

SUSTAINABLE DEVELOPMENT STRATEGY OF AUTONOMOUS
LEARNING ABILITY OF COLLEGE STUDENTS
IN SHAANXI PROVINCE

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A thesis paper submitted in partial fulfillment of the requirements for the Degree of
Doctor of Philosophy Program in Educational Management for Sustainable Development

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กลยุทธ์การพัฒนาอย่างยั่งยืนเพื่อเสริมสร้างความสามารถ
ในการเรียนรู้อย่างอิสระของนักศึกษาระดับวิทยาลัย
ในมณฑลसानซี

ลี เหมย

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปรัชญาดุษฎีบัณฑิต
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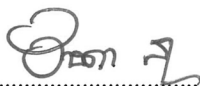
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ABSTRACT

The objectives of this research were: 1) to study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province; 2) to develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province; 3) to evaluate the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province. The research sample includes 384 questionnaire respondents and 20 interview experts, all from the higher education sector in Shaanxi Province, selected through random proportion sampling. This research is mixed method. The research tools include: 1) Questionnaire Form; 2) Interviews Form; 3) Evaluation Form. Data analysis was conducted using percentages, means, standard deviations, and content analysis. The objective agreement index (IOC) ranging from 0.60 to 1.00 reliability of the questionnaire Cronbach Alpha coefficient test score was 0.875.

The research results show that: 1) the current status of autonomous learning ability among college students in Shaanxi Province is at a moderate level and expected condition is high; 2) the sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province includes five

aspects: learning motivation, learning strategies, self-efficacy, learning environment, and self-regulation and control, there are 46 measures in total; 3) The feasibility and adaptability assessment results of each strategy are at a relatively high level.

Despite the formulation of 46 strategies, college students' autonomous learning abilities remain at a moderate level, falling short of goals. Expected outcomes include enhancing students' learning motivation, learning strategies, self-efficacy, learning environment, and self-regulation and control. In the long term, these measures will help students develop a sustainable awareness of autonomous learning, enhance their autonomous learning abilities, and cultivate individuals with social responsibility, adaptability, and continuous learning capabilities, thereby promoting educational modernization and sustainable social development.

Keywords: Sustainable development strategies, Autonomous Learning Ability, Shaanxi Province

ชื่อเรื่อง	กลยุทธ์การพัฒนาอย่างยั่งยืนของความสามารถ ในการเรียนรู้อย่างอิสระของนักศึกษาระดับวิทยาลัยในมณฑลसानซี
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บทคัดย่อ

วัตถุประสงค์ของการวิจัยครั้งนี้คือ 1) เพื่อศึกษาสถานการณ์ปัจจุบันและสถานการณ์ที่คาดหวัง ของความสามารถในการเรียนรู้อย่างอิสระของนักศึกษาในวิทยาลัยในมณฑลसानซี 2) เพื่อพัฒนากลยุทธ์การพัฒนาความสามารถในการเรียนรู้อย่างอิสระของนักศึกษาในวิทยาลัยในมณฑลसानซี และ 3) เพื่อประเมินความเป็นไปได้และการนำไปใช้ของกลยุทธ์การพัฒนาความสามารถในการเรียนรู้ อย่างอิสระของนักศึกษาในวิทยาลัยในมณฑลसानซี กลุ่มตัวอย่างงานวิจัยประกอบด้วย ผู้ตอบแบบสอบถาม 384 คน และผู้เชี่ยวชาญในการสัมภาษณ์ 20 คน ซึ่งทั้งหมดมาจากภาคการศึกษา ระดับอุดมศึกษาในมณฑลसानซี โดยเลือกด้วยวิธีการสุ่มตัวอย่างตามสัดส่วน เครื่องมือในการวิจัย ประกอบด้วย 1) แบบสอบถาม 2) แบบสัมภาษณ์ 3) แบบประเมิน ดัชนีความสอดคล้องเชิง วัตถุประสงค์ (IOC) อยู่ในช่วง 0.60 ถึง 1.00 ซึ่งแสดงถึงความน่าเชื่อถือของแบบสอบถาม ค่าสัมประสิทธิ์ Cronbach Alpha มีค่าเท่ากับ 0.875

ผลการวิจัยพบว่า 1) สถานการณ์ปัจจุบันของความสามารถในการเรียนรู้อย่างอิสระของ นักศึกษามหาวิทยาลัยในมณฑลसानซีอยู่ในระดับปานกลางและสถานการณ์ที่คาดหวังอยู่ในระดับสูง 2) การพัฒนากลยุทธ์การพัฒนาอย่างยั่งยืนสำหรับความสามารถในการเรียนรู้อย่างอิสระของนักศึกษา วิทยาลัยในมณฑลसानซีประกอบด้วย 5 ด้าน ได้แก่ แรงจูงใจในการเรียนรู้ กลยุทธ์การเรียนรู้ ความ เชื่อมั่นในตนเอง สภาพแวดล้อมการเรียนรู้ และการควบคุมตนเอง โดยมีมาตรการทั้งหมด 46 มาตรการ 3) ประเมินความเป็นไปได้ของแต่ละกลยุทธ์ความสามารถในการเรียนรู้อย่างอิสระของนักศึกษาวิทยาลัย ยังคงอยู่ในระดับปานกลาง อยู่ในระดับสูง

ถึงแม้ว่าจะมีการกำหนดกลยุทธ์ถึง 46 ข้อแล้วก็ตาม ความสามารถในการเรียนรู้ด้วยตนเองของนักศึกษาวิทยาลัยยังคงอยู่ในระดับปานกลาง ซึ่งยังไม่บรรลุเป้าหมายที่ตั้งไว้ ผลลัพธ์ที่คาดหวังได้แก่ การเพิ่มแรงจูงใจในการเรียนรู้ กลยุทธ์การเรียนรู้ ความเชื่อมั่นในตนเอง สภาพแวดล้อมการเรียนรู้ และการควบคุมตนเองของนักศึกษา ในระยะยาว มาตรการเหล่านี้จะช่วยให้นักศึกษาพัฒนาความตระหนักรู้ที่ยั่งยืนเกี่ยวกับการเรียนรู้อย่างอิสระ เพิ่มพูนความสามารถในการเรียนรู้อย่างอิสระ และปลูกฝังบุคคลที่มีความรับผิดชอบต่อสังคม ความสามารถในการปรับตัว และความสามารถในการเรียนรู้อย่างต่อเนื่อง ซึ่งจะช่วยส่งเสริมการพัฒนาการศึกษาให้ทันสมัยและการพัฒนาสังคมอย่างยั่งยืน

คำสำคัญ : กลยุทธ์การพัฒนาอย่างยั่งยืน, ความสามารถในการเรียนรู้อย่างอิสระ, มณฑล
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Chapter 1

Introduction

Rationale

UNESCO proposed that "lifelong learning is the concept of survival in the 21st century. Without the awareness and ability of lifelong learning, it is difficult to survive in the 21st century." Rong Yajun & Wang Hongwei. (2015). In 2015, UNESCO adopted and released the "Education 2030 Framework for Action" at its headquarters in Paris, which clearly aims to "get opportunity for everyone to learn for life". Improving autonomous learning ability is an important way to achieve lifelong learning goals. As an important learning ability for college students, autonomous learning ability has been valued by more and more scholars. Many colleges and universities place the cultivation of college students' autonomous learning ability in an important position in the goal of talent cultivation. Under the guidance of the educational thought of "students as the main body" and the concept of "lifelong education", autonomous learning ability has also become one of the key research directions of scholars at home and abroad.

Autonomous learning ability is the foundation of lifelong learning and one of the most important issues in building a learning society. The 18th National Congress of the Communist Party of China clearly pointed out that we should improve the lifelong education system and build a learning society. With the further advancement of education modernization and the deepening of education reform, individual ability training and all-round development have become the focus of national and social attention. As the new force of the country, college students are the future builders of the country, and their ability development is particularly important.

In 2018, the Ministry of Education proposed in the "Opinions on Accelerating the Construction of High-level Undergraduate Education and Comprehensively Improving Talent Cultivation Capabilities" that to achieve the all-round development

of undergraduates, it is not only necessary for teachers to "teach well" but also for students to "learn well" "If college students want to "learn well", the development of their autonomous learning abilities must be regarded as the focus of training. Subsequently, in 2019, Sun Chunlan, Premier of the State Council, also proposed at the plenary meeting of the Higher Education Work Advisory Committee directly under the Ministry of Education to use hard constraints to prevent college students from autonomous learning. Therefore, studying ways to improve college students' autonomous learning ability is of great significance for cultivating high quality talents, and even promoting the reform of the higher education system and building a powerful socialist education country. Yin Haiqiang (2020), believes that the cultivation of autonomous learning ability is of great significance to college students' college study and future development. "It determines the sustainable development potential of college students in the future. "Wen Li (2022), through research on the innovation of the English autonomous learning model, found that autonomous learning can not only improve scholars' self-management, but also enable scholars to rationally use diversified information channels to collect learning resources, and then adjust their own learning status in a timely manner to improve learning and efficiency. Scholars at home and abroad have conducted many studies on how to improve college students' autonomous learning ability. These studies are based on different disciplinary perspectives. Psychology focuses on the impact of personal psychological factors on college students' autonomous learning ability (Bandura1993; Wang Jingqiong 2010; Xu Jinfen 2014). Education focuses on the impact of teaching on college students' autonomous learning ability (Yu Li 2010; Wu Yuanyuan 2011; Liu Huadong 2016; Feng Qihong 2017).

However, from the actual development of education in China, under the guidance of the college entrance examination system, students are focused more on the accumulation of knowledge and the closely related test scores. The stimulation of students' interest in learning and the strengthening of internal motivation for learning are often ignored, which also results in the fact that most college students' learning behavior before entering university requires strict supervision from the

outside world. In the relaxed learning environment of colleges and universities, diversified value orientations, diversified learning goals, and autonomous learning arrangements often make college students psychologically at a loss. Coupled with the "lenient" management style of colleges and universities, most college students have not yet completed their studies when they graduate. Forming autonomous learning capabilities that are sufficient to meet the needs of social development is one of the main reasons why all walks of life criticize the quality of university education in China. At the same time, when scholars study college students' autonomous learning ability, they have not placed college students in specific conditions and comprehensively considered the factors that affect the cultivation of college students' autonomous learning ability, which ultimately affects the formulation of strategies for the sustainable development of college students' autonomous learning ability.

To sum up, it is crucial to improve the autonomous learning ability of college students. By formulating relevant strategies to continuously improve the autonomous learning ability of college students, it has a profound impact on the overall development of college students, the cultivation of lifelong learning ability, and the success of future careers. The knowledge that college students learn during school is often just the tip of the iceberg. More knowledge and skills need to be continuously learned and mastered in future work and life. Therefore, college students with autonomous learning ability can adapt to environmental changes more quickly, continue to learn new knowledge and skills, and maintain competitiveness.

Every student has different study habits, interests, and ability levels. The ability of autonomous learning allows students to choose the learning method, learning rhythm and learning content that suits them based on their actual condition, thereby achieving personalized learning. This learning method can better stimulate students' interest and motivation in learning and improve learning efficiency. Autonomous learning is not only about the accumulation of knowledge, but more importantly, about cultivating critical thinking and innovation abilities during the learning process. By regulating factors such as students' learning motivation, learning

strategies, self-efficacy, learning environment, and self-regulation and control, we can help students think proactively, raise questions, explore actively, and form their own opinions, thereby demonstrating innovative capabilities in the process of problem-solving. From a practical perspective, students' performance in these five areas is relatively weak, which directly results in low autonomous learning ability.

Therefore, in-depth research must be conducted on these five aspects to propose effective solutions. Autonomous learning ability requires students to have a high degree of self-management and time management capabilities. In the absence of supervision, students need to be self-motivated, self-disciplined, and reasonably arrange their study time to ensure the completion of learning tasks. This ability is crucial for college students. It not only helps them study during school, but also lays a solid foundation for their future work and life. In the job market, companies increasingly value candidates' learning and adaptability. College students with the ability to learn independently can integrate into the new work environment more quickly, master new work skills, and demonstrate stronger professional competitiveness. Learning is a process that lasts throughout one's life. Through the cultivation of autonomous learning ability during college, students can gradually develop the habit of lifelong learning and regard learning as a way of life rather than a burden. This is of great significance to their personal growth, professional development and social contribution.

The researcher believes that the research on the current condition of autonomous learning ability of college students in Shaanxi Province and the sustainable development strategies of autonomous learning ability has important practical value and long-term significance. To students, promotes the cultivation of students' lifelong learning ability. To teachers, can help them effectively change their teaching methods. To schools, promote the "double first-class construction" of colleges and universities, and achieve the connotative development of higher education.

Research Questions

The main research questions of this project are:

1. What is the current condition and expected condition of the autonomous learning ability of college students in Shaanxi Province?
2. What are the sustainable development strategies for the autonomous learning ability of college students in Shaanxi Province?
3. What is the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province?

Objectives

1. To study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province.
2. To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.
3. To evaluate the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

Scope of the Research

1. Population and the Sample Group

1.1 Population

The total number of students in this study is 148,789 from 10 universities in Shaanxi Province, which including Shaanxi University of Science & Technology, Yan'an University, Shaanxi University of Technology, Xijing University, Shaanxi Fashion Engineering University, Shaanxi Polytechnic Institute, Shaanxi Railway Institute, Shaanxi Technical College of Finance & Economics, Shaanxi Post and Telecommunication College, Shaanxi Energy Institute.

1.2 The Sample Group

The Sample of Questionnaire Group

Based on the Krejcie and Morgan. (1970). sampling table, the sample size was 384. Stratified sampling was used to select 384 students from 10 universities for the questionnaire form.

The sample of Interview Group

Using stratified sampling, 20 teachers and administrators were selected as interviewees from 10 universities in Shaanxi Province, among which each school selects 1 college administrator and 1 teacher. The qualifications of the respondents are: 1) have a master's degree or above, 2) have worked in a university for more than 10 years; 3) Intermediate or above administrative staff, major in education, 4) Associate professor or above.

The sample of Evaluation Expert Group

The evaluation experts in this study are 5 experts from 10 universities, including 3 experts from undergraduate colleges and 2 experts from vocational colleges. Expert qualifications are: 1) more than 15 years of work experience in universities, 2) senior leaders, 3) managers and teachers with senior titles.

2. The Variable

Independent Variable

- 1) Learning motivation,
- 2) Learning strategies,
- 3) Self-efficacy,
- 4) Learning environment,
- 5) Self-regulation and control

Dependent Variable

Sustainable Development Strategy of College Students' Autonomous Learning Ability in Shaanxi Province

3. Contents

The full text is divided into five chapters. The main contents of each chapter are as follows:

1) Research on the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province. The current condition and expected condition of autonomous learning ability of college students in Shaanxi Province was studied through questionnaires, and the current condition of autonomous learning ability of college students was analyzed using SWOT analysis method to lay a solid foundation for the formulation of strategies in the next stage.

2) Formulate a sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province. Through in-depth interviews, the content of the interviews was analyzed, and the TOWS matrix was used to formulate a sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province.

3) Evaluate the feasibility of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province. Use the mean and standard deviation to evaluate the adaptability and feasibility of the strategy for improving the autonomous learning ability of college students for sustainable development in Shaanxi Province.

4. Time

The research time is from August 2024 to August 2025 and is divided into the following stages:

1) From August to October 2024, collect receipts through questionnaire surveys, and conduct data analysis and literature research. Based on the literature review, this article aims to study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province.

2) From November 2024 to February 2025, Through in-depth interviews, we researched and formulated sustainable development strategies suitable for improving the autonomous learning ability of college students in Shaanxi Province. Based on the research to develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

3) From March to April 2025, Invite experts to evaluate the suitability and feasibility of the strategy. Based on the research to evaluate the feasibility of the

sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

4) From May to August 2025, Summarize research results, complete thesis and publish the paper.

Advantages

1. To students, it is conducive to the improvement of students' autonomous learning ability and promotes the cultivation of students' lifelong learning ability. Through systematic research and analysis of the current condition of college students' autonomous learning ability, this study can discover the impact of four factors: learning motivation, learning strategies, learning methods, and learning effects on students' autonomous learning ability, and propose effective methods to improve the current college students' autonomous learning ability.

2. To teachers, the study of college students' autonomous learning ability can help teachers effectively change their teaching methods, put students as the center, and improve the quality of teaching.

3. To schools, improving the autonomous learning ability of college students will help improve their core competencies, cultivate the talents needed by society, promote the "double first-class construction" of colleges and universities, and achieve the connotative development of higher education.

Definition of Terms

Autonomous Learning: The process where learners actively engage in their own learning activities, involving metacognitive, motivational and behavioral aspects to a significant extent.

