A STUDY OF THE FACTORS INFLUENCING STUDENT LEARNING EFFECT FROM PYTHON TRAINING COURSE OF SHANDONG UNIVERSITY OF ENGINEERING AND VOCATIONAL TECHNOLOGY

LI ZIHUI
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LI ZIHUI

This Independent Study has been Approved as a Partial Fulfillment of the Requirements for the Degree of Master of Business Administration

Advisor: .....
(Dr. Ma Yu)

Date: ...17.../...8.../...2024...

.....
(Associate Professor Dr. Jomphong Mongkhonvanit)
Dean, Graduate School of Business

Date...4.../...2.../...2025...
Siam University, Bangkok, Thailand

Title: A Study of the Factors Influencing Student Learning Effect from Python Training Course of Shandong University of Engineering and Vocational Technology

By: Li Zihui

Degree: Master of Business Administration

Major: International Business Management

Advisor: ..... Ma Yu .....
(Dr. Ma Yu)

Date: ..... 17 ...../..... 8 ...../..... 2024 .....

ABSTRACT

Modern information technology led by artificial intelligence technology is playing a role in the learning of higher vocational Python training course, based on artificial intelligence technology to personalize the student's Python training course for accurate testing and to help students find problems promptly to solve the problem. The objective of the study was to explore the effect of motivation, intellectual literacy, self-efficacy, and teacher support on student learning effect from Python training course of Shandong University of Engineering and Vocational Technology.

This study adopted the quantitative research method. A total of 450 questionnaires were distributed during the survey period and 388 valid questionnaires were collected, with a validity rate of 86.22%. This study found that motivation, intellectual literacy, self-efficacy and teacher support have a significant positive effect on student learning effect from Python training course. For recommendations, student learning effect from Python training course of Shandong University of Engineering and Vocational Technology should be enhanced by: 1) Motivating independent learning; 2) Enhancing intelligence; 3) Strengthening self-efficacy; 4) Improving teacher support.

Keywords: artificial intelligence technology, higher vocational python training course, Shandong University of Engineering and Vocational Technology, learning effect.

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DECLARATION

I, Li Zihui, hereby certify that the work embodied in this independent study entitled "A Study of the Factors Influencing Student Learning Effect from Python Training Course of Shandong University of Engineering and Vocational Technology" is result of original research and has not been submitted for a higher degree to any other university or institution.

Li Zihui
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Chapter 1 Introduction

1.1 Background of the Study

The accelerated iteration and renewal of science and technology have accelerated the transition from the information age to the intelligent age, and society has entered a new period of intelligence and information technology. The development of technology in this new period plays a role in the field of education, changing the traditional concept of education, innovating the education model, and optimizing teaching methods. The purpose of educational reform is to promote education by improving the reasonable use of technology to promote the development of education. This is the inevitable trend of educational reform and innovation in the new period. Technology is always a crucial task in the senior Python practical training course (Kung et al., 2023). Modern multimedia, networks, etc. bring network learning, mobile learning, etc.; technology has always played the role of "booster" in the teaching of higher vocational Python training course. (Holmes et al., 2021).

In the teaching of Python training course, teachers should not only use traditional teaching methods but also pay more attention to cultivating students innovative thinking, practical ability, and teamwork spirit. In this way, students can not only master the movement skills, but also better integrate into the classroom atmosphere (Borenstein & Howard, 2020). Although the teaching mode of "indoctrination education" allows the teacher to grasp the course, it also makes the classroom atmosphere dull.

Students lack learning enthusiasm, independent thinking and inquiry ability, and the habit of reviewing after class, so they can only reluctantly accept the knowledge instilled by teachers, which affects the learning effect and reduces the teaching quality. With the continuous development of the network information age, Python training course also need to keep pace with the times, constantly improve and innovate, and explore a more effective way of teaching, not only to enable students to master the skills but also to improve the student's enthusiasm for learning, cultivate the students independent learning ability and teamwork spirit, and help students realize their overall growth. Artificial intelligence (AI) is applied to higher vocational Python training course, so the traditional offline teaching mode has been greatly impacted (Guilherme, 2019). AI can effectively integrate the advantages of online teaching so that students can acquire knowledge at the same time while also having more fun. This new mode of teaching takes into full account the personalized needs of the students; its educational philosophy of advanced teaching methods is scientific and reasonable; and it attaches importance to the main body of the students. Status, and can effectively stimulate students interest in learning to cultivate students independent learning ability, but also to overcome the limitations of time and space so that students can acquire knowledge at the same time and also fully play to learn (Zhang & Aslan, 2021). Therefore, it is to

clarify the influencing factors of AI technology in higher vocational Python training course and to better utilize AI in the classroom.

1.2 Questions of the Study

Technology has always boosted classroom teaching forward, and the current AI-supported learning, as a research frontier in the development of educational information technology, has achieved certain results in teaching practice, while there is also a certain degree of learning maladaptation (Pokrivcakova, 2019). Learning adaptability is one of the important indicators to measure the learning effect of students, which is the key to determining the quality of student learning in the information technology environment. Learning maladaptation not only affects the learning outcomes of students but also directly affects the utility of AI-enabled Python training course. Therefore, it is crucial to understand the specific situation of learning adaptability in the current AI-enabled Python practical training course and to find out the influencing factors affecting student learning in the AI-enabled Python training course.

(1) Does motivation affect the student learning effect from python training course of Shandong University of Engineering and Vocational Technology?

(2) Does intellectual literacy affect the student learning effect from python training course of Shandong University of Engineering and Vocational Technology?

(3) Does self-efficacy affect the student learning effect from python training course of Shandong University of Engineering and Vocational Technology?

(4) Does teacher support affect the student learning effect from python training course of Shandong University of Engineering and Vocational Technology?

1.3 Objectives of the Study

(1) To explore the effect of motivation on the student learning effect from python training course of Shandong University of Engineering and Vocational Technology.

(2) To explore the effect of intellectual literacy on the student learning effect from python training course of Shandong University of Engineering and Vocational Technology.

(3) To explore the effect of self-efficacy on the student learning effect from python training course of Shandong University of Engineering and Vocational Technology.

(4) To explore the effect of self-efficacy on the student learning effect from python

training course of Shandong University of Engineering and Vocational Technology.

1.4 Scope of the Study

This study focused on the senior students of Shandong Engineering Vocational and Technical College, especially those who were involved in the training course on the application of Python AI technology. A questionnaire survey was conducted online from January 1, 2024, to April 1, 2024. The study aimed to analyze the factors influencing student learning effects. Specifically, the study explored the multifaceted factors of background knowledge, learning motivation, teaching methods, course design, teacher-student interaction, and technical support. By systematically analyzing these factors, the study aimed to reveal the key factors affecting student learning outcomes in AI training courses, to provide a scientific basis for improving teaching strategies and enhancing teaching quality. At the same time, the study also focused on optimizing the teaching process using AI technology to help students better adapt to and master the course content.

1.5 Significance of the Study

With the in-depth application of AI technology in Python training course, AI-supported Python training course learning has become an important form of assisting student learning. This study focuses on the learning effect of students in Python training course supported by AI, and constructs the component structure of learning effect of students in Python training course. This study is a new exploration of student learning effect in the field of AI learning, and it is also an extension of the research on learning effect and a supplement to the research results. (Berendt et al., 2020). It is also the expansion and the supplementation of the research results of learning adaptability in information-based learning. With the support of AI, the influencing factor model of student learning effect is constructed to provide theoretical support for effectively improving the quality of students intelligent learning, which has certain significance for improving student learning effect and promoting students' academic development. The study explores the current situation of the learning effect of college students in Python training course under the support of AI to provide a useful reference for the targeted improvement of student learning effect in the AI environment. The study can help guide college students to better cope with the challenges of adapting to the age of intelligence and to the development of intelligence.

