capability of real-time evaluation and feedback. In the learning process, students can get systematic feedback and guidance at any time, so that students can master their own knowledge level in real time, help them to correct their mistakes in time, and deeply understand the concept of programming. AIGC technology can collect students 'learning data and present it in a visual way, which can help teachers to intuitively understand students' learning progress, mastery and existing problems. Based on the students' learning data, teachers can provide targeted answers and guidance. Students' poor mastery of knowledge can provide additional tutoring and practice, and a good mastery can design more challenging tasks for them to stimulate their learning potential.

## 5. Outlook and challenges

With the continuous maturity and popularization of AIGC technology, the teaching resources of Python programming course will be fully intelligent. From the generation of course content, the design of personalized learning path, to intelligent tutoring and q & A, and learning effect evaluation, all will be completed by AIGC system, forming a closed-loop intelligent education system. This will not only greatly improve the efficiency and quality of teaching, but also promote educational equity and enable more students to benefit from high-quality educational resources.

Although the application prospect of AIGC technology in Python programming course is broad, its technology maturity and stability still need to be further improved. At present, AIGC technology still has some technical bottlenecks and challenges, such as high cost of model training, unstable quality of generated content, and limited ability of intelligent tutoring systems to understand complex problems. These technical problems need to be constantly overcome and improved by researchers to ensure the wide application and sustainable development of AIGC technology in the field of education. The application of AIGC technology involves the collection and analysis of large amounts of student data and learning behavior data. The security and privacy protection of these data is an important issue. It is necessary to establish a sound data security mechanism and privacy protection policy to ensure that students' personal information and learning data are not leaked or abused. At the same time, it is also necessary to strengthen the supervision and review of the use of student data to ensure the legal and compliant use of the data.

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