Autonomous Learning Ability: The process in which an individual can be responsible for his own learning activities and behaviors, consciously determine learning objectives, choose learning methods, monitor learning processes, and evaluate learning results.

Sustainable Development: Meeting the current needs without compromising the ability of future generations to meet their needs, emphasizing the balance between economy, society and the environment, and pursuing economic prosperity, social equity and environmental protection. In the field of learning, sustainable development means integrating the concept of sustainable development into the learning process and cultivating students' autonomous ability with sustainable development.

Sustainable Development Strategy: Sustainable development strategy is a theory and strategy that comprehensively considers nature, science and technology, economy, society and other aspects, and aims to ensure global sustainable development. This concept first appeared in the World Program for the Conservation of Natural Resources in 1980, and was later defined by the World Commission on Environment and Development in 1987 as "Developments that require capabilities that constitute a hazard". Sustainable development strategies emphasize meeting needs, especially the basic needs of poor people, while limiting the ability to harm future environmental needs.

Learning Motivation: Learning motivation refers to a driving tendency that initiates, maintains, and directs students' learning behaviors toward specific academic goals. It is an internal mechanism that directly propels and sustains learning activities.

Learning Strategies: Learning strategies are complex plans or schemes that learners consciously and intentionally devise to improve the effectiveness and efficiency of their learning. They are not single activities but rather a set of procedures for selecting, integrating, and applying learning techniques.

Self-efficacy: Self-efficacy, proposed by psychologist Albert Bandura, refers to an individual's subjective judgment and confidence regarding their ability to utilize their skills to accomplish a specific achievement behavior. It focuses on "whether I have the ability to do it," rather than general feelings of self-worth (such as self-esteem).

Learning Environment: The learning environment encompasses the various conditions and conditions in which learning activities take place. It includes not only physical spaces but also intangible social and psychological factors.

Self-regulation and Control: In the context of education, this usually refers to Self-Regulated Learning. It is a process involving the active management of one's cognition, emotions, and behaviors. Learners enhance their learning effectiveness by setting goals, monitoring progress, selecting strategies, and reflecting.

SWOT: SWOT analysis is to combine the four aspects of opportunities (Opportunities), risks (Threats), strengths (Strengths), and weaknesses (Weaknesses) formed by the internal and external environment of the organization for analysis, in order to find a formula that is suitable for the actual condition of the organization. business strategy approach to the condition.

Feasibility: Feasibility refers to the likelihood that a plan, project, design, or idea can be successfully implemented or realized under specific conditions. It addresses the question of "whether it can be done," typically involving a comprehensive assessment of technical, economic, legal, operational, and time-related aspects.

Adaptability: The ability of an individual to flexibly adjust their thought patterns, emotional states, and behavioral strategies when facing environmental changes, stress, uncertainty, or new challenges. It is regarded as a key personality trait or component of psychological resilience.

Conceptual Framework

Conceptual Framework is a systematic cognitive structure that defines the core philosophy and logical relationships guiding research or practice. At a macro level, it integrates key concepts, variables, and theoretical foundations to construct a comprehensive perspective on the research problem. This framework not only delineates the scope and essential elements: such as principles, objectives, and assumptions, but also reveals the intrinsic connections and mechanisms of interaction among its components. By providing theoretical support and directional

guidance, it establishes the logical groundwork for subsequent empirical analysis or practical application, thereby serving as a bridge between theory and practice.

The conceptual framework of this research is as follows:

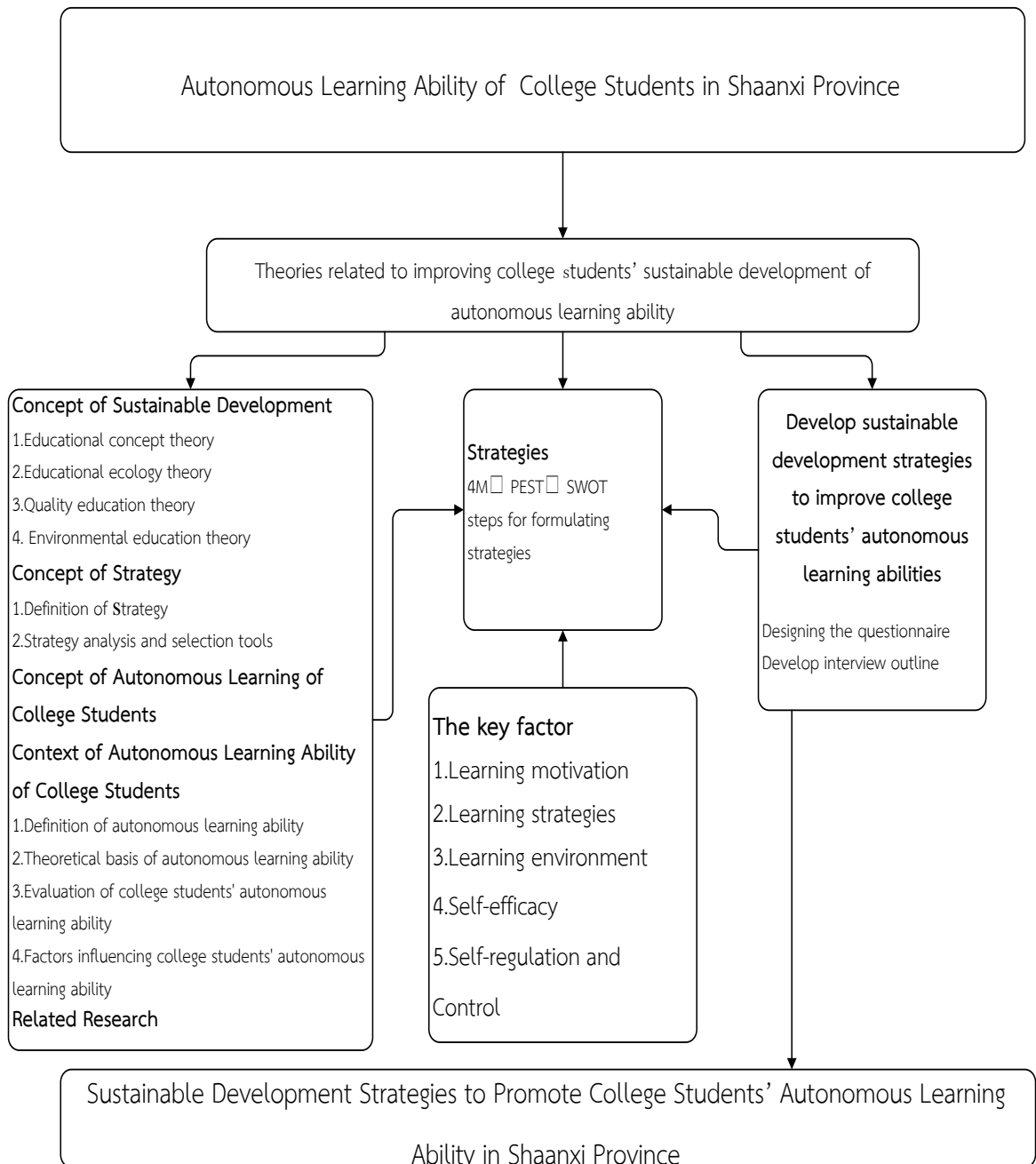


Figure 1.1 Conceptual Framework

The conceptual framework of this research integrates the following theories:

Key Factors Theory: The five dimensions selected for this research: learning motivation, learning strategies, learning environment, self-efficacy, and self-regulation and control are primarily based on Bandura's (1997) Self-Efficacy Theory, Zimmerman's (2000) Self-Regulated Learning Model, and Deci and Ryan's (1985) Self-Determination Theory. These theories collectively constitute the core elements of college students' autonomous learning ability.

SWOT Analysis Theory: This study adopts the SWOT analysis method proposed by Humphrey (2005) to systematically evaluate the internal and external environments regarding the development of autonomous learning ability among college students in Shaanxi Province, thereby providing a basis for strategy formulation.

4M Management Theory: This study employs the classic 4M management elements theory are Man, Method, Material and Money, which originates from the concept of total quality management (TQM). This theory is utilized to construct a support system that safeguards the sustainable development of autonomous learning ability.

Chapter 2

Literature Review

In this study, the researchers refer to the research results of a large number of domestic and foreign scholars on the evaluation and improvement of college students' autonomous learning ability. On this basis, the researchers summarized the literature of the research results related to the improvement of college students' autonomous learning ability from the following aspects:

1. Concept and Theory of Sustainable Development
2. Concept of Strategy
3. Concept of Autonomous Learning of College Students
4. Concept and Theory of Autonomous Learning Ability of College Students
5. Related Research

Concept and Theory of Sustainable Development

After more than half a century of development, the connotation of the concept of "sustainable development" has been greatly enriched, involving almost all material and spiritual fields. Scholars and experts from almost all disciplines use their own research perspectives to understand and study sustainable development issues from their respective research fields, thus giving multiple definitions from various perspectives.

1. Definition of sustainable development

The concept of "sustainable development" stems from concerns about ecological issues such as the environment and resources. In the 1950s and 1960s, some ecologists began to call for the protection of the ecological environment, drawing people's attention to the coexistence of humans and the natural ecological environment.

The book "World Conservation Strategy" was published in 1980, which first proposed the concept of "sustainable development", whose connotation is to

protect the ecological environment while developing. Through summary, the views can be roughly divided into the following aspects:

1.1 Ecological perspective

This perspective interprets sustainable development from an ecological perspective, as defined by the International Union for Conservation of Nature, "Used within the scope of the renewable capacity of ecosystems or resources to ensure their renewable capacity"; Mohan Munassin Definition by Mohan Monasingh and Jeffrey A. McNeely, "Dynamic ecological relationships that achieve full human development without destroying the diversity, complexity and functions of the ecosystem" (2001); and Herman Daley's definition, "Economic activities that do not lead to a decline in natural material flows" (2006), etc.

1.2 Economic perspective

Economists tend to focus on economic sustainability, such as "sustained economic growth" and "today's growth should not reduce future income" (1998). Foreign scholars also have similar views. For example, Pierce Turner (PierceTurner) believes that sustainable development is "the sustainable use of an organic ecosystem or other renewable resources within the scope of its renewable capacity" (2003).

1.3 Sociological perspective

From a social perspective, it is often defined as development that is conducive to people's livelihood and welfare. For example, Ismail Salagdin (2006) "The sum of all kinds of capital left to future generations should be no less than that of the present generation possessed".

To sum up, the definition most recognized by the academic community is the definition of the World Commission on Environment and Development (WCED). That is, "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This is an ideal type of human development and the relationship between people, people and nature, and people and society.

2. Theories related to sustainable development

The core theory of sustainable development is still being explored and formed. The genres that have taken shape at present can be roughly divided into the following categories:

2.1 Theory of sustainable utilization of resources

The epistemological basis of the school of sustainable resource utilization theory is that it believes that the sustainable development of human society depends on whether the natural resources on which human society depends for survival and development can be used forever. Based on this understanding, this school is committed to exploring theories and methods for sustainable utilization of natural resources.

2.2 Externality theory

The epistemological basis of the externality theory school is that it believes that the root cause of the deteriorating environment and unsustainable development phenomena and trends in human society is that humans have so far regarded nature (resources and environment) as "public goods" that can be enjoyed for free. Recognize that natural resources have economic value and exclude natural inputs from the economic accounting system in economic life. Based on this understanding, this school is committed to exploring the theory and methods of incorporating natural resources into the economic accounting system from an economic perspective.

2.3 Theory of fair distribution of wealth between generations

The epistemological basis of the theory of fair intergenerational distribution of wealth is that it believes that the root cause of unsustainable development phenomena and trends in human society is that the current generation has excessively occupied and used the wealth that should be used by future generations, especially natural wealth. Based on this understanding, this school is committed to exploring theories and methods by which wealth (including natural wealth) can be fairly distributed among generations.

2.4 Three production theories

The epistemological basis of the three schools of production theory is that the material basis for the sustainable development of human society lies in whether the flow of materials in the world system composed of human society and the natural environment is smooth and constitutes a virtuous cycle. They divide the material movement of the world system composed of humans and nature into three major "production" activities, namely human production, material production and environmental production, and are committed to exploring the theory and methods of harmonious operation among the three major production activities.

3. Concept of sustainable development of higher education

Since the 1980s, sustainable development has been introduced into the field of education, which has immediately caused a wave of discussion in the higher education community. There are endless definitions from various fields and perspectives. Scholars from various disciplines have profoundly interpreted the concept and connotation of sustainable development of higher education. The more common ones are:

3.1 Educational concept theory

Since the 1980s, under the advocacy of the United Nations, countries around the world have gradually incorporated sustainable development into their national economic and social development strategies, and the sustainable development of higher education has gradually developed into an idea and concept. Driven by the sustainable development strategy, "sustainability" means making people across the country realize the connotation and concept of development, and allowing higher education workers to establish the concept of sustainable development. Use the concept of sustainable development to examine many problems existing within higher education, resolve several contradictions existing in the development of higher education, and use the concept of sustainable development to carry out internal reforms in higher education.

3.2 Educational ecology theory

Ecologists or educational ecologists link sustainable development with environmental systems based on ecological theory, and the development of educational ecosystems forms an integral part of the entire social environmental ecosystem.

3.3 Quality education theory

Some scholars link the concept of "quality education" proposed in China with the concept of "sustainable development of education" and believe that "quality education" is an educational ideal type proposed by the education administration department for "examination-oriented education". Promoting quality education means starting from the needs of human development and social development, teaching students in accordance with their aptitude, and promoting the coordinated development of students' moral, intellectual, physical, and aesthetic and other aspects by promoting their strengths and avoiding weaknesses, so as to comprehensively improve the basic quality of all students. This is consistent with the balanced and coordinated connotation of sustainable development of higher education.

3.4 Environmental education theory

This statement belongs to the narrow concept type, which means to regard higher education as an "independent variable" or "element" of sustainable social and economic development, and to promote the entire social and ecological environment by implementing environmental education, ecological education or green education in higher education. sustainable development.

Summarizing the above points, it can be seen that the sustainable development of higher education points to using the principles and methods of sustainable development to find the most appropriate relationship between higher education individuals and the environment, and to achieve the sustainable development of higher education itself and its internal elements.

Concept of Strategy

Strategy is a long-term or short-term plan and method developed to achieve specific goals and a complex network that provides general guidance for specific actions and is the thoughts, ideas, insights, experiences, goals, ambitions, memories, perceptions and expectations for the pursuit of specific ultimate goals.

1. Definition of strategy

Many scholars have explored the concept and definition of strategy. Research has been conducted from different angles and different decision-making purposes.

Before the 1990s: Alfred Chandler (1962) believed that strategy is a company's decision to allocate necessary resources around long-term goals; George Steiner (1979) believed that strategy is a method of countering competitors' actual and potential actions; Kenneth Andrews (1980) believes that strategy is a decision-making method that determines or reveals the goals, objectives or purposes of an enterprise; James B Quinn (1980) and William F. Glueck (1980) also discussed the concept of strategy from the perspectives of organization and planning respectively.

From the 1990s to the present: M Treacy & F. Wiersema (1995) believe that the basic composition of strategy is through three "laws of value", namely operational excellence, customer intimacy and product leadership; Michael Porter (1996) strategy is what an enterprise does The essence of the combination of methods (policies) and ultimate goals to achieve goals is to connect a company with its environment and build a comprehensive and systematic strategic analysis system from value chain, competitive strategy and other systems; Michael Hitt, R, Duane Ireland , & Robert E. Hoskisson (1996) pointed out that strategy is a set of integrated and coordinated inputs and actions used to develop core capabilities and gain competitive advantage. Noriyuki Itami believes that strategy refers to a tool related to the basic direction and content of organizational activities from the perspective of environmental correlation. Fred Nickols (2000) believes that strategy is a complex network that provides general guidance for specific actions and is the thoughts, ideas, insights, experiences, goals, ambitions, memories, perceptions and expectations for the pursuit of specific ultimate goals.

The research believes that the strategy usually refers to a series of plans or methods developed to achieve a certain goal. It can be long-term, short-term, or situation-specific. Strategy usually involves the rational allocation and use of resources, as well as the prediction and response to risks and challenges that may arise. The formulation of strategies often requires comprehensive consideration of a variety of factors, including environment, resources, technology, personnel, etc., to ensure the achievement of goals.

The application of strategy is very wide, not only limited to the military field, but also includes business, politics, education and other fields. For example, in the commercial field, enterprises may formulate corresponding market strategies, product strategies, etc. based on market demand, competitor situations and other factors to achieve the company's long-term development goals.

To sum up, strategy is a long-term or short-term plan and method developed to achieve specific goals. It involves the analysis of the environment, the reasonable allocation of resources, and the prediction and response to challenges that may arise in the future.