By studying and exploring the learning effect of students in Python training course and its influencing factors, this study can provide an important basis for targeted improvement of student learning effect in the AI environment. It helps to optimize teaching methods and learning strategies and provides valuable references for better carrying out learning activities in the AI environment. As a result, teachers and

educational administrators can design more efficient and personalized teaching programs based on the research results, which can comprehensively improve student learning experience and academic achievement.

1.6 Definition of Key Terms

Learning Motivation refers to the intrinsic drive and interest students exhibit during the learning process. It includes students interest in the learning content, expectations of learning outcomes, and their positive attitude towards the learning process. Specifically, it can be measured by assessing students interest in the Python AI technology application training course, the clarity of their learning goals, and their engagement and enthusiasm in the course.

Intellectual literacy is the knowledge, skills, and attitudes students possess when using and applying AI technology. This includes understanding the basics of Python programming, mastering AI concepts and tools, and the ability to apply this knowledge and tools in practical projects. Operationally, it can be evaluated by testing students programming abilities, their grasp of fundamental AI knowledge, and the quality of the practical training projects they complete.

Self-efficacy refers to students' perception of their ability and confidence to complete learning tasks. Students with high self-efficacy typically believe they can overcome learning challenges and accomplish learning tasks. This can be measured by assessing students' confidence in the Python AI technology application training course, their trust in their programming abilities, and their anticipated sense of achievement in completing course tasks.

Teacher Support is the assistance and encouragement teachers provide to students during the teaching process, including both academic and emotional support. Academic support involves explaining course content, answering questions, providing learning resources, etc., while emotional support includes caring for, encouraging, and recognizing students. This can be evaluated by assessing the quality of teaching, the responsiveness and attitude of the teacher to student queries, and the overall student satisfaction with the teacher's support.

Student learning effect is a multi-dimensional and comprehensive concept, which covers the changes or progress of students in knowledge, skills, attitudes, values and behaviors after receiving education or participating in learning activities.

1.7 Limitations of the Study

When analyzing the influencing factors of the Python AI technology application training course for vocational students at Shandong Engineering Vocational and

Technical University, this study faced several limitations. The research sample was limited to vocational students at Shandong Engineering Vocational and Technical University, which may restrict the generalizability of the results, as students from other schools or regions might encounter different learning environments and influencing factors. The study was conducted within a specific time frame and did not continuously track changes in students throughout their learning process. Data from different semesters, grade levels, or after-course improvements might vary, preventing a comprehensive reflection of long-term impacts.

The study mainly relied on surveys and test data, which may be influenced by students' subjective factors, leading to potential biases. Students might not be entirely objective when answering questionnaires or might not perform to their true level in tests due to various reasons. Controlling external variables was also a challenge, as numerous uncontrollable external factors existed in the teaching environment, such as students' personal backgrounds, family environments, and changes in course content. These factors might significantly impact the research results. Despite these limitations, this study provides valuable insights into understanding and improving students' adaptability in the Python AI technology application training course.

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Chapter 2 Literature Review

2.1 Introduction

At present, research on AI technology in education and the impact of AI technology on teaching have become the main focuses of international researchers. This chapter reviews the concepts and relevant research on the factors influencing student learning effect from Python training course.

2.2 Literature Review

2.2.1 Artificial Intelligence and Education

The concept of AI has not been unified since its introduction in 1956 until now. It is usually believed that AI is a technical science that simulates human intelligence (perception, memory, learning, thinking, etc.) through programs, data, and algorithms so that machines have human functions (recognition, cognition, analysis, decision-making, etc.), and it involves the cross-cutting and comprehensive disciplines of computer science, information theory, mathematics, neurophysiology, linguistics, psychology, and other fields (Berendt et al., 2020; Guilherme, 2019; Zhang & Aslan, 2021). The development of AI and its integration in various fields have given rise to many new concepts. In the field of education, the study of AI and education often involves the discussion of "intelligent education," "AI education," and "AI in education.". It is generally believed that AI education is the education of knowledge and skills related to AI as a learning object. Educational AI, on the other hand, uses AI as a means of education to boost the innovative development of education. Intelligent education usually has dual attributes, i.e., the educational perspective aims at educating people, and the informational perspective refers to the technology of educating people (Williamson & Eynon, 2020). It follows that educational AI focuses on how to apply AI to education to augment, enable, and empower education, provide support services for the realization of educational goals, and promote the optimal development of education. The AI in this study refers to educational AI, pointing to the specific application of educational AI in learning. AI is a collection of hardware and software, such as educational robots, intelligent teaching platforms, intelligent assessment systems, and other intelligent applications or tools, that are developed and realized by combining various technological functions to support and assist education and teaching. In this study, they referred to "AI learning tools" (Kim et al., 2020).

For the development of AI technology within the field of education, scholars have mainly focused on two aspects, the first is to study the development status of AI technology applied to teaching, and the other is to predict the future development trend

of AI technology applied to teaching.

In terms of studying the current development of AI technology in education, scholars from various countries have paid close attention to the application of AI technology in education, and the four major areas of intelligent guidance systems, automatic assessment systems, educational games, and educational robots are developing rapidly (How & Hung, 2019). Intelligent guidance systems can create personalized courses based on student learning styles, development levels, and emotional states, and provide personalized teaching guidance for students based on data feedback. It meets the needs of different students. Automatic assessment systems based on natural language processing technology, such as E-rater, Proiect Essay Grade, Intelli-Metic, MyAccess, Criterion, etc., are developed to improve assignments (How & Hung, 2019). And within the education sector educational robots are increasingly being used as powerful learning tools, with a wider range of applications within teaching and learning. AI educational robots can simulate interactions with students, create virtual socialization patterns, improve students' social skills and abilities, and promote learning development in bilateral interactions (Hwang et al., 2020).

In predicting future trends in the application of AI technology to teaching, scholars believe that future developments will focus on the evolution of education. The research looks at existing classroom practices, collaboration between AI and teachers, and the diversity of technologies. AI and the transformation of education, i.e., the integration of technology into students daily lives to advance their learning and practice (Fanning & Gaba, 2021). Scholars have focused on predicting future trends in the use of AI technology in teaching and learning in general, while others have investigated the changes caused by AI for specific purposes (Fanning & Gaba, 2021). The application of AI technology in computerized teaching has been studied, and it is believed that the development of AI in education focuses on how to make informative learning more effective through the integration of AI technology. Scholars have studied the application of AI technology in English teaching, using intelligent teaching robots to assist in their English teaching process, and the actual evaluation results show that the learning robots promote English learning and provide suggestions for further development (How & Hung, 2019).

From the perspective of research trends in the application of AI in education and teaching, the research on the development trend of AI in education in the past decade has changed because of the continuous development of AI technology. The research on AI applications should shift to data collection, analysis, and application. Machine Learning Combined with Intelligent Education analyzes the appropriateness of machine learning education, finds that future research on machine learning education focuses on six major aspects, and analyzes and looks forward to combining AI and education (Nwosisi et al., 2016). With the increasing development of AI technology, its impact on education is also increasing. The further development of AI will have a great impact on future educational goals, learning styles, learning content, educational environment

educational resources, and the role of teachers (Fanning & Gaba, 2021).

To summarize, with the progress of science and technology, AI technology is being widely used in education. The intervention of AI in teaching enables teachers to further improve teaching efficiency and teaching effectiveness, monitor student learning in real-time, grasp student learning progress, provide students with personalized learning tools and provide targeted diagnosis in teaching, and the application of AI technology in the field of education has become a new trend in education and teaching reform. Through combing and analyzing the literature, it is found that related research is paying more and more attention to AI technology in teaching, and there are more and more studies on "AI 10 Education"(Singh & Hiran, 2022).