2. Concept of Sustainable Development Strategy

Sustainable development strategy is a multi-dimensional, comprehensive concept that aims to achieve coordinated economic, social and environmental development to meet the needs of the current generation without compromising the ability of future generations to meet their needs. The sustainable development strategy is a series of action plans and programs based on the concept of sustainable development. It emphasizes that in the process of economic development, the carrying capacity of resources and the environment must be fully considered to ensure that economic development is coordinated with environmental protection and social progress.

Sustainability strategies typically revolve around three core pillars:

Environmental protection: Take measures to reduce pollution, protect biodiversity, rationally utilize and conserve resources to maintain the health and stability of the earth's ecosystem.

Social progress: Pay attention to social equity, promote comprehensive development in education, health, culture and other fields, and improve people's quality of life and happiness.

Economic feasibility: Ensure that economic activities are carried out within the environmental and social affordability, and achieve a win-win situation of economic, social and environmental benefits.

According to the meaning of sustainable development strategy, combined with the concept of autonomous learning ability, the sustainable development strategy of autonomous learning ability is also a comprehensive method system, aiming to cultivate individuals' ability to continuously and effectively self-learn and improve themselves.

3. Strategy analysis and selection tools

3.1 PEST analysis method

PEST analysis is a fundamental tool for strategic external environment analysis. It analyzes the macro environment from four perspectives—politics, economy, society, and technology—to grasp the overall macro environment and evaluate the impact of these factors on corporate strategic goals and strategy formulation. This tool helps organizations understand market dynamics and anticipate potential challenges or opportunities.

P: Politics, includes government policies, laws and regulations, political stability, labor laws, and government subsidies.

E: Economics, includes total economic output, economic growth rate, disposable income, per capita income, consumption level, and economic prosperity index.

S: Society, including demographics, cultural values, lifestyles, education levels, family circumstances, and social media influence.

T: Technology, including technological development, R&D investment, innovation speed, artificial intelligence, etc.

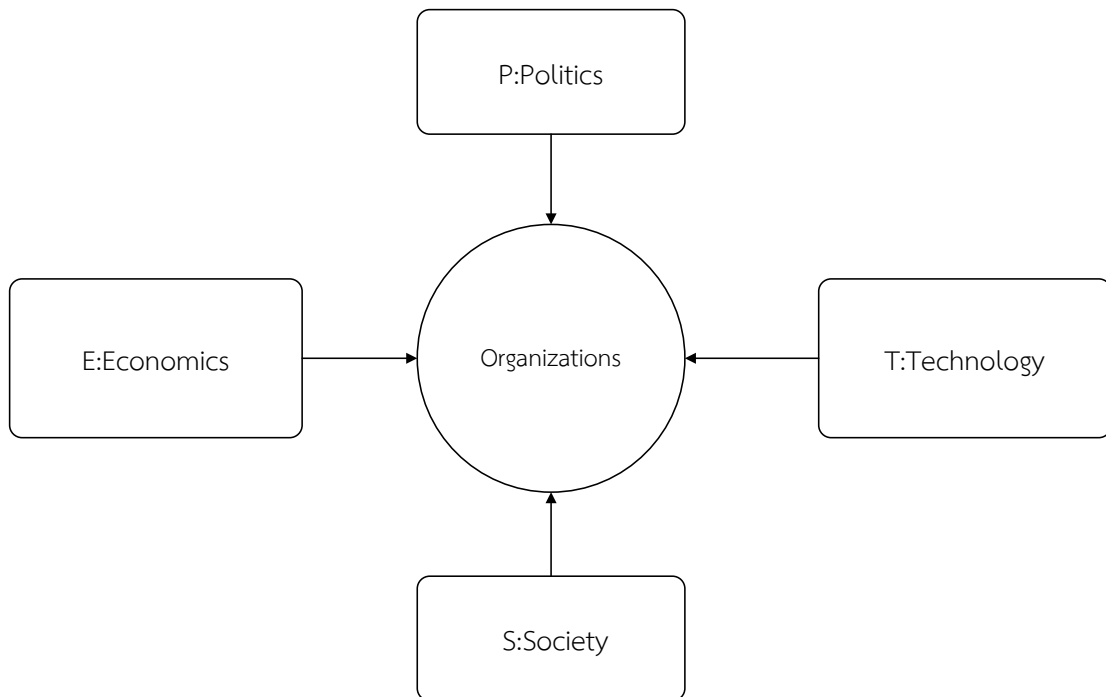


Figure 2.1 PEST Model

3.2 4M Theory

The 4M Theory was developed by Japanese safety expert Nishijima Shigeichi through an in-depth analysis of the causes of accidents. He identified four key factors that led to accidents, which he then summarized into the current "4M Theory." The 4M Theory, abbreviated to the "4M Theory" after the initials of the four key factors. The 4M analysis method mainly focuses on analyzing the internal environment of an organization to identify its strengths and weaknesses. Specifically refers to:

Man: Unsafe human behavior is the most direct cause of accidents.

Machine: Unsafe equipment conditions are also the most direct cause of accidents.

Material: Materials are a major contributor to accidents.

Method: Inadequate management methods are an indirect cause of accidents.

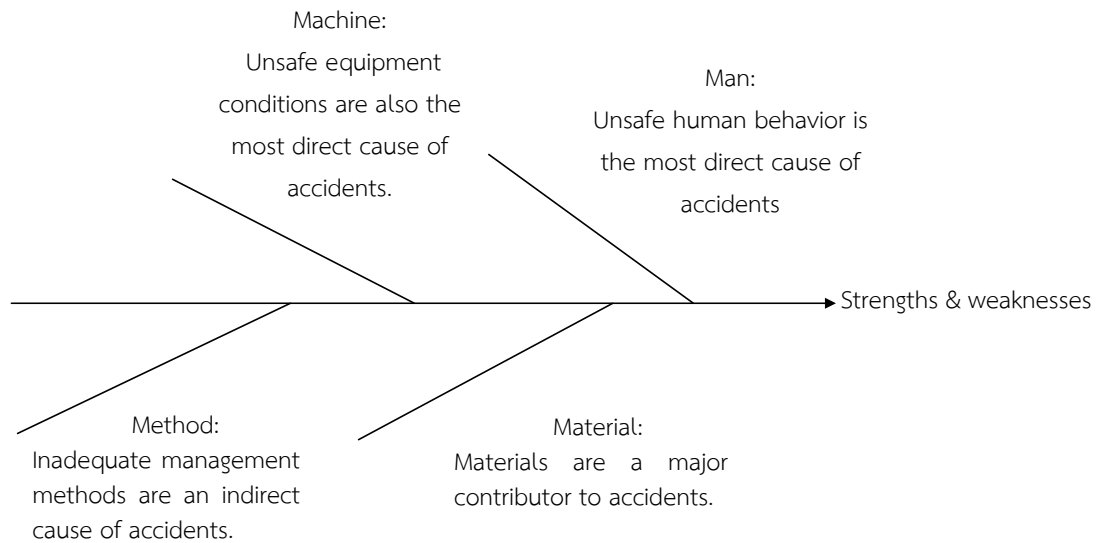


Figure 2.2 4M Model

3.3 SWOT analysis method

The main purpose of SWOT analysis is to make an objective and fair evaluation of the company's comprehensive situation in order to identify various strengths, weaknesses, opportunities and threats, which will help develop ideas and correctly formulate strategies.

SWOT analysis is to combine the four aspects of opportunities (Opportunities), risks (Threats), strengths (Strengths), and weaknesses (Weaknesses) formed by the internal and external environment of the organization for analysis, in order to find a formula that is suitable for the actual situation of the organization. business strategy approach to the situation.

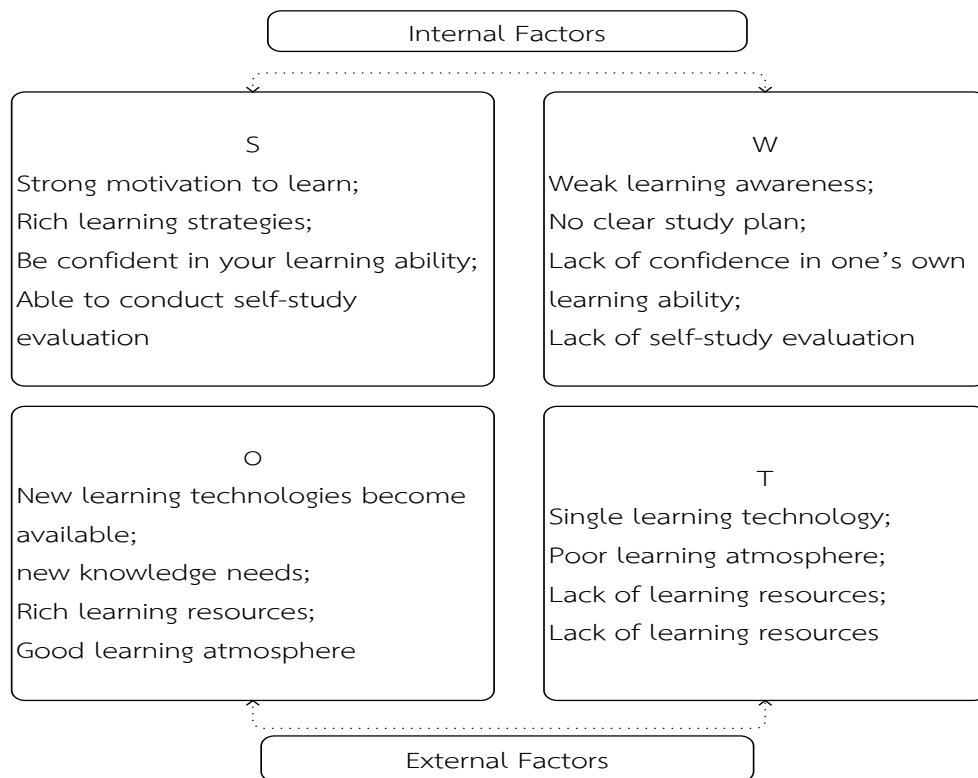


Figure 2.3 SWOT Model

The basic point of the SWOT method is that all policies and strategies formulated by an organization must adapt its internal capabilities (strengths and weaknesses) to the external environment (opportunities and threats) in order to achieve business success.

The research employs the SWOT analysis method as a fundamental tool to conduct a comprehensive strategic analysis. It systematically identifies and evaluates the internal strengths and weaknesses inherent within the subject of study. Concurrently, the analysis extends to the external environment to pinpoint potential opportunities and significant threats. Following this identification, the research utilizes the TOWS matrix to strategically match and pair these factors. This structured approach facilitates the generation of specific strategic combinations based on the interaction of internal and external elements. As a result of this rigorous matching process, the study is able to formulate a cohesive strategy. Ultimately, this strategy is tailored to be highly suitable and effective for the specific situation and context of this study.

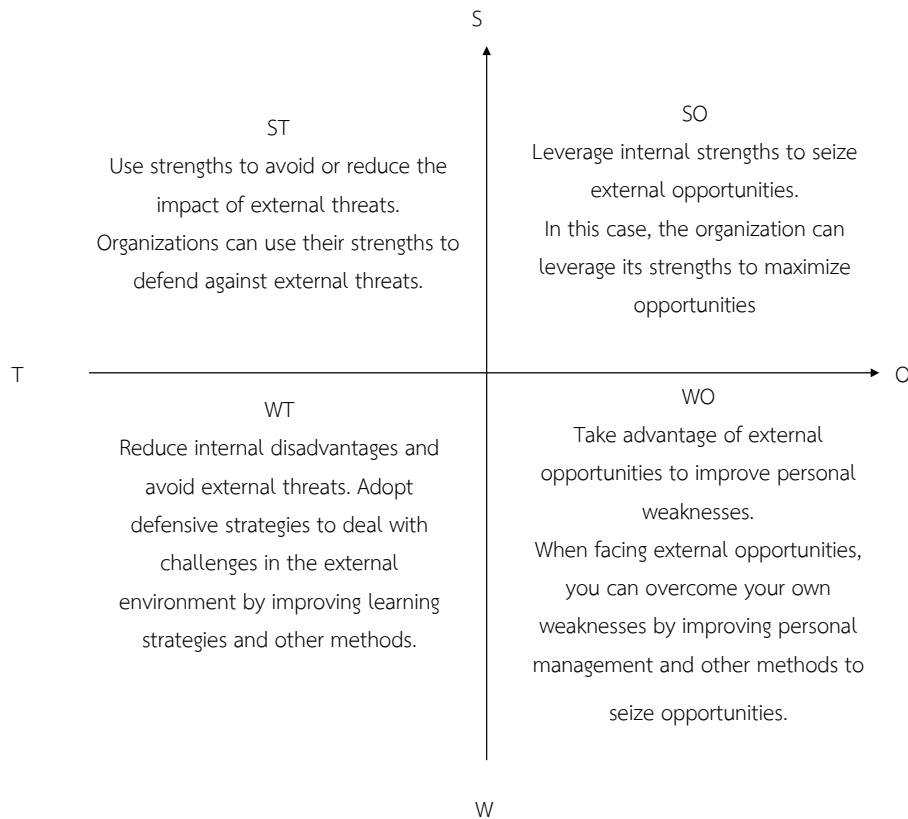


Figure 2.4 TOWS matrix

In the summary, the image illustrates the TOWS Matrix, a strategic planning tool used to match an organization's internal factors (Strengths and Weaknesses) with external environmental factors (Opportunities and Threats). It generates four distinct strategic quadrants.

Concept of Autonomous Learning of College Students

Domestic and foreign scholars have different views on the concept of autonomous learning, but scholars have expounded the nature of autonomous learning.

The ideological enlightenment of autonomous learning abroad can be traced back to the "the midwife of knowledge" advocated by Socrates in ancient Greece, aiming to stimulate students to explore the answers to questions by themselves. Systematic research on autonomous learning began in the 1960s. With the deepening

of research in the field of psychology, autonomous learning has become a research hot spot in teaching, psychology and other aspects. The most representative authoritative foreign research scholar is Professor Zimmerman of City University of New York in the United States. He believes that autonomous learning requires students to be active participants in metacognition, behavior and motivation, and puts forward a systematic six-dimensional research framework of autonomous learning, which is widely recognized by the academic circles.

In the 1980s, the United States, Japan, South Korea and other countries began to pay attention to cultivating students' innovative and creative ability, and education, which originally took memory as the main way of acquiring knowledge, was gradually eliminated. From the 1990s to the early 21st century, countries around the world gave higher education new missions by focusing on cultivating students' independent innovation ability and implementing their national science and technology development strategy. The United States has launched the "Innovative American Plan", the United Kingdom has set up the "Science and Innovation Investment Plan", Canada has launched the "National Innovation Strategy", and Russia has developed the "Innovative University Evaluation Standards", in which the cultivation of autonomous learning ability is listed as one of the important teaching indicators.

Foreign scholars first started their research on the connotation of autonomous learning from the British linguist Henri Holec. In his 1981 book *Autonomy and Foreign Language Learning*, he mentioned autonomous learning as determining learning goals, determining learning content and progress, choosing learning methods and techniques, monitoring learning processes, and evaluating the results of acquisition. The scholar believes that "autonomous learning is a kind of ability to control their own learning", and individual learners should control their own learning in the learning process and solve the situation in the learning process. Zimmerman pointed out that autonomous learning means that learners actively improve their own knowledge and ability and actively self-construct knowledge. Zimmermann's connotation view of autonomous learning points out that learners

should actively self-construct knowledge in the process of autonomous learning, rather than blindly relying on teachers. In addition, learners also need to be able to continuously improve their autonomous learning ability, master learning strategies and learn to learn. Scholar Zimmerman studies autonomous learning more specifically on learners' self-construction of knowledge. In the process of autonomous learning, learners should constantly improve their ability and level of autonomous learning, better master knowledge, and have in-depth understanding and reflection on knowledge.

David Little (D. Little, 1991) believes that autonomous learning refers to the ability of learners to decide and implement independent behaviors during the learning process. David Little's research on the connotation of self-directed learning focuses on the ability of learners to perform independent behaviors in the process of self-directed learning and whether they have the ability to decide independently. In addition, he also stressed that autonomous learning should be a learning process in which learners fully enjoy this freedom in their learning activities. His point not only points out that learners should not only have the ability to learn independently, but also that learners are willing to learn and have a positive attitude towards the learning process. Of course, this kind of freedom is conditional and restricted, and is not an absolute freedom. Learners' autonomous learning needs the guidance and guidance of teachers. In addition, in the process of autonomous learning, college students also need to actively communicate and cooperate with their learning peers and classmates. Share your learning experience or learning experience with others during the learning process. Learners sharing and cooperating with others can help learners to better learn the advantages of others, improve them with their own characteristics, apply correct learning strategies in the learning process, and solve the problems in the learning process, so as to complete the learning task more smoothly. In addition, in the process of autonomous learning, individual learners should treat learning activities with a positive attitude, think that learning is a pleasant thing and fully enjoy the learning process, rather than thinking that learning is a burden and boredom of learning. The mentality of learners is also very important

in the process of autonomous learning, positive learning mentality will be more conducive to learning.

Dickinson (1995) According to his own actual research, autonomous learning includes two aspects: "autonomous learning ability and learning attitude". "Ability refers to the feedback of the learning process, and attitude refers to the responsibility of students for their learning behavior".

Little-Wood (1996) on the connotation of autonomous learning is more detailed and specific. The first, middle and second three stages of autonomous learning are described in detail. Before learning activities, learners will make detailed learning plans according to their own needs; During the learning process, learners will actively monitor and regulate the learning process; finally, learners will reflect, feedback and evaluate the learning activities, and the feedback and evaluation information can provide reference for the next stage of learning.

Benson (1997) believes that autonomous learning can be understood from two aspects: one is the psychological level, he thinks this is a kind of ability, students need more self-restraint, self-control; the other is the technical level, mainly is the ability to learn without teacher control.

Little-Wood (1999) defines it as "the learner's desire and ability to make choices independently of their own learning". Wish refers to students' expectation of learning goals and being responsible for those set by themselves; ability refers to students' judgment of their learning situation and execution in the learning process.

Pintrich (2000) believes that autonomous learning is a way of learning, and his research on autonomous learning tends to think that autonomous learning is a learning process. He believes that this kind of learning is a learning process in which learners actively carry out learning activities and construct knowledge themselves. In the learning process, individual learners decide the learning direction according to their own learning needs and their own characteristics, and use the correct learning strategies according to the learning content.

There are many foreign terms about autonomous learning, such as self-learning (self-regulated learning) self-guidance (self instruction), self-discipline learning (autonomous learning), autonomous learning (autonomous learning), etc. Different researchers pay attention to different aspects of autonomous learning. In addition, on the classification of autonomous learning, some think autonomous learning is a kind of ability, others think a process, and others think it is an attitude.

Throughout the independent study in China, it can be divided into three stages according to the research characteristics: first, the proposed stage of autonomous learning was before 1920s; second, the preliminary experimental stage of autonomous learning was from 1920s to 1970s; and third, the systematic research stage of autonomous learning was from 1980s to now.

Domestic scholars on the connotation of autonomous learning are mainly as follows: Scholars Dong Qi and Zhou Yong (1994) believe that autonomous learning is a learning process in which learners have learning plans, learning goals, active supervision, active adjustment, feedback and evaluation. Judging from the research of these two scholars on the connotation of autonomous learning, it can be seen that individual learners face the learning process with a positive attitude in the autonomous learning process and carry out active learning behavior.

Pang Weiguo (2003) mainly elaborated the connotation of autonomous learning from four levels. "Ability to learn" means that learners have the ability to carry out autonomous learning behavior in the learning process. This ability needs to cultivate students, rather than the high ability and level of autonomous learning as soon as they enter the study. "Want to learn" refers to the attitude of learners towards learning. Students have a positive attitude towards autonomous learning and are not tired of learning. Therefore means learners have the ability of autonomous learning and actively carry out learning activities. "Learning ability" means that learners can learn to learn and use the right learning strategies in the learning process. For example, individual learners can choose and use appropriate learning strategies to complete the learning tasks according to different learning contents. "Insist on learning" means that learners should persevere in the school process.

Xiao Chuan elaborated the connotation of autonomous learning from three levels. First, "self-orientation" refers to the self-orientation that individual learners can give to their learning behavior in autonomous learning activities. Students' autonomous learning is not a learning process without direction. Students need to plan and plan the learning process and direction. Second, "self-motivation" refers to that individual learners should be able to encourage and motivate themselves in the process of autonomous learning, actively face learning activities, encourage themselves to actively adopt correct learning strategies to complete learning tasks, and encourage and imply that they can complete the learning goals and achieve good learning results. Third, "self-monitoring" refers to the fact that learners can actively monitor and regulate the learning process in the process of autonomous learning, and timely solve the problems in the process of autonomous learning, so that the autonomous learning activities can progress smoothly.

To sum up, autonomous learning is an important learning method and ability. It emphasizes the process by which learners acquire knowledge, skills or improve their abilities through self-driving, self-management and self-evaluation without the direct guidance of teachers. autonomous learning is not limited to school education, but runs throughout a person's life and is of great significance to personal growth, career development and lifelong learning.

Concept and Theory of Autonomous Learning Ability of College Students

Ability is the necessary psychological condition for human beings to successfully realize and complete certain activities, and the ability of autonomous learning is the necessary internal condition for autonomous learning.

1. Definition of autonomous learning ability

As an important teaching goal, autonomous learning ability was first proposed by Henri Holec (1981) and applied to foreign language teaching. In *Autonomy and Foreign Language Learning*, he defined "autonomous learning ability" as "the ability to take charge of one's own learning" (the ability to manage his own learning). This ability is reflected in five aspects: (1) learners can independently determine the

learning goals; (2) learners can determine their own learning content and progress; (3) learners can choose the learning strategy according to the learning content; (4) learners have the ability to monitor their own learning process; (5) learners can evaluate the learning effect.

Little (1991) defines autonomous learning as three abilities: the ability to make objective and critical reflection, the ability to make decisions, and the ability to take independent actions.

Arnold (1999) points out that autonomous learning consists of psychological-social support and technical support. Psychological-social support refers to motivation and its influencing factors; technical support refers to cultivate the ability of learners to set goals, to select materials, methods, tasks and perform tasks, to self-monitoring, to select evaluation criteria and self-evaluation.

Little-Wood believes that "the ability to learn independently" is "an independent ability to act independently, think critically, make decisions and implement independently".

Pang Weiguo, a domestic scholar, believes that if the students themselves can consciously choose and control all aspects of their study, they will have the ability to study independently.

Through the understanding of foreign and domestic scholars, the author believes that autonomous learning ability is a psychological tendency of individuals, which is embodied in the ability of learners to establish learning goals, choose the learning content, the ability to regulate the learning process and evaluate the learning results.

2. Theoretical of autonomous learning ability

The theoretical basis of this study are self-regulation learning theory, constructivist learning theory and mixed learning theory.

2.1 Theory of self-regulation learning

Zimmerman uses a three-dimensional analysis mode for self-regulation. Students in autonomous learning need to constantly adjust state, students can choose according to different learning tasks of the correct and diversified learning

strategies to solve learning problems, in order to achieve the best state into learning, actively complete learning tasks, so self regulation learning theory provides basic research theory for autonomous learning.

2.2 Constructivism learning theory

Constructivism learning theory believes that learners can use the necessary learning resources through the way of meaning construction with the help of others under certain situations. Constructivism learning theory emphasizes that the knowledge construction of learning is completed by oneself, which cannot be replaced by others. The constructivism learning theory is characterized by "enthusiasm" and "constructiveness", and its guiding role is becoming more and more effective for autonomous learning. Therefore, constructivism learning theory plays a guiding role in understanding the connotation of autonomous learning and the process of autonomous learning of college students.

2.3 Mixed learning theory

The basic idea of mixed learning theory has the following three points: first, it emphasizes the central position of individual students in the learning process, and at the same time, it also emphasizes the combination of the leading role of teachers and the main body position of students. Although college students have initiative and independence in learning, their autonomous learning is a learning mode that needs the guidance and guidance of teachers. The second is the deep organic mix of online learning and traditional face-to-face learning methods. The organic integration of the two learning methods, rather than the simple addition of the two. Third, attach importance to the in-depth communication and interaction between teachers and students in learning. In the in-depth communication between teachers and students, teachers can understand the students' learning situation and learning dynamics, which is conducive to teachers to provide targeted guidance and help for students.

3. Evaluation of college students' autonomous learning ability

Scholars at home and abroad have studied the evaluation of college students' autonomous learning ability, and evaluated their autonomous learning ability from different dimensions.

Foreign researchers mainly use the method of questionnaire for the evaluation of autonomous learning. The evaluation tools for autonomous learning include: the learning strategy adjustment table compiled by Weinstein and others; the autonomous learning interview table and the student autonomous learning results rating scale compiled by Zimmerman) and Martinez-Pons : this measurement table is mainly for the evaluation of autonomous learning results, which can help teachers understand the students' learning results. The Learning Motivation and Strategies questionnaire scale (MSLQ) was developed by Pintrich et al. In the study of Schraw, the measurements of self-directed learning were divided into online measurements and offline measurements. The online measurement method is applied to the process of students' learning, while the offline measurement method is applied to students before or after the students' learning activities. In addition, the measures for self-directed learning also include self-report. The Learning Motivation Strategy Questionnaire (MSLO) is one of the widely used self-report questionnaires, mainly assessing the orientation of learner motivation and different learning strategies for a specific course or topic. The Weinstein et al. Learning Strategy Level Test Scale (LASSI) is mainly used to assess the level of learning strategies used by college students. This questionnaire contains 77 measures.

Domestic scholars Zhu Zude and others have compiled the "autonomous learning Scale for College Students", and Xie Jiashu (2004) and other scholars have compiled the college students' learning autonomy scale, which is suitable for measuring the autonomous learning ability of Chinese college students. The learning autonomy scale of college students compiled by these two scholars measures their autonomous learning ability from five dimensions. The factors affecting autonomous learning include two parts: internal factors and external factors. The external

influencing factors of autonomous learning include learning environment, learning conditions and so on.

Yuan Hongmei (2006)'s scale of learning autonomy includes four dimensions: self-regulation, learning strategy, content and environment, and learning motivation.

The autonomous learning ability adjustment questionnaire designed by Hu Jiehui (2011) is mainly divided into six aspects: learning motivation, learning confidence, learning strategy knowledge, target content, strategy knowledge and learning skills.

Wang tian of northeast normal university (2014) through the study of previous questionnaire independently compiled the questionnaire about college students' autonomous learning, the questionnaire mainly around the learners in autonomous learning in learning willingness, learning methods, learning time, learning results and learning environment, the content of the five aspects of the survey.

Zhang Lifeng and Xiang Rong (2023) constructed an autonomous learning ability evaluation index system by sorting out the research on autonomous learning ability by domestic and foreign scholars and combining the outstanding characteristics of the training of design professionals in Sino-foreign cooperative education, including 3 dimensions and 7 items. Secondary indicators and 25 third-level indicators.

Zhou Liqiu and Wu Ling (2024) explored the autonomous learning ability of college students' ideological and political theory. They can clarify the evaluation ideas of college students' autonomous learning ability of ideological and political theory from three dimensions: evaluation subject, evaluation content, and evaluation method, and divide the content dimensions of ability evaluation into: There are four levels of learning awareness ability, strategic coordination ability, reflective evaluation ability and theory application ability.

Xue Xinxin and Su Xinliu (2024) analyzed the necessity of cultivating the autonomous learning ability of higher vocational students and the problems existing in the learning evaluation of higher vocational students, from the perspective of "what to evaluate - who to evaluate - how to evaluate - how to use "Four aspects to

build a multi-dimensional, diversified and whole-process feedback-focused learning evaluation system for higher vocational students, mainly including: expanding evaluation content and cultivating students' higher-order thinking; increasing evaluation subjects to encourage students to self-evaluate; innovating evaluation methods to pay attention to student learning Process; strengthen result feedback and improve student learning effects.

The autonomous learning of college students itself is a complex process, and the evaluation of the learning activities is also more complicated. In addition, the evaluation of college students' autonomous learning process should pay attention to process evaluation and developmental evaluation, give students positive feedback and evaluation, and help students learn better.

4. Factors influencing college students' autonomous learning ability

There are many factors affecting autonomous learning. Different individuals and even different majors also have different factors affecting their autonomous learning process. According to the study of the influencing factors of autonomous learning at home and abroad, it is found that the influencing factors of college students' autonomous learning can be divided into internal factors and external factors.

4.1 Research on the internal influencing factors of autonomous learning ability

Internal influencing factors mainly include students' self-efficacy factors, learning attribution factors, learning attitude factors, learning strategy factors and learning goal factors, etc.

The research of Liu Fang (2009) and others shows that students' self-efficacy is directly proportional to their self-learning ability, and the higher the students' self-efficacy, the stronger their self-learning ability. Correspondingly, students will also show strong autonomy in learning motivation, learning setting and self-regulation.

The empirical research of Zhang Wei, Zhu Zude (2010) et al. shows that self-concept not only has a direct impact on self-learning, but also has an indirect

impact on self-learning through the mediation of learning attribution and learning environment.

The experimental research results of Zhou Yangen and Sang Qingsong (2010) showed that there were all significant positive associations between achievement goal orientation and autonomous learning, and between autonomous learning and academic achievement.

Rong Yajun and Wang Hongwei (2015) further based on the research conclusions of Liu Fang and others that the internal influencing factors of autonomous learning mainly include: learning motivation, learning strategy and self-control level.

Xiang Miao, Sun Jiawei (2019) and others shows that the internal factors affecting college students' autonomous learning include: learning attitude, learning strategy and learning control level.

Jiao Xiyan (2021) and others conducted a qualitative study on the autonomous learning of post-00s college students based on rooted theory, and found that the autonomous learning of post-00s college students was influenced by internal factors such as learning interest, goal, attitude, mode and motivation.

Cheng Jianfeng (2023) conducted an empirical study on the factors affecting college students' English online autonomous learning ability and believed that self-efficacy, learning motivation, learning anxiety, etc. have a significant direct effect on English online autonomous learning ability.

4.2 Research on the external influencing factors of autonomous learning ability

External influence factors mainly include: teachers, peer influence and family factors, etc. Teachers play a pivotal role by shaping students' learning motivation and self-regulation through instructional strategies, feedback, and supportive classroom environments. Peer influence significantly affects autonomous learning as students often model behaviors, set social norms, and engage in collaborative learning that fosters responsibility and engagement. Family factors, including parental expectations, involvement in education, and the home learning

environment, profoundly impact students' attitudes toward independent learning and academic perseverance.

On the basis of summarizing the relevant studies at home and abroad, Pang Weiguo (2002) put forward that students' peer factors mainly affect students' autonomous learning in three aspects: learning ability evaluation, example demonstration and academic help.

The study of Wang Tian (2004) shows that social and cultural factors have a positive effect on students' autonomous learning by affecting students' learning willingness and learning results.

Liu Qiong (2008) and others pointed out, through the repositioning of the role of teachers as an external factor, that teachers are the analyst, inspiration and guide of the teaching process, which directly affects the autonomous learning status of students.

Wu Weiping (2010) pointed out that learners' autonomous learning takes place in a specific cultural environment, and different cultural characteristics may have both a promoting effect and an inhibitory effect on students' individual skills and knowledge acquisition, so as to accelerate or hinder the process of students' autonomous learning.

Zhang Shulong and Xie Qian (2015) pointed out that honor incentive can help drive students to form a good learning motivation and promote college students to study independently.

Luo Min (2017) emphasized the positive role of incentives on students' autonomous learning, encourage teachers to rationally use external incentives in teaching practice, and promote the play of students' autonomy.

The research of Xiang Miao, Sun Jiawei (2019) and others shows that the external factors affecting college students' autonomous learning mainly include: teachers' role positioning, peer group influence, honor incentive and social culture, etc.

Huang Ledan (2019) conducted a more systematic study on the different roles of teachers in autonomous learning. The results show that in specific teaching

links, the most desired teachers are the roles of facilitator, instructor, trainer, helper and trainer. This shows that the teacher's facilitation role has a significant effect on improving students' self-efficacy.

Cheng Jianfeng (2023) conducted an empirical study on the factors affecting college students' English online autonomous learning ability and believed that learning strategies and teacher support have a significant direct effect on English online autonomous learning ability.

Cai Mengjiao (2023) based on the research on factors affecting college students' autonomous learning ability in online learning environment, and believed that Online learning environment, learning motivation and learning strategies are the main factors affecting college students' autonomous learning ability.

Yu Xinyu (2024) analyzed the main influencing factors of high school students' autonomous learning ability in mathematics and believed that the external factors affecting autonomous learning ability include pre-class learning factors, classroom learning factors, after-class learning factors, teacher factors, classmate factors, and school environment factors., family factors, social factors, etc.