2.2.2 Motivation

Motivation is the internal force that drives students to engage in learning activities and maintain learning behaviors. Motivation referred to as "motivation to learn", motivation is the internal thrust that drives learning activities forward and the emotional factors that inspire learners to engage in learning behaviors and guide and sustain them (Ditta et al., 2020). Motivation is used to explain the behavior caused by the goal. The composition of motivation can be interpreted as the reason and purpose of learning and direction, which is to achieve the goal of the degree of effort. According to achievement motivation theory learning motivation can be categorized into cognitive internal drive, self-improvement internal drive, and affiliative internal drive. Among them, the cognitive internal drive is the most stable and long-lasting, to acquire knowledge, which is the internal motivation for learning. Self-improvement internal drive belongs to the needs of career development, obtaining achievement or status, and is the external motivation for learning. Attachment internal drive is the need to strive for praise or recognition from elders and is an external motivation for learning (Salta & Koulougliotis, 2015).

Studies have shown that motivation has a significant effect on student learning outcomes in a hands-on Python training course (Kontoghiorghes, 2008). Students with strong intrinsic motivation tend to participate more actively in the course, showing higher learning initiative and stronger problem-solving ability. Whereas extrinsic motivation, such as earning a high grade or fulfilling graduation requirements, can also drive student learning to some extent, its effects are usually not as long-lasting as those of intrinsic motivation. Students with high motivation are more willing to participate in discussions and hands-on work in the classroom, which is especially important in a hands-on Python training course (Zeyer et al., 2013). Python programming requires a lot of hands-on work and problem-solving, and students with high levels of engagement usually master programming skills faster and can carry out project development on their own at the end of the course. Students with different levels of motivation also differ in their learning strategies. Students with high intrinsic motivation are more inclined to

in-depth learning strategies, such as understanding programming principles and applying knowledge to solve real-world problems, while students driven by extrinsic motivation may rely more on surface learning strategies, such as memorizing codes and formulas to cope with exam or task requirements (Salta & Koulougliotis, 2015; Zeyer et al., 2013).

Creating a positive learning atmosphere can enhance motivation to learn. Teachers should create a supportive learning environment that stimulates students' intrinsic motivation. By setting clear learning goals, providing timely feedback, and recognizing and encouraging students' efforts, students' motivation can be effectively enhanced (Chan, 2023; Kasneci et al., 2023). Combining Python programming with practical applications and demonstrating the application of programming skills in real life can enhance student learning interests and motivation. For example, organizing students to conduct project development competitions or matching course content with industry needs can make students feel the practical value of what they have learned (Chan, 2023). Personalized teaching guidance is provided to students according to their different backgrounds and needs. Provide more tutoring and support for students with weaker foundations, and give more challenging tasks to students who keep them motivated to learn. The influence of learning motivation on higher vocational Python training course is multifaceted (Luckin & Cukurova, 2019). Through theoretical analysis and empirical research, it can be seen that improving student learning motivation can significantly enhance their learning effectiveness and engagement.

2.2.3 Intellectual Literacy

Intellectual literacy refers to the knowledge, skills, and attitudes that individuals need in learning and applying AI technologies. In an intelligent society, an individual's intellectual literacy is the key ability to adapt to the development of an intelligent society and to meet the challenges of the future intelligent society (Zawacki-Richter et al., 2019). The core literacy of students in the smart era consists of smart knowledge, smart ability, smart sentiment, and smart ethics. Smart knowledge is the understanding and definition of AI; smart ability is the application of AI in learning; and smart sentiment and smart ethics are the observance of relevant AI ethics. Some scholars have pointed out that "human-computer collaboration will become the new normal of human social structure in the future", and the improvement of intellectual literacy can only cope with the challenges of human-computer collaboration in the future intelligent society. AI supported learning is collaborative learning between humans and machines, and students' intellectual literacy affects their attitudes and applications of AI learning tools (Kasneci et al., 2023; Zawacki-Richter et al., 2019).

Technical competence in intellectual literacy is the foundation for students to master Python programming. Research has shown that students with higher technical competence show higher learning outcomes in hands-on Python courses. These students

can understand programming concepts faster and become proficient in programming tools and environments, thus performing well in the hands-on training (Kasneci et al., 2023). Higher-level Python training course require students to solve problems. Students with strong problem-solving skills are more active and positive in the course, able to efficiently analyze problems, design solutions, and verify and adjust them in practice. This not only enhances individual learning but also increases interaction and engagement throughout the classroom. Intellectual literacy emphasizes critical thinking and innovation, which is in a hands-on Python course (Chan, 2023). Critical thinking helps students critically evaluate the strengths and weaknesses of different solutions during the programming process, while creativity pushes students to explore novel programming approaches and application scenarios. The enhancement helps students develop more creative and practical projects during the practical training (Luckin & Cukurova, 2019).

Incorporating the cultivation of intellectual literacy in the Python practical training course, students can improve relevant abilities while mastering programming skills through integrated course design. For example, the course can be set up with projects related to real-world applications, encouraging students to improve their technical skills and problem-solving abilities (Kasneci et al., 2023; Luckin & Cukurova, 2019). Diversified teaching methods, such as case-based teaching, project-driven teaching, and flipped classrooms, are used to enable students to develop intellectual literacy in different learning contexts. These methods can promote students deep learning and practical skills. Establish an effective assessment and feedback mechanism to continuously assess students' intellectual literacy and provide targeted feedback and guidance (Fanning & Gaba, 2021; Hwang et al., 2020). Through stage-by-stage feedback, students are helped to understand their deficiencies and clarify the direction of improvement The influence of intellectual literacy on higher vocational Python training course is significant and multifaceted. Through theoretical analysis and empirical research, it can be seen that improving students' intellectual literacy not only enhances their programming skills but also promotes the development of their problem-solving ability, critical thinking, and innovation ability (Kasneci et al., 2023; Singh & Hiran, 2022).

2.2.4 Self-Efficacy

Self-efficacy is a learner's subjective prediction of his or her ability and value judgment of whether or not he or she can complete the learning task. Scholars divide learning self-efficacy into an individual's sense of effort, sense of ability, sense of context to the environment, and sense of control over behavior (Wang et al., 2018). Among them, the sense of competence is given to students' subjective perception of their natural abilities, as well as their expectations of learning outcomes and their perception of whether they can achieve their goals. People with a strong sense of learning self-efficacy are more confident. Sense of Effort is the perception of one's level

of effort, and those with a strong sense of learning self-efficacy. Sense of environment is a grasp of the learning environment (Fuentes-Tauber, 2018). Sense of control is the sense of control over learning activities and learning behaviors, and people with a strong sense of self-efficacy for learning can control their learning behaviors (Fanning & Gaba, 2021).

Self-efficacy, proposed by psychologist Bandura, refers to an individual's belief that he or she can successfully perform behavior in a given situation. The theoretical basis includes Bandura's social cognitive theory, which emphasizes the interaction of behavioral, environmental, and personal factors. According to this theory, self-efficacy affects an individual's behavior and performance by influencing motivation, persistence, and coping strategies. Studies have shown that students with a high sense of self-efficacy show higher motivation to learn in a hands-on Python training course (Singh & Hiran, 2022). They are confident in their abilities, more willing to invest time and energy in learning, and show higher motivation and autonomy. This positive learning attitude helps them master programming skills faster and achieve better learning results. In Python programming learning, students often encounter various programming errors and challenges. Students with a high sense of self-efficacy show more persistence and patience in the face of difficulties, they are more willing to spend time to find solutions and do not give up easily (Zawacki-Richter et al., 2019). This persistence not only improved their problem-solving ability but also increased their interest and confidence in programming. Students with a strong sense of self-efficacy tend to adopt more positive coping strategies when facing programming tasks, such as actively seeking help and utilizing multiple resources for learning. Such strategies not only helped them complete tasks more effectively but also promoted their ability to explore new approaches and innovative solutions in programming (How & Hung, 2019).