Table 2.1 Factors affecting autonomous learning ability

Author	Factors affecting	Learning motivation	Learning strategies	Self-efficacy	Learning environment	Self-regulation and control
Pang Weiguo (2002)					√	
Wang Tian (2004)					√	
Liu Fang (2009)		√		√		√
Zhang Wei, Zhu Zude (2010)					√	
Zhou Yangen, Sang Qingsong (2010)		√				

Table 2.1 (Continued)

Author	Factors affecting Learning motivation	Learning strategies	Self-efficacy	Learning environment	Self-regulation and control
Rong Yajun & Wang Hongwei (2015)	√	√			√
Xiang Miao, Sun Jiawei (2019)		√			√
Jiao Xiyan (2021)	√				
Huang Leda (2019)			√	√	
Cheng Jianfeng (2023)	√		√		
Cai Mengjiao (2023)	√	√		√	
Total	6	3	3	5	3

According to the summary in Table 2.1, it can be seen that scholars mainly focus on five aspects regarding the influencing factors that affect college students' autonomous learning ability: 1) learning motivation; 2) learning strategies; 3) self-efficacy; 4) learning environment; 5) Self-regulation and control. Among them, most scholars pay special attention to two factors: learning motivation and learning environment.

5. Research on the sustainable development and improvement strategy of college students' autonomous learning ability

Dickinson, L. (1995) pointed out that in order to enable students to actively and actively participate in the learning process and complete the learning tasks, students must intervene from the three aspects of students' learning motivation, cognitive strategy and metacognitive strategy, otherwise, students cannot acquire the ability of autonomous learning.

Littlewood, W (1996) pointed out that it is impossible to form the autonomous learning ability only through students 'course learning, and it is essential to promote students' autonomous learning and strengthen the teaching of cognitive learning strategies.

Gardner D, Miller L. (2011) and others believe that the improvement of autonomous learning ability is not simple, it is not a vertical linear process, in which there are many influencing factors, the existence of these factors makes this concept very complex.

Paris and Newman point out that the following three specific measures can be taken to improve students 'autonomous learning ability: first, to strengthen their subjective consciousness and change from the depths of thought; second, to stimulate students' learning initiative and encourage students to actively participate in learning; third, to help students to learn about how to think and reflect on their learning behavior.

Pang Weiguo (2002) believes that cultivating students 'autonomous learning ability can start from various factors affecting students' internal learning motivation, enriching students' various cognitive strategies, training their various metacognitive processes, and teaching students to take the initiative to create and use the social and material resources of learning.

Mi Li (2008) research paid more attention to the role of students themselves and self-evaluation in cultivating autonomous learning abilities, pointing out that by changing students' concepts, improving learning initiative and mastering correct learning methods and techniques, students' collaborative learning abilities can be enhanced, Various abilities such as self-monitoring ability and the role of evaluation also profoundly affect the cultivation of students' autonomous learning ability.

Ban Guilian and Yan Heyi (2010) believe that cultivating autonomous learning ability requires teachers to guide students in a targeted manner according to students' physiological and psychological development and learning rules during the teaching process, stimulate motivation for seeking knowledge, and induce learning.

Interest, teach learning methods, cultivate learning habits, strengthen learning perseverance, promote autonomous learning, and improve self-study efficiency.

Yang Mei (2011) believes that the improvement of autonomous learning ability is the fundamental guarantee of autonomous learning. It expounds the ways to improve students' autonomous learning ability from the aspects of guiding students to do the right things, cultivating students to do things in the correct ways, requiring and helping students to do things in order.

Guo Shengwei et al. (2012) Under the guidance of constructivism, humanism, situational cognition theory, multiple intelligence theory, cognitive flexibility theory and other theories, they discussed the theoretical basis, cultivation mode and evaluation means of the cultivation and evaluation of autonomous learning ability.

Chen Ruiling (2012) proposed that the improvement of college students' autonomous learning ability must be based on the change of educational concepts, and then guide students to clarify their goals and promote students to master certain cognitive strategies.

Jiang Xin, Zhao Xiuwen (2013) put forward the concept of lifelong learning under the path of cultivating students' autonomous learning ability, colleges and universities should optimize talent training scheme, improve teaching mode, using all kinds of favorable information technology, enrich students' extracurricular activities, widen horizons, broaden the thinking, innovative activities, to improve the learning environment, enhance the students' autonomous learning ability, further meet the needs of lifelong learning.

Dong Hongsheng, Liu Qing (2015) and others mainly focused on and emphasized the value of "people" in cultivating students' autonomous learning abilities. First of all, educators should establish a correct awareness of roles, change educational concepts, change teaching methods, and provide places for autonomous learning; secondly, learners should enhance their awareness of autonomous learning and pay attention to the establishment of a correct outlook on learning.

Shi Xianhong's (2017) research regards institutional guidance as one of the important strategies to cultivate students' autonomous learning ability, and proposes

to ensure students' autonomous learning through good training guidance, strengthening network resource construction, active guidance, improving the evaluation system, and improving institutional incentives and formation. Long-term ability mechanisms and other measures can improve college students' online autonomous learning abilities.

Li Jing (2017) mainly explored how to cultivate students' autonomous learning ability in the new media environment. The results show that current college students' autonomous learning can be improved by improving social cognition, optimizing environmental resource allocation, strengthening school support services, transforming the learning atmosphere, strengthening teacher process guidance and teaching supervision and evaluation, expanding individual abilities and improving media literacy ability.

Zhang Jijia (2023) proposed a strategy to improve college students' English autonomous learning ability through research on constructivism theory and college students' English autonomous learning ability as creating situations to promote the improvement of students' autonomous learning ability; teachers change their role from "teaching" to "guiding"; innovation Construction and practice of sex teaching models; guiding students to choose and apply correct learning strategies.

Wang Hao (2024) believes that it is necessary to establish a "student-centered" concept to stimulate students' interest in learning English; improve students' awareness of the importance of the course and promote the intrinsic motivation for autonomous learning; optimize the design of teaching links and closely follow the "before class-during class" After one lesson", create an efficient classroom.

Zhu Zhengli and Chen Tongtong (2024) believe that teaching methods should be reformed; curriculum content should be updated; and teachers' roles should be changed.

Zeng Xuemei (2024) Knowledge-oriented intelligent personalized learning path design; data-driven learning process monitoring and feedback; cross-media interactive learning experience improvement; strengthening the cultivation of cross-

cultural communication skills; innovation of teaching roles and course content Strategies for improving autonomous learning capabilities have been proposed in several aspects such as reconstruction.

In the summary of scholars' opinions, it can be seen that scholars' strategies for improving autonomous learning ability mainly focus on the following five aspects: 1) learning motivation; 2) learning strategies; 3) learning environment; 4) self-efficacy; 5) self-regulation and control. Most scholars believe that teaching reforms and changes in the learning environment will greatly improve students' autonomous learning abilities. Therefore, in this study, more consideration and discussion will be given to teaching reform and the construction of learning environment.

Related Research

There is a rich research on college students' autonomous learning, with a wide range of topics, and other scholars are also of reference significance.

1. Research on the process model of autonomous learning

According to six classical and influential theoretical models of autonomous learning, the autonomous learning process of college students is analyzed. autonomous learning is the interactive process of "self-environment-behavior"; it is the unified process of "motivation-emotion-goal"; the implementation process of "planning-monitoring-evaluation"; and the autonomous learning is the generation process of "sharing-co-operation-innovation".

1.1 College students' autonomous learning is an interactive process of "self-environment-behavior"

Autonomous learning of college students is an interactive process of "self-environment-behavior", which is based on the theoretical model of autonomous learning of Zimmerman. College students self-monitor and regulate the learning process, and environmental factors also participate in this process. Under the premise of fully understanding their own advantages and disadvantages, learners should make full use of the favorable learning environment and actively take measures to change the adverse learning environment and improve the learning

effect. For example, actively seek help from teachers, create a favorable place for learning, find information through the Internet, and so on.

1.2 Autonomous learning of college students is a unified process of "motivation--emotion--goal"

College students' autonomous learning is a unified process of "motivation--emotion--goal". This conclusion is based on the autonomous learning theoretical model of Dutch scholar Boekaerts and the autonomous learning theoretical model of American scholar Pintrich. Central to this theoretical model is focusing on cognitive and motivation autonomic regulation mechanisms. Under the background of mixed learning, undergraduate autonomous learning is also influenced by the autonomous regulation mechanisms of cognition and motivation.

1.3 College students' autonomous learning is the implementation process of "planning--monitoring--evaluation"

College students' autonomous learning is the implementation process of "planning--monitoring--evaluation". This view is based on the theoretical model of autonomous learning by Winne and Hadwin. This theoretical model focuses its attention on both the cognitive and metacognitive aspects. By monitoring and using (meta-) cognitive strategies to recognize how autonomous learning students actively manage their own learning. The model advocates the nature of goal-driven autonomous learning as well as the influence of self-learning behavior on motivation.

1.4 College students' autonomous learning is the generation process of "sharing--cooperation--innovation"

Autonomous learning for college students is the generation process of "sharing--cooperation--innovation". This conclusion is based on the theoretical model of autonomous learning of Finnish scholar Javella and Canadian scholar Hadwin. The two scholars explore the potential of autonomous learning theory in explaining and regulating the social and interactive characteristics of learning. Two scholars proposed a sharing / cooperative self-learning theoretical model (SSRL). This model presents a sharing / cooperation mode of autonomous learning.

To sum up, the autonomous learning of college students more highlights the "central" position of learners. In the process of autonomous learning, students need to think actively and constantly solve the problems encountered in learning. Scholars' research on the independent study of college students provides rich supporting materials and theoretical references for this study, but the existing research has some deficiencies.

2. Research on the deficiency of college students' autonomous learning

First of all, the measurement scale for autonomous learning has been very mature, but the measurement scale index for autonomous learning ability still needs to be further improved. The learning environment adaptation scale also involves factors such as family environment, but because the research focuses on the school, many scholars have made some trade-offs on this problem.

Secondly, many studies are model building under the guidance of social cognitive theory. For individuals, behavior and environment, three important factors are learning motivation, learning strategies and learning environment adaptation. In fact, research models can also be designed from other different perspectives, and in-depth research can be carried out.

Finally, in the investigation of the status quo of autonomous learning ability, due to the limitations of regional conditions, disciplines, majors, grade and other factors, the selection of samples still has some limitations, which needs to be further improved.

To sum up, scholars at home and abroad have conducted a lot of research on the field of autonomous learning, including in-depth research on its connotation, measurement and evaluation, and influencing factors.

Scholars have explained various aspects of autonomous learning from different research perspectives. First of all, research on autonomous learning has been ongoing at home and abroad, and the meaning of autonomous learning continues to develop and enrich in different eras. Both domestic and foreign scholars have similar research on the connotation of autonomous learning. Scholars believe that autonomous learning has the following characteristics: In the planning stage,

individual learners will formulate a detailed learning plan before conducting autonomous learning activities. In the monitoring and regulating stage, learners will actively monitor and regulate the learning process during learning activities. In the feedback and evaluation stage, individual learners will actively feedback and evaluate the learning process during their autonomous learning process. College students' reflection on the learning process can help learners better complete learning tasks. Secondly, regarding the research on factors affecting autonomous learning, domestic and foreign scholars have conducted research from different levels. Factors affecting autonomous learning are divided into internal factors and external factors. Internal factors include learners' own metacognition, learning will, learning motivation, etc.; external factors include environmental factors, teachers, learning peer groups, etc. Finally, regarding the research on autonomous learning measurement, domestic and foreign scholars have proposed mature measurement questionnaires and measurement tables. However, there are few studies on autonomous learning in higher education, which is where the value of this article lies. At the same time, domestic research on college students' autonomous learning mainly focuses on nursing majors, English majors, etc. There are few studies on the autonomous learning of ordinary college students, and there are few empirical studies on college students' autonomous learning.

At present, many scholars have obtained certain scientific research results through theoretical and empirical research in the field of autonomous learning. However, we also found that there are too many studies that are biased towards theory, and there are too few empirical studies. Therefore, this study starts from the actual situation of college students in Shaanxi Province, based on the educational environment of the new era, discusses the issues and influencing factors of college students' autonomous learning, and finally formulates practical and feasible sustainable development strategies for improving the autonomous learning ability of college students in Shaanxi Province.

Chapter 3

Research Methodology

The main objectives of this study are: 1) To study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province. 2) To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province. 3) To evaluate the feasibility of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

To solve the research questions mentioned in Chapter 1 and achieve the goals of this study, the researchers have the following procedures:

Phase 1: To study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province.

Phase 2: To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

Phase 3: To evaluate the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

Phase 1: To study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province.

The population/Sample Group

1. The Population

The total number of students in this study is 148,789 from 10 universities in Shaanxi Province.

2. The Sample Group

The sample of questionnaire group

These 10 universities include: Shaanxi University of Science & Technology, Yan'an University, Shaanxi University of Technology, Xijing University, Shaanxi Fashion Engineering University, Shaanxi Polytechnic Institute, Shaanxi Railway Institute, Shaanxi Technical College of Finance & Economics, Shaanxi Post and Telecommunication College, Shaanxi Energy Institute. The distribution of the 10 schools in Shaanxi Province is shown in Figure 3.1 below:

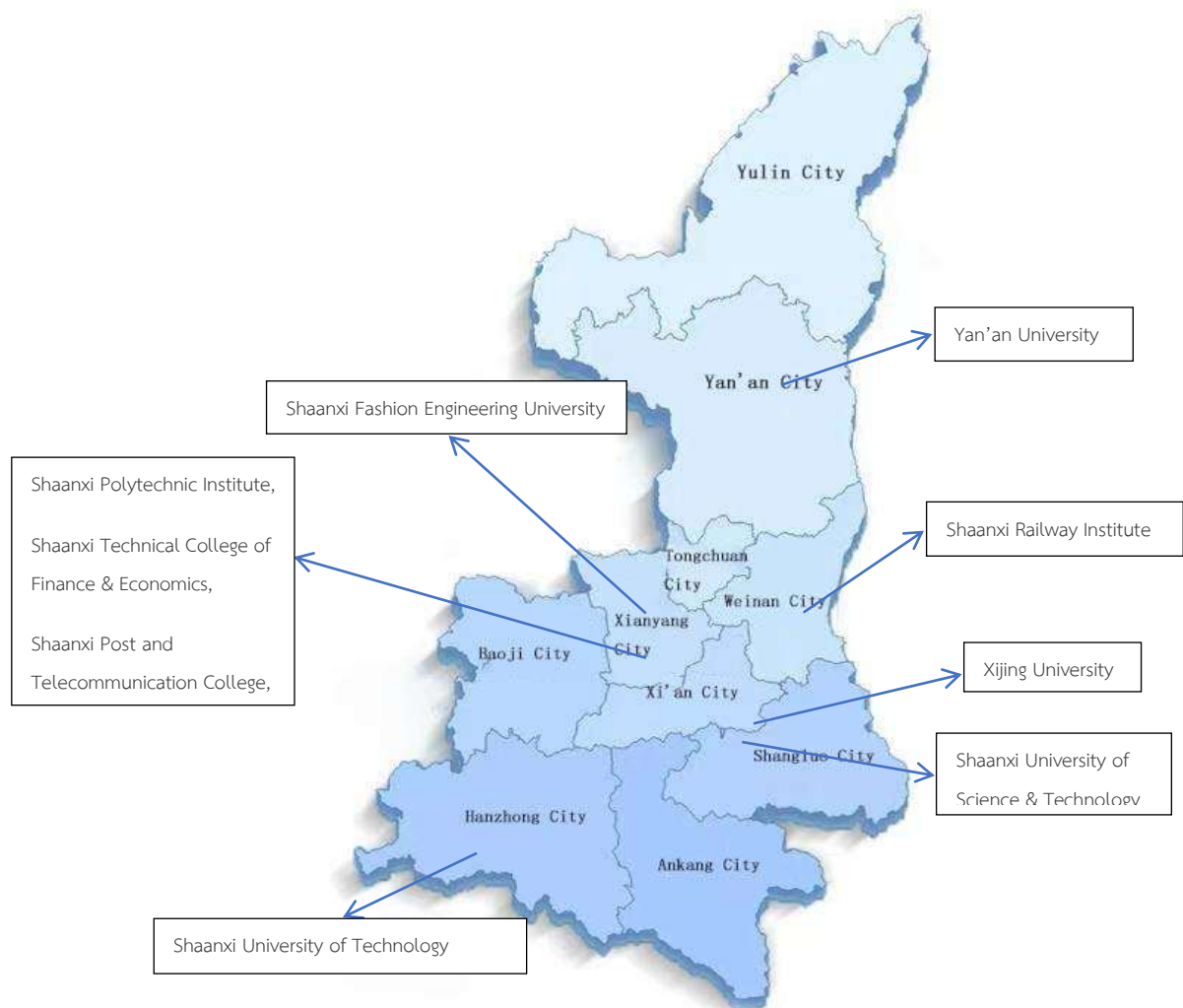


Figure 3.1 Distribution map of 10 universities

Among them, there are 5 undergraduate colleges and 5 vocational colleges. The reasons for choosing the above 10 universities are: 1) From the nature of the school, 3 of the 5 undergraduate colleges belong to the public, 2 belong to the

private, vocational colleges are all public schools; 2) From the school level, 5 undergraduate colleges, 5 vocational colleges; 3) Geographically, the five undergraduate colleges and universities are located in the north, middle and south of Shaanxi Province; 4) From the perspective of disciplinary characteristics, 5 undergraduate colleges belong to comprehensive universities, and 5 vocational colleges have more significant specialty characteristics. From the above aspects, it can be seen that the 10 universities selected above have certain representativeness and universality.

Based on the Krejcie and Morgan. (1970). sampling table, the sample size was 384. The specific data are shown in the table 3.1:

Table 3.1 Sample Distribution

No.	University	City	Population	Sample Group
1	Shaanxi University of Science & Technology	Xi'an	19,000	47
2	Yan'an University	Yan'an	15,234	45
3	Shaanxi University of Technology	Hanzhong	18,720	46
4	Xijing University	Xi'an	19,894	51
5	Shaanxi Fashion Engineering University	Xianyang	6,000	15
6	Shaanxi Polytechnic Institute	Xianyang	21,296	55
7	Shaanxi Railway Institute	Weinan	15,000	38
8	Shaanxi Technical College of Finance & Economics	Xianyang	14,320	37
9	Shaanxi Post and Telecommunication College	Xianyang	5,900	15
10	Shaanxi Energy Institute	Xianyang	13,425	35
Total			148,789	384

Research Instruments

Questionnaire

A questionnaire about the current condition and expected condition of college students' autonomous learning ability was designed to investigate sample students from 10 colleges and universities in Shaanxi Province.

Designed a questionnaire about college students' autonomous learning ability, studied the current and expected condition of college students' autonomous learning ability in Shaanxi Province, analyzed the reasons for the differences in the autonomous learning ability of different college students, and obtained the factors affecting college students' autonomous learning ability.

Step 1: The researchers requested an invitation from the Graduate School of Bansomdejchaopraya Rajabhat University to collect data from 10 universities in Shaanxi Province.

Step 2: The researchers sent questionnaires to students from 10 sample universities in Shaanxi Province.

The criteria for data interpretation based on five-point Likert's scale, as follows:

5 means Strongly Agree

4 means Agree

3 means Average

2 means Disagree

1 means Strongly Disagree

As show in the Table 3.2

Table 3.2 Measurement scale for sustainable development strategy development of autonomous learning ability among college students in Shaanxi Province

Perception level	Score
Strongly Agree	5
Agree	4
Average	3
Disagree	2
Strongly Disagree	1

Regarding the measurement items, we proposed an assessment framework for the sustainable development of autonomous learning ability among Shaanxi university students by categorizing the average scores of the responses into five perceptual levels. The average scores were calculated using the evaluation criteria proposed by Best (John W. Best, 1977: 190). Mean scores are 1.00-1.49, 1.50-2.49, 2.50-3.49, 3.50-4.49, 4.5-5.00.

For the calculation of the current condition and expected condition, the Priority Needs Index Modified (PNI Modified) is used, with the following calculation formula:

$$\text{PNI modified} = (I-D)/D$$

I (Important) means the condition that should be.

D (Degree of success) means the actual/current state of being.

$$\text{PNI modified} = (I-D)/D$$

Constructing a Questionnaire Processes

The construction process of questionnaire were as follows:

Step 1: Review and analyze the literature, concepts, theories and researches related to college students' autonomous learning ability.

Step 2: Construct a questionnaire on the status quo of college students' autonomous learning ability in Shaanxi Province. Then the questionnaire outline will be sent to the thesis supervisor, and the content will be reviewed and modified according to the suggestions.

Step 3: The objective agreement index (IOC) of the questionnaire was tested by 5 experts. The researchers invited three experts from Thai universities with background in education and sustainable development research, and two experts from Chinese universities with senior and senior professional titles and student management backgrounds to evaluate the project-goal consistency (IOC) of the questionnaire and focus interview forms. According to the acceptance criteria, an IOC value of 0.50 or higher was deemed acceptable. Based on this criterion, all 32 items in the questionnaire achieved IOC values ranging from 0.60 to 1.00, indicating satisfactory content validity. Consequently, all items were retained in the final version of the instrument.

Step 4: Modify the questionnaire according to the advice of the experts.

Step 5: The investigators conducted a pilot test. The process involved the following key actions: 1) To test the reliability of the questionnaire. 2) Randomly invited 50 eligible to participate in the research subjects. 3) The participants completed the questionnaire, and the collected data was used to perform a Cronbach's Alpha (CA) test. The Cronbach. α coefficient test score of the questionnaire was 0.875 (see Appendix), with item discrimination indices ranging from 0.42 to 0.89, indicating the reliability of the study.

Step 6: Finalisation: Based on expert feedback and pilot results, the questionnaire was revised and approved by the academic advisor before being used in the main data collection phase.

Data Collection

Questionnaire

1. Questionnaire design: The researchers design the research questionnaire according to the first research purpose, accept the guidance of the tutor, and then submit it to the School of Graduate Studies for approval.

2. Questionnaire distribution: Researchers distributed questionnaires in 10 universities in Shaanxi Province and asked respondents to fill out questionnaires.

3. Questionnaire follow-up: Follow up the sample size of the questionnaire, stop the questionnaire when the sample size is satisfied, and proceed to the next step of questionnaire data analysis.

4. Questionnaire data collation: sort out the collected questionnaires, check the completeness of the questionnaires, and use analysis software to analyze the complete and valid questionnaire data.

Data Analysis

The researcher analyzed the data through the software package program as follows:

1. Analyze the frequency and percentage of the personal information of the respondents, and classify them according to gender, from, subject, education type, current grade.

2. Demographic data were analyzed using descriptive statistics, frequencies, and percentages. Descriptive statistics, including means (\bar{X}) and standard deviations (S.D.), were used to analyze indicators related to the sustainable development of autonomous learning ability among college students in Shaanxi Province.

3. A software package was utilized to summarize and analyze the results statistically. The analysis involved calculating the mean and standard deviation (S.D.) to assess the overall trends. Additionally, the PNImodified (Priority Need Index) was applied to determine the significance of the needs, using the formula adapted by Suwimon Wongwanich (Wongwanich, 2005, p. 279).

$$PNI_{\text{Modified}} = \frac{I-D}{D}$$

PNI Represents the priority needs index.

I Represents the average score of the expected conditions of sustainable development of college students' autonomous learning ability

D Represents the average score of the current conditions of sustainable development of college students' autonomous learning ability

The mean data based on Rensis Likert (1932) is interpreted as follows:

4.50 - 5.00 expresses the highest level

3.50 - 4.49 expresses high level

2.50 - 3.49 expresses the level

1.50 - 2.49 expresses low level

1.00 - 1.49 expresses the lowest level

Phase 2: To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The Population/Sample Group

Interviewees

The subjects of this study are 20 college administrators and teachers from 10 colleges and universities in Shaanxi Province, among which each school selects 1 college administrator and 1 teacher. The qualifications of the respondents are: 1) have a master's degree or above, 2) have worked in a university for more than 10 years; 3) Intermediate or above administrative staff, major in education, 4) Associate professor or above.

Table 3.3 Sample Interviewee

No.	University	City	Number of Interviewee	
			Student Manager	Teacher
1	Shaanxi University of Science & Technology	Xi'an	1	1
2	Yan'an University	Yan'an	1	1
3	Shaanxi University of Technology	Hanzhong	1	1
4	Xijing University	Xi'an	1	1
5	Shaanxi Fashion Engineering University	Xianyang	1	1
6	Shaanxi Polytechnic Institute	Xianyang	1	1
7	Shaanxi Railway Institute	Weinan	1	1
8	Shaanxi Technical College of Finance & Economics	Xianyang	1	1
9	Shaanxi Post and Telecommunication College	Xianyang	1	1
10	Shaanxi Energy Institute	Xianyang	1	1
Subtotal			10	10
Total			20	

Research Instruments

Interview

Structured interview outline was designed, and in-depth interviews were conducted with a total of 20 teachers and student administrators from 10 universities to understand the existing problems, obstacles and relevant suggestions in cultivating and improving college students' autonomous learning ability, and finally the

sustainable development strategy of college students' autonomous learning ability in Shaanxi Province was formulated.

The steps of the interview mainly include:

Step 1: The researcher designs the interview outline.

Step 2: The researchers invited participants to participate in the proposed strategy.

Step 3: The researcher interviewed the interviewees for 15-30 minutes each time.

Step 4: The researcher sorted out the interview results and worked out the sustainable development strategy of college students' autonomous learning ability in Shaanxi Province.

Data Collection

Interview

1. Summarize the analysis results of the questionnaire on the status quo of college students' autonomous learning ability in Shaanxi Province, and formulate the interview outline.

2. Respondents of structured interview chose Shaanxi University of Science & Technology, Yan'an University, Shaanxi University of Technology, Xijing University, Shaanxi Fashion Engineering University, Shaanxi Polytechnic Institute, Shaanxi Railway Institute, Shaanxi Technical College of Finance & Economics, Shaanxi Post and Telecommunication College, Shaanxi Energy Institute. 10 universities as interview schools. A total of 20 university administrators and teachers were interviewed, and one university administrator and one teacher were selected from each school. The qualifications of the respondents are: 1) have a master's degree or above, 2) have worked in a university for more than 10 years; 3) Intermediate or above administrative staff, major in education, 4) Associate professor or above, 5) experts with experience in testing autonomous learning ability.

3. Select interviewees according to requirements.
4. Conduct an interview. The researchers distributed an interview outline to 20 interviewees.
5. Interview data analysis. After the interview, organize the content of the interview.

Data Analysis

This stage focused on the strategic development process to promote the sustainable development college students' autonomous learning ability in Shaanxi Province. It comprised four systematic steps: contextual and needs analysis, SWOT analysis, construction of the TOWS matrix, and drafting of the strategic framework. Each step is detailed below.

2.1 Contextual and Needs Analysis

The first step involved a contextual and needs-based assessment to inform strategic planning. The analysis utilised both quantitative and qualitative data gathered in Stage 1, examining internal and external environmental factors that influence college students' autonomous learning ability in Shaanxi Province.

External Environment

External environment, the PEST analysis method to analyze the questionnaire content, thereby summarizing the opportunities and threats faced by college students in self-directed learning.

Internal Environment

Internal environment, the 4M method is used to analyze the self-directed learning condition of college students from the aspects of personnel, mechanisms, data, and methods. Finally, the advantages and disadvantages of the self-directed learning environment of college students are summarized.

2.2 SWOT Analysis

The second step is to divide internal and external factors into four strategic dimensions: strengths, weaknesses, opportunities, and threats (SWOT analysis). This division is based on the combined results of 4M and PEST analysis.

The results of the SWOT analysis were subsequently used to draft strategies through the TOWS Matrix in the next stage of the research.

2.3 TOWS Matrix Construction

Following the SWOT analysis, the TOWS matrix was constructed to convert diagnostic data into strategic directions. The matrix was used to formulate four types of strategies:

SO (Strengths–Opportunities) Strategies:

Capitalise on internal strengths to exploit external opportunities.

ST (Strengths–Threats) Strategies:

Use internal strengths to counteract or mitigate external threats.

WO (Weaknesses–Opportunities) Strategies:

Address internal weaknesses by taking advantage of emerging opportunities.

WT (Weaknesses–Threats) Strategies:

Formulate defensive strategies to reduce both internal and external vulnerabilities.

This step ensured that the insights derived from data analysis were systematically translated into practical, prioritised strategic options aligned with institutional and policy contexts.

Phase 3: To evaluate the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The Population/Sample Group

Evaluation Expert

The evaluation experts in this study are 5 experts from 10 universities, including 3 experts from undergraduate colleges and 2 experts from vocational colleges. Expert qualifications are: 1) more than 15 years of work experience in universities, 2) senior leaders, 3) managers and teachers with senior titles.

The evaluation form is based on a 5-point Likert scale with four evaluation levels: “highest”, “high”, “moderate”, “low” and “lowest”.

Table 3.4 Sample Experts

No.	University	City	Number of experts
1	Shaanxi University of Science & Technology	Xi'an	1
2	Shaanxi University of Technology	Hanzhong	1
3	Xijing University	Xi'an	1
4	Shaanxi Polytechnic Institute	Xianyang	1
5	Shaanxi Railway Institute	Weinan	1
Total			5

Research Instruments

Evaluation Form

This tool collected data for Objective 3 and assessed the applicability of a sustainable development strategy for the self-directed learning ability of university students in Shaanxi Province. We invited five experts to evaluate the feasibility and adaptability of this strategy. The evaluation form consists of two parts:

Part One: Expert Personal Information, categorized by job title, work unit, educational background, and professional title.

Part Two: Evaluation Form for the Development of a Sustainable Development Strategy for the Self-Directed Learning Ability of University Students in Shaanxi Province.

The criteria for data interpretation based on a five-point Likert's scale (1932), The data interpretation is as follows:

4.50 - 5.00 refers to the highest level

3.50 - 4.49 means high level

2.50 - 3.49 refers to moderate level

1.50 - 2.49 refers to low level

1.00 - 1.49 refers to the lowest level

Constructing an Evaluation Form Process

The construction process of evaluation form was as follows:

Step 1: Review and analyze the literature, data, concepts, theories and research related to college students' autonomous learning ability.

Step 2: Construct the adaptability and feasibility evaluation table of the sustainable development strategy of improving college students' autonomous learning ability in Shaanxi Province.

Step 3: Distribute the evaluation form to 5 university experts for evaluation.

Data Collection

Evaluation Expert

1. Design an evaluation form and check its correctness, feasibility and applicability.
2. Invite experts to participate in the strategy evaluation.
3. After the evaluation, analyze the evaluation content and data.

Data Analysis

Using the mean value and standard deviation to analyze the adaptability and feasibility evaluation of the strategy of improving college students' autonomous learning ability for sustainable development in Shaanxi Province.

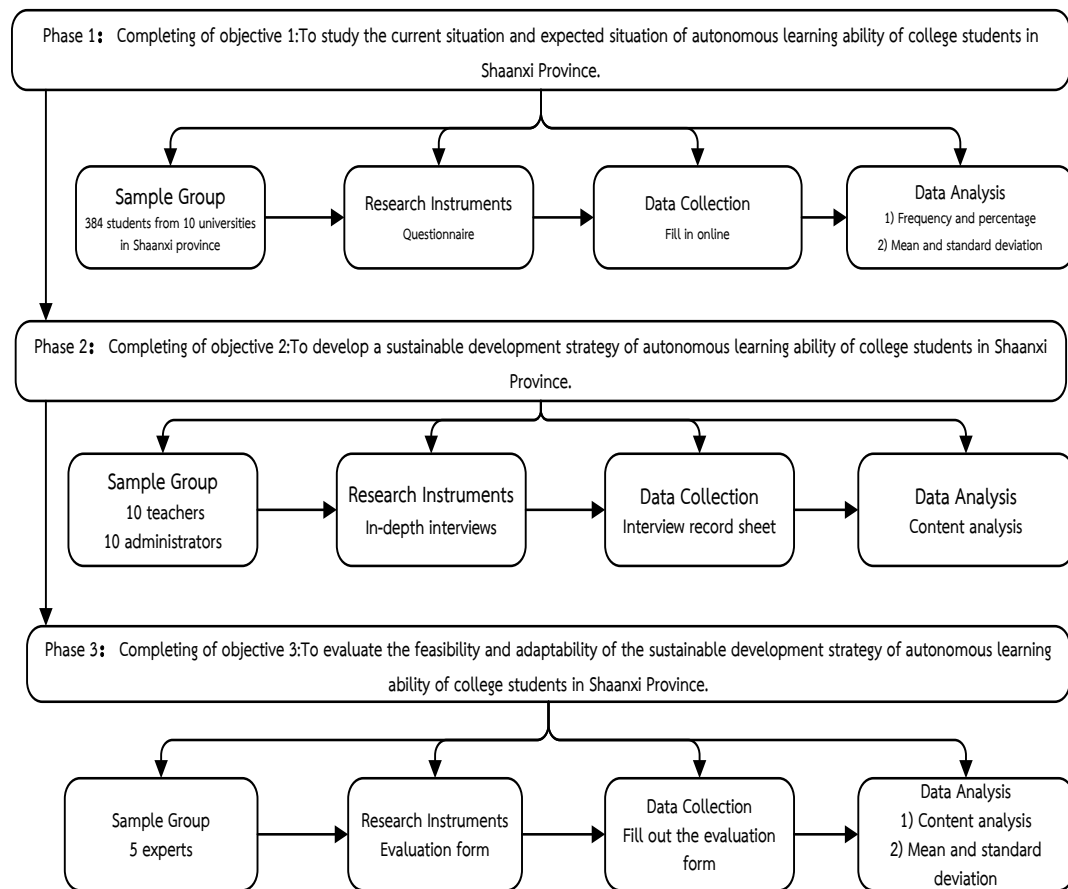


Figure 3.2 Research Method

According to the Figure 3.2, this study is divided into three stages, aiming to explore the current condition and expected condition of autonomous learning ability among college students in Shaanxi Province, formulate development strategies and assess their feasibility and adaptability. Phase 1, aimed at assessing the current condition and expected condition utilized a questionnaire distributed online to a sample of 384 students from 10 universities, with data analyzed via frequency, percentage, mean, and standard deviation. Phase 2, focused on developing a sustainable development strategy through in-depth interviews with 10 teachers and 10 administrators, utilizing an interview record sheet for data collection and content analysis for data interpretation. Phase 3, evaluated the feasibility and adaptability of the proposed strategy by distributing an evaluation form to 5 experts, analyzing their feedback through both content analysis and mean/standard deviation calculations.