Teachers should help students accumulate successful experiences in practice by designing appropriate learning tasks and projects. Successful experiences can significantly enhance students' self-efficacy and give them confidence in future learning and challenges (Qadir, 2022). By inviting successful alumni or industry experts to give lectures and share their achievements and experiences in Python programming and AI applications (Kim et al., 2020). Demonstration by role models can motivate students and enhance their belief in their abilities. Teachers should provide timely positive feedback and encouragement to student's efforts and progress to help them recognize their progress and potential (Williamson & Eynon, 2020). Constructive feedback can not only enhance students' self-efficacy but also guide them to improve their deficiencies. The influence of self-efficacy on higher vocational Python training course is multifaceted. Through theoretical analysis and empirical research, it can be seen that improving students' self-efficacy can significantly enhance their motivation, persistence, and coping strategies, thus promoting the development of their programming skills and innovation (Hwang et al., 2020; Williamson & Eynon, 2020).

2.2.5 Teacher Support

In the specific practice of AI-supported learning, there are "student-intelligent machine" and "student-teacher-intelligent machine" forms of learning. Among them are AI machines as learning resources, teachers, teaching companions, learning management, learning assistants, and other multiple roles. Students can learn directly under the help and guidance of intelligent machines, which triggered the debate on whether "artificial can replace the teacher.". Some scholars believe that with the development of AI, AI will replace teachers. Some scholars believe that with the development of AI, education and the teaching of some complex, repetitive work will be done by AI (Lim et al., 2023; Qadir, 2022). To make up for the shortcomings of the teacher, the teacher is working hand in hand with the machine rather than competing. In practice, it has been found that the teacher's recognition of the intelligent writing system in the intelligent collaborative system will motivate students to continue to use it. Teacher guidance is still needed in AI-supported learning, and the teacher is still the leader of instruction. Teachers influence students' self-efficacy or motivate students to learn, and thus indirectly have an impact on student learning adaptations (Guilherme, 2019; Zhang & Aslan, 2021). In AI-supported learning, the teacher's endorsement of the intelligent system will motivate students to continue using it and not rely on the Noh system, and the teacher's guidance is important.

Research has shown that instructor support has multiple positive effects in higher-level Python training course. Emotional support significantly enhances students' motivation and confidence. Establishment of a positive teacher-student relationship and caring for and encouraging students. Specifically, teachers can enhance students' motivation by creating a relaxed and friendly atmosphere in class and responding positively to students' questions and confusion. Academic guidance is crucial to students' mastery of programming skills (Lim et al., 2023; Qadir, 2022). Python programming has high technical requirements, and students often encounter various difficulties and challenges in the learning process. Teachers can significantly improve students programming skills by providing specific guidance and demonstrations to help students understand complex programming concepts and solve practical programming problems. For example, by explaining code examples, conducting code demonstrations, and hands-on instruction, teachers can help students understand and master programming skills more intuitively. Timely and constructive feedback is an important means to enhance student learning (Guilherme, 2019; Zhang & Aslan, 2021). In Python training course, teachers can help students correct their mistakes in time and consolidate what they have learned by reviewing the code written by students in detail, pointing out the errors and deficiencies, and providing suggestions for improvement. Research has shown that specific and timely feedback can effectively improve students programming level and problem-solving ability. Resource provision is another important aspect of instructor support. In Python training course, teachers can help students learn and practice better by providing rich learning resources, such as textbooks, tutorials, programming tools, and practical training cases. For example, by recommending high-

quality online tutorials and programming community resources, instructors can expand student learning channels and promote their independent learning and skill enhancement outside the classroom (Guilherme, 2019; Zhang & Aslan, 2021).

2.2.6 Learning Effect

Student learning effect is an important index to measure the quality of education and teaching results. In recent years, with the renewal of educational ideas and the development of educational technology, the research on student learning effect is increasingly rich and in-depth. There are many researches on influencing factors of student learning effect. Qadir(2022) found that strong learning motivation can significantly improve student learning results. Some researchers believes that effective learning strategies, such as cognitive strategies and resource management strategies, play an important role in improving learning results. Kontoghiorghes(2008) believes that teachers' professionalism, teaching methods and attitudes have a significant impact on student learning effect, and high-quality teaching can stimulate student learning interest. Student learning effect can be evaluated through quantitative indicators such as exam scores, homework completion and learning time. This approach is objective and comparable, but it ignore the individual differences and comprehensive qualities of students. Through project-driven learning, setting up study groups, students' interest and ability of independent learning can be stimulated. Student learning effect is a complex and multi-dimensional concept, which is influenced by many factors. Through the review of relevant literature, it can be found that to improve the learning effect of students, it is necessary to comprehensively consider the individual factors of students, teaching environment factors and evaluation methods. Future research should further explore the specific mechanism of these factors and innovate assessment methods to provide more effective guidance and support for educational practice.

2.3 Conceptual Framework

Based on the review of the literature, the influencing factors of student learning effect from Python training course are motivation, intellectual literacy, self-efficacy, and teacher support. The hypothesis of the relationships of the factors influencing student learning effect from Python practical training course in the application of AI technology is proposed. The model of influencing factors of the higher vocational Python practical training course in AI technology application is shown in Fig 2.1.

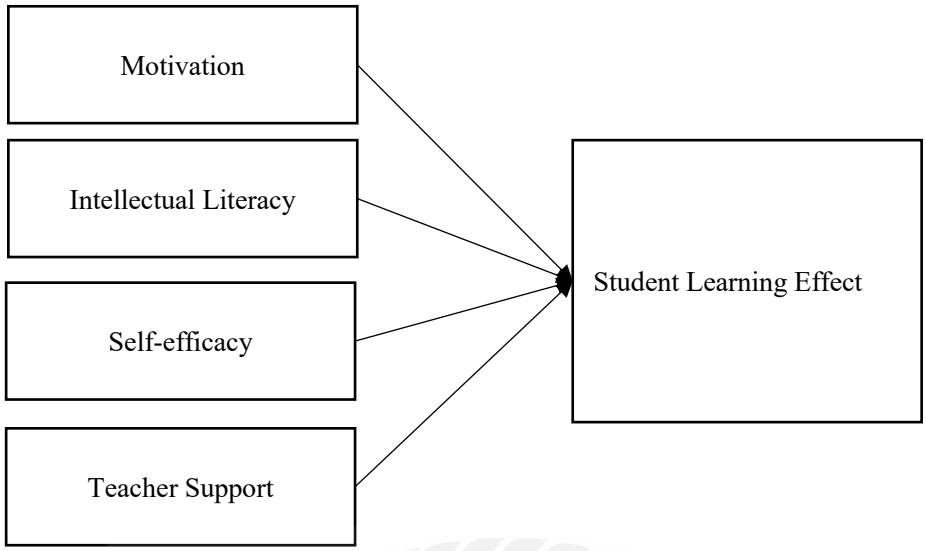

Figure 2.1 Conceptual Framework

Chapter 3 Research Methodology

3.1 Research Design

The quantitative method was used in this study. Factors influencing the student learning effect in Python training course include motivation, intellectual literacy, self-efficacy, and teacher support. A questionnaire survey was conducted to collect data. A questionnaire was designed as follow: Motivation is divided into three aspects: cognitive drive, self-improvement drive, and affiliative drive (items Q1-Q3). Intellectual literacy is divided into three dimensions: knowledge, skills, and attitudes towards AI (items Q4-Q6). Self-efficacy is divided into three aspects: sense of capability, sense of control, and sense of effort (items Q7-Q9). Teacher support is divided into three dimensions: teacher recognition of AI learning resources, usage of AI teaching tools, and guidance in AI-supported teaching (items Q10-Q12). Student learning effect is divided into three dimensions: knowledge mastery, ability development, learning attitude and emotion (items Q13-Q15). The survey questionnaire uses a five-point Likert scale. For each variable, measurement items were designed, and the coding of the items is shown in Table 3.1.

Table 3.1 Measurement Items

Dimension	Measurement Item	NO.
Motivation	I am very excited in learning new concepts of AI.	Q1
	I hope to improve my career competitiveness by learning about AI.	Q2
	I enjoy discussing and sharing knowledge about AI with my classmates.	Q3
Intellectual Literacy	I think I have mastered enough basic knowledge of AI.	Q4
	I am able to solve the problems encountered in AI learning independently.	Q5
	I am passionate and interested in AI learning.	Q6
Self-efficacy	I believe I am capable of mastering complex AI techniques.	Q7
	I feel that I can control the progress of my AI learning.	Q8
	I will continue to work hard at learning AI when I encounter difficulties.	Q9
Teacher Support	My teacher recognizes and recommends the use of a variety of AI learning resources.	Q10
	My teacher regularly uses AI teaching tools in the classroom.	Q11
	My instructor effectively guides our learning in AI-supported instruction.	Q12
	I support the AI technology applications senior python practicum course.	Q13

Student Learning Effect	The AI technology applications higher level python practical training course has improved our learning attitude and emotion.	Q14
	The AI technology applications higher vocational python practical training course has improved our participation level.	Q15

3.2 Hypothesis

Learning motivation is widely recognized in educational research. As a critical factor influencing student learning effects. Self-determination theory suggests that intrinsic motivation, such as interest and enthusiasm for learning, can significantly enhance student achievement. Specifically, in vocational Python training course focusing on AI technology applications, student learning motivation directly affects their engagement and course outcomes.

Intellectual literacy, which refers to an individual's ability to process information, solve problems, and innovate, is crucial when learning complex technologies like AI. Intelligence encompasses analytical ability and practical skills, which are essential for applying AI technology. There is a strong relationship between intelligence and learning, and intellectual literacy is a fundamental basis for effective learning. Therefore, students with high intellectual literacy will achieve excellent results in vocational Python AI technology application training courses.

Self-efficacy, the belief in one's ability to complete a task, is another critical factor influencing learning outcomes. Individuals with high self-efficacy have more confidence and persistence when facing challenges, aiding their success in learning new technologies. Self-efficacy significantly impacts both learning motivation and outcomes. In vocational Python AI technology application training courses, students with high self-efficacy are more likely to overcome learning difficulties and achieve good results.

Teacher support plays a crucial role in the learning process. It is one of the key factors influencing student learning outcomes, especially in technical courses where teacher guidance and feedback are important. The guiding role of teachers in the learning process demonstrates how teacher support can promote student learning and comprehension. In vocational Python AI technology application training courses, effective teacher support can help students better understand and apply course content and learning outcomes. These literature findings support the significant positive impact of learning motivation, intellectual literacy, self-efficacy, and teacher support on the vocational Python AI technology application training courses. Therefore, the following hypotheses are proposed in this study:

H1: Motivation has a significant positive effect on the student learning effect from

Python training course of Shandong University of Engineering and Vocational Technology.

H2: Intellectual literacy has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology.

H3: Self-efficacy has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology.

H4: Teacher support has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology.

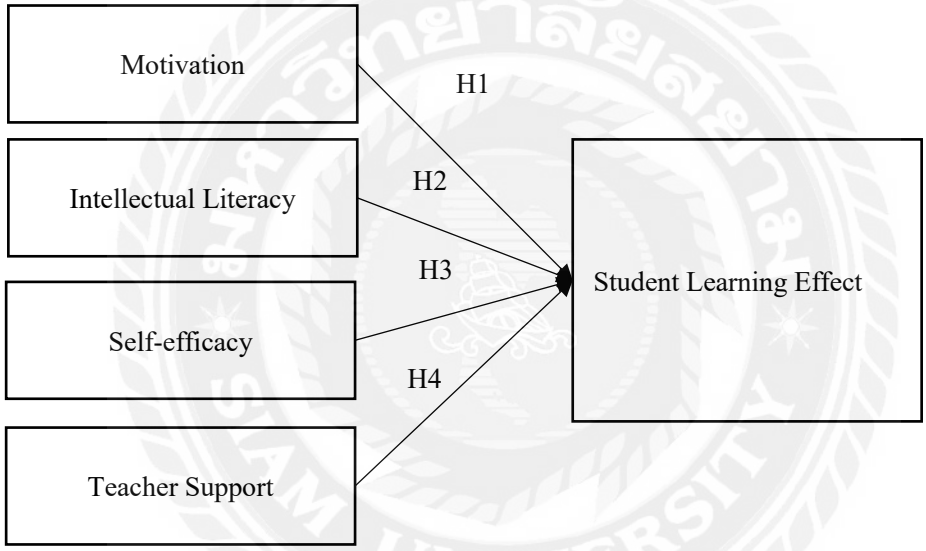

Figure 3.1 Hypotheses

3.3 Population and Sampling

The population of the study was the students of Shandong University of Engineering and Vocational Technology. The simple random sampling method was used in the study. In the formula (Yamane, 1973), n represents the sample size, s is the quartile of the standard normal distribution with a confidence level usually 95%, currently Z=1.96. p is the sample standard deviation, which is estimated to be 0.5. The permissible margin of error, E (i.e., the maximum permissible difference between the sample mean and the overall mean), was set at 0.05. The result of calculating is 450 samples.

$$n = \frac{s^2 * p^2}{E}$$

3.4 Data Collection

The data collection process of this study was mainly conducted through an online questionnaire as follows:

- Survey period: the distribution and collection of the study questionnaires took place between January 1, 2024, and April 1, 2024, which lasted three months.

- Questionnaire distribution: a total of 450 questionnaires were distributed during this period. These questionnaires were sent to the target respondents mainly through online channels to ensure coverage of the population and to increase the recall rate.

- Questionnaire Recovery: At the end of the survey, 388 valid questionnaires were collected. Valid questionnaires were defined as those that were fully answered and met the requirements of the study.

- Questionnaire Effectiveness: The number of valid questionnaires recovered was 388, and the effectiveness rate of questionnaire recovery was 86.22%.

Through the above steps, the study completed the data collection, providing sufficient data for the subsequent analysis.

3.5 Data Analysis

3.5.1 Questionnaire Reliability Analysis

Cronbach's alpha was used to measure the reliability of the questionnaire, and the value of alpha ranges from 0 to 1. The larger the Alpha coefficient is, the higher the reliability is, and the more reliable the results are. SPSS was used to analyze the reliability of the questionnaire, and the results are shown in Table 1. The Cronbach's alpha of all the factors is higher than 0.8. According to Cronbach's alpha criterion, a coefficient of more than 0.8 is good for reliability; between 0.7 and 0.8 is acceptable; and less than 0.7 is not good for reliability. Then the reliability of the questionnaire in this study is acceptable, and the internal consistency of the data is good.

The reliability analysis of the survey data is judged by Cronbach's alpha index. Through the study, the Cronbach's alpha of motivation is 0.846; the Cronbach's alpha of intellectual literacy is 0.869； the Cronbach's alpha of self-efficacy is 0.896; the Cronbach's alpha of teacher support is 0.891; the Cronbach's alpha of student learning

effect is 0.856. As shown in Table 3.2.