Chapter 4

Results of Analysis

The research objective of the study on the autonomous learning ability of college students in Shaanxi Province is as follows: 1) To study the current condition of the autonomous learning ability of college students in Shaanxi Province. 2) To develop a sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province. 3) To evaluate the feasibility of the sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province. The research adopted random proportion sampling techniques, involving a total of 384 students and 20 university administrators and teachers. The current condition and influencing factors of the autonomous learning ability of college students in Shaanxi Province were investigated through questionnaire surveys. The relevant research data are divided into the following three parts:

1. Analysis results serving Research Objective 1: To study the current condition and expected condition of autonomous learning ability among college students in Shaanxi Province.

1.1 Analysis of the basic personal information of the respondents in the questionnaire.

1.2 Analysis of the current condition and expected condition of the sustainable development of college students' autonomous learning ability in Shaanxi Province.

2. Analysis results serving Research Objective 2: To develop sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province.

2.1 Taking results of analysis of development of the strategies for enhancing of sustainable development of autonomous learning ability among college students to development strategies.

2.1.1 SWOT and TOWS Matrix of Learning motivation

2.1.2 SWOT and TOWS Matrix of Learning strategies

2.1.3 SWOT and TOWS Matrix of Self-efficacy

2.1.4 SWOT and TOWS Matrix of Learning environment

2.1.5 SWOT and TOWS Matrix of Self-regulation and control

2.1.6 Corresponding TOWS Strategy

2.2 Taking Strategies to interview 20 experts

2.3 Summary of development strategies

3. Analysis results serving Research Objective 3: Evaluating the adaptability and feasibility of the sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province.

3.1 Analysis of evaluating the adaptability and feasibility of the sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province

The symbols used to represent the results of data analysis and their meanings are as follows:

n Represents the sample group

\bar{X} Represents the average

S.D. Represents standard deviation

The details of the research methodology are as below:

Analysis results serving Research Objective 1: To study the current condition and expected condition of autonomous learning ability among college students in Shaanxi Province.

Questionnaire data analysis results

In this section, the results of the analysis of Objective 1 are presented using the methods of frequency, percentage, mean, standard deviation and ranking, as follows:

1.1 Analysis of the basic personal information of the respondents in the questionnaire

The results of the analysis of the basic personal information of the respondents in the questionnaire are based on gender, place of origin, discipline, level, and current grade. Data are presented in frequency and percentage form (see Table 4.1 for details).

Table 4.1 Analysis of participants' personal information

(n=384)

Dimension	Personal information	Number of people (units)	Proportion (%)
Gender	Male	99	25.78
	Female	285	74.22
	Total	384	100
From	Urban	104	27.08
	Rural area	280	72.92
	Total	384	100
Subject	Science	160	41.67
	Liberal Arts	155	40.36
	Engineering	43	13.80
	Art	16	4.17
	Total	384	100
Education Type	Undergraduate education	249	64.84
	Vocational education	135	35.16
	Total	384	100

Table 4.1 (Continued)

(n=384)

Dimension	Personal information	Number of people (units)	Proportion (%)
Current Grade	Freshman	24	6.25
	Sophomore	261	67.97
	Junior	94	24.48
	Senior	5	1.30
	Total	384	100

According to Table 4.1, among the students who participated in the questionnaire, there were more female students than male students, more students from rural areas than urban areas, the most science students, more undergraduate students than vocational students, and the most sophomores.

Table 4.1 shows that a total of 384 valid participants were involved in this study. Among the respondents, 99 were male, accounting for 25.78%; 285 were female, accounting for 74.22%. 104 students from urban areas, accounting for 27.08%; 280 students in rural areas, accounting for 72.92%. 160 science students, accounting for 41.67%; 155 liberal arts students, accounting for 40.36%; 43 engineering students, accounting for 13.8%; 16 art students, accounting for 4.17%. 249 undergraduates, accounting for 64.84%; 135 higher vocational students, accounting for 35.16%. 24 freshmen, accounting for 6.25%; 261 sophomores, accounting for 67.97%; 94 junior students, accounting for 24.48%; 5 senior students, accounting for 1.3%. This sample is randomly selected from the selected 10 universities according to the proportion of students, which meets the requirements of random proportional sampling.

1.2 Analysis of the current condition and expected condition of the sustainable development of college students' autonomous learning ability in Shaanxi Province

After collecting the questionnaire, the researchers clarified the data interpretation criteria and used the mean and standard deviation of the scale questions for statistical analysis. The specific analysis is as follows:

Table 4.2 Analysis of the sustainable development status and improvement expectations of college students' autonomous learning ability in Shaanxi Province

(n=384)

Shaanxi Province College Students' Autonomous Learning Ability Sustainable Development	Current Condition			Expected Condition			PNI modified (I - D)/D	Rank
	\bar{X} (D)	S.D.	Level	\bar{X} (D)	S.D.	Level		
Learning motivation	3.37	0.848	Moderate	4.00	0.802	High	0.187	3
Learning strategies	3.40	0.787	Moderate	3.93	0.754	High	0.156	5
Self-efficacy	3.44	0.800	Moderate	4.03	0.763	High	0.170	4
Learning environment	3.36	0.797	Moderate	4.16	0.683	High	0.239	1
Self-regulation and control	3.42	0.794	Moderate	4.21	0.664	High	0.230	2
Total	3.40	0.805	Moderate	4.07	0.733	High	0.196	

Table 4.2 presents the analysis of the current condition and expected condition of the sustainable development of college students' autonomous learning ability in Shaanxi Province. From the current condition, the overall sustainable development level of college students' autonomous learning ability in Shaanxi Province is above average, ($\bar{X} = 3.40$, $S.D. = 0.805$). Among the five dimensions of the assessment, the self-efficacy dimension ranked first ($\bar{X} = 3.44$, $S.D. = 0.848$), indicating that the current level of students' self-efficacy is relatively high. The self-regulation and control dimension ranked second ($\bar{X} = 3.42$, $S.D. = 0.794$). The learning strategy dimension ranked third, ($\bar{X} = 3.40$, $S.D. = 0.787$), indicating that the current use of

learning strategies is at a moderate level. The learning motivation dimension ranked fourth ($\bar{X} = 3.37$, $S.D. = 0.848$), indicating that the level of students' learning motivation was relatively low. The average score of the current condition of the learning environment dimension ranked fifth ($\bar{X} = 3.36$, $S.D. = 0.797$), indicating that students are not satisfied with the existing learning environment.

The standard deviations for all dimensions ranged from 0.79 to 0.85, indicating that although there was some variation in teachers' responses, the data were relatively concentrated around the mean. This consistency indicates that the results of the survey are reliable and the questionnaire design is valid. The PNI correction further reveals areas that students feel need to be strengthened. According to the ranking of PNI values from high to low, the most anticipated aspects of students were the improvement of learning environment (0.239) and self-regulation and control (0.230), followed by learning motivation (0.187), and finally self-efficacy (0.170) and learning strategies (0.156). This suggests that while all areas are considered important for the sustainable development of self-directed learning skills, students find self-regulation and control and the learning environment to improve the most urgent. Overall, these data clearly show the room for improvement in the sustainable development of college students' autonomous learning ability in Shaanxi Province.

1.2.1 Analysis of the current condition and expected condition of respondents' learning motivation

In this study, the mean and standard deviation methods were mainly used to statistically analyze the variables

Table 4.3 Analysis of the current condition and expected condition of respondents' learning motivation

(n=384)

Learning Motivation	Current Condition		Expected Condition		PNI modified (I - D)/D	Rank
	\bar{X} (D)	S.D.	\bar{X} (D)	S.D.		
	You will study hard to be recognized by teachers, family and classmates	3.26	0.899	3.85	0.780	0.181
You hope that you can significantly improve your academic performance in a short period of time	3.49	0.819	4.04	0.793	0.158	6
You believe that learning focuses on improving one's own quality and is not limited to academic performance	3.53	0.791	4.20	0.738	0.189	3
You will forget to eat and sleep, and stay up all night to complete a certain assignment in time	3.16	0.942	3.88	0.929	0.228	1
You will work hard to achieve your learning goals	3.51	0.777	4.18	0.751	0.191	2
You will assign yourself more challenging learning tasks	3.28	0.858	3.86	0.823	0.177	5
Total	3.37	0.848	4.00	0.802	0.187	

Table 4.3 shows the current condition and expected condition analysis of learning motivation for the sustainable development of college students' autonomous learning ability in Shaanxi Province. The table compares the current condition with expectations through dimensions such as mean, standard deviation and PNI corrections to assess areas for improvement.

Among the dimensions, "You will forget to eat and sleep, and stay up all night to complete a certain assignment in time" ranks first, with a PNI correction of 0.228. This shows a relatively significant gap between status quo and expectations, highlighting the importance of these factors for sustainable development. "You will work hard to achieve your learning goals" ranked second, with a PNI value of 0.191, indicating that students' urgency and importance to achieving learning goals need to be strengthened urgently, and students' understanding of the ultimate goal and direction of learning is still biased and needs to be changed urgently.

"You believe that learning focuses on improving one's own quality and is not limited to academic performance" ranked third, with a PNI value of 0.189, indicating that students believe that the purpose of learning is ultimately to improve their own quality, "You will study hard to be recognized by." teachers, family and classmates" ranked fourth, with a PNI value of 0.181, indicating that the formation of students' learning motivation is related to the recognition of those around them, but there is still room for improvement. "You will assign yourself more challenging learning tasks" ranked fifth, with a PNI value of 0.177, indicating that the gap between the current condition and expectations in assigning challenging tasks is small, indicating that modern students are more willing to challenge themselves and stimulate their potential, but there is still room for improvement. In contrast, "You hope that you can significantly improve your academic performance in a short period of time" has the lowest PNI value (0.158), which means that the field is considered relatively well-developed and in need of low improvement.

Overall, the corrected mean of PNI for learning motivation dimension reached 0.187, indicating that there was a low degree of improvement in all dimensions. However, from the perspective of specific factors, there is still a gap between the current condition and expectations, and there is still room for improvement and improvement. The higher PNI value highlights the importance and urgency of improving students' learning and the goals and meanings of learning that need to be improved and improved. Lower values indicate that some areas have met the expected standards to a greater extent.

1.2.2 Analysis of the current condition and expected condition of respondents' learning strategies

Table 4.4 Analysis of the current condition and expected condition of respondents' learning strategies

(n=384)

Learning Strategies	Current Condition		Expected Condition		PNI modified (I - D)/D	Rank
	\bar{X} (D)	S.D.	\bar{X} (D)	S.D.		
	You often develop study plans for each course	3.28	0.830	3.77	0.782	0.149
You know how to estimate the completion of your learning tasks	3.39	0.798	3.88	0.755	0.145	5
You will adjust your learning status to the best	3.40	0.784	4.06	0.744	0.194	1
You know how to find the information you need	3.48	0.760	3.91	0.740	0.124	7
You know how to classify and apply the information you obtain	3.44	0.767	3.89	0.727	0.131	6
You can make the most of your study time	3.38	0.798	4.02	0.791	0.189	2
you know how to use outside forces to overcome them	3.45	0.775	3.99	0.739	0.157	3
Total	3.40	0.787	3.93	0.754	0.156	

Table 4.4 analyzes the current condition of learning strategies related to the influencing factors of sustainable development of college students' autonomous learning ability in Shaanxi Province. The table compares the current condition with

expectations through seven aspects: mean, standard deviation, and PNI correction to determine the extent to which improvement is needed.

Among all dimensions, "You will adjust your learning status to the best" ranked highest in terms of improvement needs, with a PNI correction of 0.194. This indicates a significant gap between the status quo and expectations, highlighting the importance of adjusting students' learning status factors. "You can make the most of your study time" came in second, with a PNI value of 0.189, indicating that students still have room to improve in making the most of their study time.

"You know how to use outside forces to overcome them" ranked third, with a PNI of 0.157, reflecting that students' ability to overcome difficulties with the help of external forces needs to be improved and cultivated when learning is hindered. In contrast, "You know how to find the information you need" had the lowest PNI value of 0.124, indicating that students are relatively mature in finding information and are less in need of immediate improvement.

Overall, the total PNI_{modified} value of the learning strategy reached 0.156, indicating that the gap between the current status and expectations of each dimension is small overall, but there is still room for improvement and improvement. A higher PNI value highlights the importance of adjusting the optimal learning state and making full use of learning time, while a lower value indicates that students' ability to find information, organize and classify information is relatively mature, and there is little room for improvement.

1.2.3 Analysis of the current condition and expected condition of respondents' self-efficacy

Table 4.5 Analysis of the current condition and expected condition of respondents' self-efficacy

(n=384)

Self-efficacy	Current Condition		Expected Condition		PNI modified (1 - D)/D	Rank
	\bar{X} (D)	S.D.	\bar{X} (D)	S.D.		
	You can encourage yourself when you encounter difficulties in learning	3.46	0.783	4.11	0.767	0.188
You think you can well understand the knowledge in the books and the content taught by the teacher	3.41	0.818	3.97	0.781	0.164	3
You can handle any learning task	3.43	0.841	4.16	0.774	0.213	1
You are able to work towards defined learning goals	3.46	0.773	3.94	0.752	0.139	5
You will pay attention to the learning success or failure of classmates with similar abilities to yourself to motivate yourself	3.46	0.787	3.97	0.742	0.147	4
Total	3.44	0.800	4.03	0.763	0.170	

Table 4.5 analyzes the current condition and expected condition of self-efficacy among the influencing factors of sustainable development of college students' autonomous learning ability in Shaanxi Province. The table compares the current and expected conditions of each factor in the self-efficacy dimension through mean, standard deviation and PNI correction values, so as to evaluate the degree of improvement in each field.

Among all dimensions, "You can handle any learning task" has the highest awareness of improvement requirements, with a PNI correction value of 0.213. This indicates that there is a significant gap between the current condition and the

expected conditions, highlighting that there is more room for improvement in students' ability to cope with various learning tasks. "You can encourage yourself when you encounter difficulties in learning" came in second with a PNI of 0.188, reflecting the need to build incentives to help students self-motivate and solve difficulties when they encounter difficulties.

"You think you can well understand the knowledge in the books and the content taught by the teacher" ranked third with a PNI value of 0.164, indicating that students have a need to improve their ability judgment in understanding book knowledge and the knowledge taught by teachers. "You will pay attention to the learning success or failure of classmates with similar abilities to yourself to motivate yourself" The PNI value of 0.147 ranked fourth, indicating that students will pay attention to the learning condition of their classmates at the same level and motivate themselves with their learning success experiences and failure lessons. "You are able to work towards defined learning goals" ranked last with a PNI value of 0.139, indicating that the development of this field is relatively complete and is considered to not need priority improvement.

Overall, the PNI_{modified} mean of the self-efficacy dimension reached 0.170, indicating that the gap between the current condition and expectations at each level is relatively small. A higher PNI value highlights the importance of students coping with various learning tasks and encouraging themselves when encountering difficulties, while a lower value indicates that students have basically achieved the expected results in terms of textbook knowledge and teacher teaching knowledge, learning and learning goals from classmates of the same level. This analysis helps to clarify students' subjective evaluation of their ability to complete learning tasks during independent learning, so as to support the sustainable development of their autonomous learning ability.