Table 3.2 Variable Reliability Test

Variable	Cronbach's Alpha	N of Items
Motivation	0.846	3
Intellectual Literacy	0.869	3
Self-Efficacy	0.896	3
Teacher Support	0.891	3
Student Learning Effect	0.856	3

3.5.2 Questionnaire Validity Analysis

The validity of the questionnaire was tested by the KMO test and Bartlett's test of sphericity. Using SPSS to carry out "factor analysis" of the sample data, the results in Table 3.3 show the questionnaire KMO = 0.911 and P = 0.000. According to the discriminant criteria: KMO value range (0, 1), the closer the KMO value is to 1, the stronger the correlation between the variables. KMO test coefficient > 0.5 and eye Bartlett sphere test P less than 0.05, two indicators reach the standard only when the factor analysis can be done. It means that the validity of the questionnaire in this study passed, and factor analysis can be done. Factor analysis verifies whether the dimension division of the questionnaire is reasonable. Factor analysis was conducted by principal component analysis, and four factors with eigenvalues greater than one were extracted as the common factors, which were consistent with the conception of the study; moreover, the cumulative variance contribution rate reached 66.694%, which exceeded 60% of the overall, indicating that the screened factors had good representativeness and that the results of the factor extraction were relatively satisfactory. Using the maximum difference method for factor rotation, the indicators and the corresponding dimensions are consistent with the scale initially sorted out by the study, and thus the dimensions delineated by the study are more scientific and reasonable. In conclusion, the reliability and validity of the questionnaire in this study passed the test and can be analyzed in subsequent studies.

Table 3.3 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.911
Bartlett's Test of Sphericity	Approx. Chi-Square	3298.521
	df	66
	Sig.	0.000

Table 3.4 Confirmatory Factor Analysis（CFA）

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Rotation Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	% of Variance	Cumulative %	% of Variance	Cumulative %
1	8.453	56.352	56.352	45.844	45.844	17.629	17.629
2	1.055	7.031	63.383	8.203	54.047	16.97	34.599
3	1.000	6.664	70.047	7.604	61.651	16.955	51.554
4	0.811	5.407	75.455	6.638	66.694	16.734	66.694
5	0.695	4.635	80.089				
6	0.475	3.168	83.258				
7	0.382	2.544	85.801				
8	0.363	2.421	88.223				
9	0.338	2.253	90.476				
10	0.311	2.075	92.551				
11	0.289	1.924	94.475				
12	0.246	1.638	96.113				
13	0.231	1.543	97.656				
14	0.197	1.310	98.966				
15	0.155	1.034	100.000				

In the study, Confirmatory Factor Analysis (CFA) was applied to categorize all the questionnaire items, which were finally classified into five dimensions. Based on the results of the dependent factor analysis, a total of five dimensions with eigenvalues greater than 1 were extracted, which is the same as the division of the questions in the original questionnaire design. The factor loadings of each measurement item of the questionnaire on its corresponding dimension were all greater than 0.5, which indicated that the performance of each measurement item on the dimension to which it belonged was highly representative. In addition, the discriminant validity between the dimensions is good, implying that the dimensions are independent of each other and there is no significant overlap. This further suggests that the dimensions are conceptually independent and can accurately reflect the aspects being measured. These results indicate that the overall validity of the questionnaire is good and can effectively measure the aspects of concern. Specific data and results are detailed in Table 3.5.

Table 3.5 Rotated Component Matrix

	1	2	3	4	5
Q1	0.791				

Q2	0.722				
Q3	0.756				
Q4			0.738		
Q5			0.754		
Q6			0.770		
Q7		0.728			
Q8		0.722			
Q9		0.762			
Q10					0.795
Q11					0.827
Q12					0.716
Q13				0.776	
Q14				0.789	
Q15				0.810	

3.5.3 Questionnaire Date Analysis

After data collection, analysis was required, and the specific process was as follows: Firstly, the collected data were cleaned and inspected, including checking for missing data, outliers, and abnormal values. If there were issues, the data were processed or excluded. Secondly, descriptive statistical analysis was performed on the survey sample, including the sample size and proportions. Correlation analysis was conducted on the collected data to determine the interactions between variables. Finally, regression analysis was performed, using path coefficient diagrams and coefficient tables to describe the relationships between latent and observed variables, verifying research hypotheses.

Chapter 4 Findings

4.1 Introduction

The factors affecting the student learning effect from Python practical training course of Shandong Engineering Vocational College were sorted out through a literature review. The quantitative research method was used. The collected questionnaires were analyzed to determine the reliability and validity of the collected data. Descriptive statistics, correlation analysis, and regression analysis were conducted for the study. The analysis was done to test the hypotheses and to clarify the interactions between the variables in the model.

4.2 Demographic Characteristics of Respondents

According to the statistical data, among the respondents, 43.8% were male and 56.2% were female. The age distribution showed that 42.5% were aged 18-25, 19.6% were aged 26-35, 27.6% were aged 36-45, 6.2% were aged 46-55, and 4.1% were over 55 years old. In terms of household income, 11.1% of respondents had an income below 2000 RMB, 24.2% had an income between 2001 and 4000 RMB, 15.2% had an income between 4001 and 6000 RMB, 10.6% had an income between 6001 and 8000 RMB, 8.2% had an income between 8001 and 10000 RMB, and 30.7% had an income above 10000 RMB.

Based on the provided statistical data, the survey respondents included a slightly higher proportion of females (56.2%) compared to males (43.8%). This gender distribution is common in social surveys but may be influenced by the choice of survey subjects and the survey method used. The age distribution shows that the 18-25 and 36-45 age groups had relatively higher participation rates, at 42.5% and 27.6%, respectively. This reflects a higher engagement among young and middle-aged individuals in the survey, which could be related to the survey topic or the selection of survey subjects. In terms of household income, the group with incomes above 10000 RMB accounted for the highest proportion at 30.7%, while those with incomes below 2000 RMB and between 2001 and 4000 RMB accounted for lower proportions, at 11.1% and 24.2%, respectively. This indicates a higher proportion of high-income individuals among the respondents, which may have significant implications for interpreting and generalizing the survey results. The analysis is shown in Table 4.1

Table 4.1 Demographic Characteristics of Respondents

Items	Options	Frequency	Percent%
Gender	Male	170	43.8
	Female	218	56.2

Age	18-25	165	42.5
	26-35	76	19.6
	36-45	107	27.6
	46-55	24	6.2
	above 55	16	4.1
Income	Less than 2000yuan	43	11.1
	2001-4000	94	24.2
	4001-6000	59	15.2
	6001-8000	41	10.6
	8001-10000	32	8.2
	More than 10,000 yuan	119	30.7

4.3 Results of the Study

4.3.1 Correlation Analysis

Based on the given data, the study obtained the following correlation coefficients between the variables:

The correlation coefficient between motivation and intellectual literacy is 0.613, with a significance level of $P<0.01$. This indicates a significant positive correlation, suggesting that participants with higher motivation exhibit higher intellectual literacy.

The correlation coefficient between motivation and self-efficacy is 0.597, with a significance level of $P<0.01$. This indicates a significant positive correlation, suggesting that individuals with higher motivation also have stronger self-efficacy.

The correlation coefficient between motivation and teacher support is 0.592, with a significance level of $P<0.01$. This indicates a significant positive correlation, suggesting that individuals who receive more teacher support have higher motivation to participate.

The correlation coefficient between motivation and student learning effect is 0.591, with a significance level of $P<0.01$. This indicates a significant positive correlation.

The correlation coefficient between intellectual literacy and self-efficacy is 0.649, with a significance level of $P<0.01$. This indicates a significant positive correlation, suggesting that individuals with higher intellectual literacy also have stronger self-efficacy.

The correlation coefficient between intellectual literacy and teacher support is 0.693, with a significance level of $P<0.01$. This indicates a significant positive

correlation, suggesting that individuals who receive more teacher support exhibit better intellectual literacy.

The correlation coefficient between intellectual literacy and student learning effect is 0.648, with a significance level of P<0.01. This indicates a significant positive correlation, suggesting that individuals with higher intellectual literacy perform better in Python training course.

The correlation coefficient between self-efficacy and teacher support is 0.656, with a significance level of p<0.01. This indicates a significant positive correlation, suggesting that individuals who receive more teacher support have stronger self-efficacy.

The correlation coefficient between self-efficacy and the student learning effect is 0.589, with a significance level of P<0.01. This indicates a significant positive correlation, suggesting that individuals with stronger self-efficacy perform better in Python practical training course.

The correlation coefficient between teacher support and student learning effect is 0.699, with a significance level of P<0.01. This indicates a significant positive correlation, suggesting that individuals who receive more teacher support perform better in Python practical training course.

Table 4.2 Correlation Between Variables (Pearson Correlation Matrix)

	Motivation	Intellectual Literacy	Self-efficacy	Teacher Support	Student Learning Effect
Motivation	1				
Intellectual Literacy	.613**	1			
Self-efficacy	.597**	.649**	1		
Teacher Support	.592**	.693**	.656**	1	
Student Learning Effect	.591**	.648**	.589**	.699**	1

NOTE：*P<0.05, **P<0.01, ***P<0.001

These results highlight the importance of motivation, intellectual literacy, self-efficacy, and teacher support in influencing student learning effect in vocational Python AI technology application training courses. According to the analysis results in Table 4.2, the relationship between each variable was obtained.

4.3.2 Multiple Regression Analysis

Multiple regression analysis was performed on the data to determine the relationship between the dependent and independent variables. The regression equation was significant with F = 124.968, p<0.001. The Durbin-Watson test value was 1.870, which is between 1.8 and 2.2. This indicates that the data complied with linear regression. In the covariance diagnostic results, the VIF value of each variable is close to 1. The VIF value meets the requirement, which indicates that there is no covariance in the data. Motivation (β=0.552, P<0.001), intellectual literacy (β=0.678, P<0.001), self-efficacy (β=0.408, P<0.001), and teacher support (β=0.757, P<0.001) have significant positive effects on the student learning effect from Python training course. Together, these variables explain the weight of 75.2% of the student learning effect from Python training course, which meets the requirement.

Table 4.3 Multiple Regression Analysis

Item	Unstd. B	Std. Beta	t	Sig.	VIF	F	Durbin-Watson
C	3.267	3.112	7.237	0.000		124.968***	1.870
Motivation	0.552	0.539	3.846	0.000	1.168		
Intellectual Literacy	0.678	0.621	4.079	0.000	1.364		
Self-Efficacy	0.408	0.399	3.909	0.000	1.143		
Teacher Support	0.757	0.734	7.509	0.000	1.03		
R Square	0.752						
Adjusted R Square	0.748						

NOTE：*P<0.05, **P<0.01, ***P<0.001

Therefore, according to the results of the data analysis, motivation has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology, which supports hypothesis H1. Intellectual literacy has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology, which supports hypothesis H2. Self-efficacy has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology, which supports hypothesis H3. Teacher support has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology, which supports hypothesis H4.

Chapter 5 Conclusion and Recommendation

5.1 Conclusion

The study results show that motivation, intellectual literacy, self-efficacy, and teacher support all have a significant effect on the student learning effect from the senior Python practical training course of Shandong University of Engineering and Vocational Technology. According to the model of factors affecting learning effect, intellectual literacy is the main factor affecting the student learning effect from Python practical training course in the application of AI technology. The high-quality learning resources does not mean that effective learning can be achieved, and students need to have the ability to choose resources independently and apply them reasonably to obtain effective learning.

Through the above research, several suggestions can be put forward for the improvement of the students learning effect from the senior Python practical training course of Shandong University of Engineering and Vocational Technology: 1) Motivating independent learning. By introducing practical cases and specific challenges, students can witness the practical application value of knowledge and skills in the course, thereby stimulating their interest and motivation in learning. 2) Enhancing intelligence. Consequently, educators can adopt challenging and interactive learning tasks in curriculum design and teaching methodologies, guiding students to employ logical reasoning and problem-solving strategies, thereby fostering their comprehensive development of intellectual literacy. 3) Strengthening self-efficacy. In curriculum design and teaching implementation, educators can adopt encouraging feedback, set achievable goals, and provide support and resources to help students establish and strengthen their self-efficacy. 4) Improving teacher support. Teachers should actively communicate and interact with students, paying attention to their learning progress and individual development needs.

5.1.1 Motivation Has a Significant Positive Effect on the Student Learning Effect from Python Training Course

The research results indicate that the application of AI technology in Python training course in higher vocational colleges is significantly influenced by multiple factors. Motivation ($\beta=0.552$, $P<0.001$) has a positive impact on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology. The study finds that the higher the student learning motivation, the more active they are in the course, and the better their learning outcomes. This suggests that students intrinsic drive and enthusiasm play a crucial role in the learning process, directly affecting their academic achievements and skill enhancement. In terms of instructional design, these findings prompt educators and curriculum designers to

prioritize student learning motivation. This may involve devising challenging and realistic tasks, providing real-time feedback and personalized support, and creating a teaching environment that encourages collaboration and autonomous learning. Moreover, guiding students to discover the purpose and significance of their learning, as well as skills and knowledge relevant to their career development, is also one of the critical strategies to stimulate learning motivation.

5.1.2 Intellectual Literacy Has a Significant Positive Effect on the Student Learning Effect from Python Training Course

The research findings reveal that intellectual literacy (β=0.678, P<0.001) is another pivotal factor in Python training course in higher vocational colleges. Students with high intellectual literacy can comprehend and apply AI technology more effectively, demonstrating superior performance and learning outcomes in the course. This finding underscores the importance of cultivating students intellectual literacy, emphasizing the need to enhance their logical thinking and problem-solving abilities in instructional design and implementation. Students with high intellectual literacy may possess stronger analytical and reasoning skills, enabling them to grasp complex concepts and algorithms more profoundly, which facilitates the efficient application of their knowledge in Python training course. Consequently, educators can adopt challenging and interactive learning tasks in curriculum design and teaching methodologies, guiding students to employ logical reasoning and problem-solving strategies, thereby fostering their comprehensive development of intellectual literacy. Intellectual literacy plays a significant role in enhancing students performance in Python training course. By integrating teaching strategies and activities suitable for students' intellectual development into instruction, educators can effectively elevate their learning outcomes and application abilities.

5.1.3 Self-Efficacy Has a Significant Positive Effect on the Student Learning Effect from Python Training Course

The research findings demonstrate that self-efficacy (β=0.408, P<0.001) has a positive impact on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology. Self-efficacy refers to students' confidence in their ability to accomplish tasks. The study reveals that students with higher self-efficacy are more likely to succeed in the course because they have faith in their abilities and can better tackle challenges and difficulties encountered in the curriculum. This discovery underscores the importance of fostering students' self-efficacy. By enhancing students' self-confidence and perceived competence, educators can motivate them to maintain a positive attitude towards learning difficulties and challenges and have greater motivation to overcome obstacles. In curriculum design and teaching implementation, educators can adopt encouraging feedback, set

achievable goals, and provide support and resources to help students establish and strengthen their self-efficacy. As one of the critical factors influencing student learning outcomes, self-efficacy should be a focal point of educators' attention and support. Through effective teaching strategies and personalized support measures, educators can effectively enhance students' self-efficacy, thereby promoting their learning achievements and capability development in Python training course.

5.1.4 Teacher Support Has a Significant Positive Effect on the Student Learning Effect from Python Training Course

The research findings indicate that teacher support (β=0.757, P<0.001) is one of the most crucial factors influencing the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology. The support provided by teachers has proven to have a significant positive impact on the course, encompassing guidance, assistance, and encouragement. This support not only enhances student learning experience but also significantly improves their learning outcomes in the course. The study points out that effective teacher support assists students in overcoming various difficulties and challenges encountered during the learning process. Through timely guidance and personalized assistance, teachers can help students comprehend complex concepts, resolve learning issues, and boost their learning motivation and self-efficacy. This support is not only academically beneficial but also psychologically reinforces student learning confidence and enthusiasm, making them more willing to engage in learning tasks. Consequently, educators should prioritize the role and supportive functions of teachers when designing and implementing Python training course. It is recommended that teachers actively promote student learning progress and comprehensive ability development by establishing positive teacher-student relationships, providing personalized learning support and feedback, and encouraging student participation in practical activities. See Table 5.1.

Table 5.1 Hypothesis Test Results

NO.	Hypothesis	Result
H1	Motivation has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology.	Supported
H2	Intellectual literacy has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology.	Supported
H3	Self-efficacy has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology.	Supported
H4	Teacher support has a significant positive effect on the student learning effect from Python training course of Shandong University of Engineering and Vocational Technology.	Supported

5.2 Recommendation

(1) Motivating Independent Learning

Learning motivation is of great importance in the Python AI Technology Application Practical Training Course offered by Shandong Vocational College of Engineering. Curriculum design should emphasize real-world application scenarios and problem-solving. By introducing practical cases and specific challenges, students can witness the practical application value of knowledge and skills in the course, thereby stimulating their interest and motivation in learning. Providing opportunities for personalized learning and choices is also a crucial strategy. Students can choose research topics or deepen their learning directions based on their interests and abilities. This personalized learning path can enhance students' autonomy and participation. The role of teachers in the teaching process is also vital. They should act as guides and supporters, helping students overcome difficulties and challenges in learning by establishing good teacher-student relationships, providing timely feedback and guidance. Teachers' support can not only strengthen student learning motivation but also enhance their self-efficacy and academic achievements. Encouraging students to participate in learning communities and teamwork is also an effective way to stimulate learning motivation. Through collaborative learning and knowledge sharing, students can inspire and motivate each other, jointly explore solutions to problems, and thereby improve the depth and breadth of their learning.

(2) Enhancing Intelligence

The positive impact of intellectual literacy on the Python AI Technology Application Practical Training Course offered by Shandong Vocational College of Engineering is evident. The curriculum design should emphasize cultivating students logical thinking and problem-solving abilities. Introducing challenging and in-depth academic and practical tasks encourages students to analyze complex problems and propose effective solutions. Through these tasks, students can enhance their intellectual literacy, develop critical thinking, and foster innovation capabilities. Teaching methods should focus on heuristic instruction and practice-oriented learning. By engaging in laboratory practices, project-based learning, and real-world case analyses, students interest and participation in learning can be stimulated. These practical activities not only deepen students understanding of theoretical knowledge but also cultivate their abilities to solve real-world problems. Personalized learning and feedback mechanisms are also effective strategies for improving intellectual literacy. Providing customized learning paths and feedback tailored to individual learning needs and ability levels can effectively promote students' intellectual growth and academic progress. Interdisciplinary learning and cross-disciplinary discussions also contribute to enhancing intellectual literacy. Encouraging students to participate in courses can broaden their knowledge horizons and thinking

patterns, fostering comprehensive intellectual literacy and cross-disciplinary problem-solving abilities.

(3) Strengthening Self-Efficacy

Shandong Vocational College of Engineering provides a supportive learning environment and resources. This includes ample learning materials, technical support, and laboratory facilities to ensure students have access to the necessary learning resources and tools throughout their learning process. Such a supportive environment can enhance student learning confidence, boosting their self-efficacy. The teaching approach employs progressively challenging learning tasks and goal-setting. By setting goals suitable for students' ability levels and gradually guiding them towards achieving these goals, students can build confidence and competence in completing tasks. This contributes to improving self-efficacy and encourages students to face learning challenges. Encouraging students to participate in real-world projects or competitions not only enables them to apply theoretical knowledge in practice but also strengthens their self-confidence and self-efficacy. By completing projects or achieving good results in competitions, students can further validate their abilities and potential, thereby reinforcing their self-efficacy. Providing timely and specific feedback is a crucial way to enhance self-efficacy. Teachers should provide affirmation and constructive feedback when students complete tasks or reach milestones. This feedback not only helps students recognize their progress and achievements but also guides them to adjust and improve their learning process, further enhancing their self-efficacy.

(4) Improving Teacher Support

The positive impact of teacher support in the Python Practical Training Course for AI Technology Application in Higher Vocational Education at Shandong Vocational College of Engineering is significant. Establishing a strong teacher-student relationship is key. Teachers should actively communicate and interact with students, paying attention to their learning progress and individual development needs. Through regular individual conversations or group discussions, teachers can understand student learning dynamics and difficulties, providing timely support and guidance. Providing personalized academic guidance and tutoring tailored to student learning levels and needs can help them overcome learning issues. This support effectively enhances student learning confidence and motivation, promoting their academic performance in the course. Encouraging open communication and feedback mechanisms allows students to raise questions and opinions. Through open communication channels and feedback mechanisms, teachers can better understand students needs and expectations, subsequently adjusting teaching strategies and methods to improve teaching effectiveness and student satisfaction. Teachers can also expand students' academic horizons and practical application abilities by providing additional learning resources and opportunities, such as recommended extracurricular readings. These extra learning opportunities enrich student learning experiences, enhancing their understanding and application of course content.

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Appendix

Dear Sir/Madam,

Thank you for your participation in this questionnaire survey. The survey will be conducted anonymously, and your relevant information will be kept confidential. Thank you again for your cooperation.

Part Ⅰ:

1. Gender? A Male B Female
2. Age

A.18-25 B.26-35 C.36-45 D. 46-55 E. Above 55

3. Income

A. Less Than 2000yuan
B.2001-4000
C.4001-6000
D.6001-8000
E.8001-10000
F. More Than 10,000 Yuan

Part Ⅱ: Please judge to what extent you agree with the following statement; choose the most appropriate option, and mark the corresponding number " √. " The questionnaire used a Likert scale, ranging from 1 to 5 in which one indicates strongly disagree (or strongly disagree), two indicates relatively disagree (or relatively disagree), three indicates neutral, four indicates relatively agree (or relatively agree), and five indicates strongly agree (or strongly agree)

Measuring item	Strongly disagree	Disagree	General	Agree	Strongly agree
I am very excited in learning new concepts of AI.					
I hope to improve my career competitiveness by learning about AI.					
I enjoy discussing and sharing knowledge about AI with my classmates.					

I think I have mastered enough basic knowledge of AI.					
I am able to solve the problems encountered in AI learning independently.					
I am passionate and interested in AI learning.					
I believe I am capable of mastering complex AI techniques.					
I feel that I can control the progress of my AI learning.					
I will continue to work hard at learning AI when I encounter difficulties.					
My teacher recognizes and recommends the use of a variety of AI learning resources.					
My teacher regularly uses AI teaching tools in the classroom.					
My instructor effectively guides our learning in AI-supported instruction.					
I support the AI technology applications senior python practicum course.					
The AI technology applications higher level python practical training course has improved our learning effect.					
The AI technology applications higher vocational python practical training course has improved our participation level.					