1.2.4 Analysis of the current condition and expected condition of the respondents' learning environment

Table 4.6 Analysis of the current condition and expected condition of respondents' learning environment

(n=384)

Learning Environment	Current Condition		Expected Condition		PNI modified (I - D)/D	Rank
	\bar{X} (D)	S.D.	\bar{X} (D)	S.D.		
	You can adapt to your dormitory living environment	3.27	0.866	3.91	0.758	0.196
You often go to the library to study and do your homework in an environment that allows you to concentrate	3.21	0.852	4.32	0.702	0.346	1
You can skillfully select and use network resources	3.39	0.746	4.06	0.724	0.198	4
You think a good campus cultural environment is conducive to your study	3.42	0.786	4.56	0.497	0.333	2
You will consciously pay attention to the learning behaviors of your role models and accumulate learning experience for yourself	3.38	0.786	3.99	0.747	0.180	7
You think teachers' teaching methods have a great impact on learning outcomes	3.45	0.766	4.48	0.555	0.299	3
You think it is important to share learning materials with classmates	3.41	0.769	4.03	0.733	0.182	6
You think your parents' expectations have a great impact on your motivation to learn	3.36	0.801	3.95	0.751	0.176	8
Total	3.36	0.797	4.16	0.683	0.239	

Table 4.6 analyzes the current condition and expected learning environment of college students in Shaanxi Province. The table compares current conditions with expected conditions from multiple dimensions through indicators such as mean, standard deviation, and PNI correction values to identify areas for improvement.

Among all dimensions, "You often go to the library to study and do your homework in an environment that allows you to concentrate" ranks first in improving demand perception, with a PNI correction of 0.346. This indicates that there is a significant gap between the current condition and the desired conditions, highlighting the importance of strengthening students' concentration on learning in the library and promoting the sustainable development of their autonomous learning ability. "You think a good campus cultural environment is conducive to your study" ranked second, with a PNI value of 0.333, reflecting the urgent need to strengthen the creation of a good campus cultural learning environment.

"You think teachers' teaching methods have a greater impact on learning outcomes" came in third with a PNI value of 0.299, reflecting the need for improvement in teachers' teaching methods. "You think your parents' expectations have a greater impact on your motivation to learn" is the lowest gap item with a PNI value of 0.176, indicating that the area is relatively well-established and is considered not to need priority improvement.

Overall, the total PNI correction value of the learning environment is 0.239, indicating that there is a certain degree of improvement needed in all dimensions at present, reflecting that there is still room for systematic improvement in the overall learning environment. Specifically, the dimensions of the library learning environment, campus cultural environment, and teachers' teaching methods show relatively high PNI values, suggesting that these aspects have a crucial impact on the formation of students' autonomous learning abilities and are the core areas that need to be prioritized and invested in at this stage. For instance, the completeness of library facilities, openness, and academic support functions, the academic atmosphere, innovation incentives, and peer interaction mechanisms in campus culture, as well as the inspiration, interactivity, and technology integration of teachers' teaching methods,

are all important links that directly affect students' active learning motivation and ability construction. Furthermore, this analysis not only clarifies the differences in the significance of various environmental factors but also provides a directional basis for the systematic optimization of the learning environment.

1.2.5 Analysis of the current condition and expectations of respondents' self-regulation and control

Table 4.7 Analysis of the current condition and expected condition of respondents' self-regulation and control

(n=384)

Self-regulation and Control	Current Condition		Expected Condition		PNI modified (I - D)/D	Rank
	\bar{X} (D)	S.D.	\bar{X} (D)	S.D.		
You can arrange the best study time according to your own learning needs	3.44	0.775	4.55	0.498	0.323	1
You can complete independent learning tasks within the specified time	3.44	0.787	4.54	0.499	0.320	2
You can continue to implement your original study plan when studying conflicts with other things	3.41	0.800	4.02	0.756	0.179	5
You will make full use of library materials to assist your studies	3.37	0.838	3.95	0.759	0.172	6
You will make good use of other learning methods when one method cannot meet your learning needs	3.47	0.756	4.16	0.714	0.199	3
You still insist on doing it well when you encounter learning content that you are not interested in	3.40	0.805	4.04	0.755	0.189	4
Total	3.42	0.794	4.21	0.664	0.230	

Table 4.7 analyzes the current condition and expectation of self-regulation and control of college students in Shaanxi Province. The table compares current conditions with expected conditions from multiple dimensions through indicators such as mean, standard deviation, and PNI corrections to identify areas for improvement.

Among all dimensions, "You can arrange the best study time according to your own learning needs" ranked first in improving needs perception, with a PNI correction of 0.185. This shows that there is a significant gap between the current condition and the expected conditions, which reflects that there is still a large gap between the current condition and the expected condition in the optimal learning time arrangement of students, and the need for improvement is more obvious. "You can complete independent learning tasks within the specified time" ranked second, with a PNI value of 0.182, reflecting that students' ability to complete learning tasks independently within the specified time is relatively weak and there is still a lot of room for improvement.

"You will make good use of other learning methods when one method cannot meet your learning needs" ranked third with a PNI value of 0.075, which reflects the important impact of learning to use multiple learning methods to improve self-directed learning ability to meet learning needs. "You will make full use of library materials to assist your studies" was the lowest gap term with a PNI value of 0.048, indicating that the field is relatively complete and does not need priority improvement.

Overall, the total PNI correction value for the self-regulation and control dimension was 0.230, indicating that there is some degree of need for improvement in all dimensions. The higher PNI value highlights that there is still a certain degree of room for improvement and strengthening in arranging the best learning time, completing learning tasks independently within a specified time, and using a variety of learning methods, while the lower value indicates that students are doing relatively well in terms of learning persistence and the use of library materials, and basically achieve the expected results. This analysis helps to identify key areas for

development, so as to strengthen the degree of self-regulation and control, and improve the sustainable development of college students' autonomous learning ability.

Analysis results serving Research Objective 2: To develop a sustainable development strategy for college students' autonomous learning ability in Shaanxi Province.

SWOT analysis and TOWS analysis of five factors affecting the sustainable development of college students' autonomous learning ability in Shaanxi Province

At this stage, the researchers made full use of the advantages of the 4M analysis method and the PEST analysis method to conduct in-depth discussions on internal and external factors, respectively, and used the SWOT analysis method to conduct a comprehensive integrated analysis (see Figure 4.1). As can be seen from the framework in the figure, the two analysis tools of 4M and PEST refine the SWOT matrix elements from the micro and macro levels, respectively. Based on the results of SWOT analysis, the TOWS analysis method is used to match internal strengths and weaknesses with external opportunities and threats, and formulate strategic recommendations.

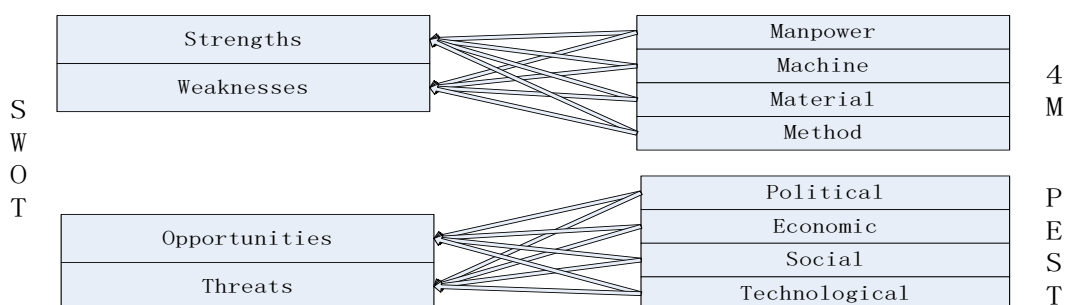


Figure 4.1 SWOT composition analysis

2.1 Learning motivation SWOT analysis and develop a TOWS strategy

2.1.1 4M & PEST Analysis of Learning Motivation Factors

Table 4.8 4M & PEST Analysis of Learning Motivation Factors

Factors Analysis	Learning motivation
4M	<p>Manpower - learners' own abilities and attitudes</p> <ol style="list-style-type: none"> 1. Strong goal execution; 2. Weak demand for external recognition. <p>Machine - Equipment and technology for assisted learning</p> <ol style="list-style-type: none"> 3. Lack of digital goal tracking tools. <p>Material – Learning resources and content</p> <ol style="list-style-type: none"> 4. High demand for quality improvement content; 5. The supply of challenging tasks is insufficient. <p>Method - learning strategy and incentive mechanism</p> <ol style="list-style-type: none"> 6. The short-term performance pressure method is inefficient; 7. The way of forgetting to eat and sleep is not sustainable.
Strengths (S)	<ol style="list-style-type: none"> S1. Strong target execution; S2. High demand for quality improvement content.
Weaknesses (W)	<ol style="list-style-type: none"> W1. Weak demand for external recognition; W2. Lack of digital target tracking tools; W3. Insufficient supply of challenging tasks; W4. The short-term performance pressure method is inefficient; W5. The way of forgetting to eat and sleep is not sustainable.
PEST	<p>Political</p> <ol style="list-style-type: none"> 1. The "double reduction" policy continues to deepen to promote the demand for quality education; 2. The review of teacher qualifications has become stricter, affecting the supply of teachers.

Table 4.8 (Continued)

Factors Analysis	Learning motivation
PEST	<p>Economic</p> <p>3. The proportion of family education expenditure increased (12% in 2021 →18% in 2025);</p> <p>4. Overnight learning behavior reflects the high cost of time.</p> <p>Social</p> <p>5. Quality-oriented motivation enhances the pursuit of achievements;</p> <p>6. Sleeping and forgetting to eat and sleep is associated with students' sleep deprivation.</p> <p>Technological</p> <p>7.AI technology and educational activities are closely integrated;</p> <p>8. Artificial intelligence technology promotes personalized education;</p> <p>9.AI technology optimizes the student management model;</p> <p>10. Over-reliance on AI technology leads to a decline in students' enthusiasm for learning.</p>
Opportunities (O)	<p>O1." The "double reduction" policy continues to deepen to promote the demand for quality education;</p> <p>O2. The proportion of family education expenditure has increased (12% in 2021 → 18% in 2025);</p> <p>O3. Quality-oriented motivation enhancement beyond the pursuit of performance;</p> <p>O4.AI close integration of technology and educational activities;</p> <p>O5. Artificial intelligence technology for personalized education;</p> <p>O6.AI technology to optimize the student management model.</p>

Table 4.8 (Continued)

Factors Analysis	Learning motivation
Threats (T)	<p>T1. The examination of teacher qualifications is becoming stricter, which affects the supply of teachers;</p> <p>T2. Overnight learning behavior reflects the high cost of time;</p> <p>T3. Forgetting to sleep and eating is associated with students' lack of sleep;</p> <p>T4. Over-reliance on AI technology leads to a decline in students' motivation to learn.</p>

Table 4.8 analyzes the internal and external environment of learning motivation, and finally analyzes the internal advantages as follows: S1. Strong target execution, S2. High demand for quality improvement content. Internal disadvantages are as follows: W1. Weak demand for external recognition, W2. Lack of digital goal tracking tools, W3. Insufficient supply of challenging tasks, W4. Inefficient short-term performance pressure methods, and W5. Unsustainable ways of forgetting to sleep and eat. The main opportunities offered in the external environment are: O1. The "double reduction" policy continues to deepen to promote the demand for quality education; O2. The proportion of family education expenditure has increased (12% in 2021 → 18% in 2025); O3. Quality-oriented motivation enhancement beyond the pursuit of grades; O4. AI technology and educational activities are closely integrated; O5. Artificial intelligence technology promotes personalized education; O6. AI technology optimizes student management mode. At the same time, the external threats are mainly as follows: T1. Stricter examination of teachers' qualifications, which affects the supply of teachers, T2. Overnight learning behavior reflects the high cost of time, T3. Forgetting to sleep and forgetting to eat is associated with students' lack of sleep, T4. Excessive reliance on AI technology leads to a decline in students' learning enthusiasm and motivation.

2.1.2 SWOT Analysis of Factors Influencing Learning Motivation

SWOT analysis of the internal and external environmental factors affecting learning motivation is conducted based on the results presented in Table 4.8, as shown in the following Table 4.9

Table 4.9 SWOT Analysis of Learning Motivation

S	W
<p>S1. Strong execution ability for achieving goals;</p> <p>S2. High demand for content related to quality improvement.</p>	<p>W1. Demand for external recognition is weak;</p> <p>W2. There is a lack of tools for tracking digital goals;</p> <p>W3. There is an insufficient supply of challenging tasks;</p> <p>W4. The methods for managing short-term performance pressure are inefficient;</p> <p>W5. The approach of working tirelessly is not sustainable.</p>
O	T
<p>O1. The "Double Reduction" policy continues to deepen, promoting the demand for quality education;</p> <p>O2. The proportion of household education expenditure is rising (from 12% in 2021 to 18% in 2025);</p> <p>O3. Quality-oriented motivation enhances the pursuit of excellence beyond academic achievement;</p> <p>O4. AI technology is closely integrated with educational activities;</p> <p>O5. Artificial intelligence technology facilitates personalized education;</p> <p>O6. AI technology optimizes student management models.</p>	<p>T1. The tightening of teacher qualification reviews affects the supply of teachers;</p> <p>T2. All-night study behaviors reflect an excessively high time cost;</p> <p>T3. The behavior of neglecting sleep is related to the issue of students lacking sufficient sleep;</p> <p>T4. An over-reliance on AI technology leads to a decline in students' learning enthusiasm and a drop in learning motivation.</p>

The SWOT analysis of the factors influencing learning motivation highlights several key points:

1) The advantages include students' ability to execute learning goals, generally speaking, the execution of students' goals is strong, and students have a high demand for quality improvement content. This will help stimulate students' motivation to learn.

2) The disadvantages manifest in the students' weak demand for external recognition, the lack of goal-tracking tools, the scarcity of challenging tasks, the poor motivational effect of achievement-oriented methods, and the unsustainable approach of extending study time to improve outcomes. All of these factors contribute to a decrease in students' learning motivation.

3) The aspects of the external environment that provide opportunities for enhancing learning motivation primarily include: guidance from national policies aimed at improving the quality of education for students, which internally stimulates students' enthusiasm for learning. At the same time, families are increasingly valuing educational issues concerning students, with a continuous increase in their financial investment. The deep integration of AI technology into education promotes the reform of educational content and methods, while also optimizing the management models for students.

4) Meanwhile, the external environment also poses a threat to the enhancement of students' motivation to learn, which is mainly manifested in the following ways: the government's stricter scrutiny of teachers has ensured the quality of educators but has also affected the supply of teaching staff; the demand for prolonged study periods increases the time costs, while also raising concerns about the effectiveness of learning and being detrimental to students' physical and mental health. Furthermore, students' excessive reliance on technologies such as AI has, paradoxically, diminished their enthusiasm for learning.

2.1.3 Analysis of TOWS Strategy in Terms of Learning Motivation

According to the SWOT analysis matrix of learning motivation presented in Table 4.9 the following is an analysis of TOWS strategies regarding the aspect of learning motivation:

1) SO Strategy (Strengths + Opportunities)

(S2 + O1, O3) Combine the quality requirements of S2 with the policy support of O1 and the demand-oriented quality education of O3 to develop a "Core Competency + AI Assessment" curriculum system;

(S1 + O4, O6) Utilize the execution ability of S1 along with AI technology from O4 and O6 to deploy a digital goal tracking system.

2) ST Strategy (Strengths + Threats)

(S1+T3) Utilize the goal management capabilities of S1 to address the T3 sleep issues by introducing neuroscience-based time management tools;

(S2+T1) Leverage the advantage of S2 quality content design to alleviate the T1 pressure on teacher supply and establish an internal training system.

3) WO Strategy (Weaknesses + Opportunities)

(W3+O5) In response to the inadequacy of the W3 task, O5 personalized technologies have been integrated to generate layered learning packages;

(W1+O2) To address the issue of weak external recognition demand for W1, the O2 increase in household expenditure will be utilized to develop a data dashboard for parents.

4) WT Strategy (Weaknesses + Threats)

(W2, W4 + T4) Establish W2's lack of digital goal tracking tools, balance W4's inefficient methods with T4's technology dependency, and set a daily threshold for AI learning duration; (W5 + T2) Develop a learning behavior analysis warning module to address W5's unsustainable learning model and T2's time costs.

2.2 SWOT analysis of learning strategies and formulation of TOWS strategy

2.2.1 4M & PEST analysis of learning strategy factors.

Table 4.10 4M & PEST Analysis of Learning Strategy Factors

Factors Analysis	Learning Strategy
4M	<p>Manpower</p> <p>1.The adjustment of learning states indicates that students generally lack effective self-monitoring techniques;</p> <p>2.The expected value of help-seeking strategies when encountering difficulties is significantly higher than the current condition.</p> <p>Machine</p> <p>3.The information retrieval strategy PNI is only 0.124, indicating that the majority of students possess good information retrieval skills.</p> <p>Material</p> <p>4.The ability to classify information is slightly below the expected value;</p> <p>5. The utilization rate of time is not very high.</p> <p>Method</p> <p>6.The establishment of the learning plan PNI 0.149 indicates that one has essentially learned to formulate a study plan;</p> <p>7.The gap in time utilization strategies reflects the existence of 'pseudo-learning' phenomena.</p>
Strengths (S)	<p>S1.Students possess a certain level of information retrieval skills;</p> <p>S2.Students have the ability to organize and categorize information;</p> <p>S3.Students can develop study plans based on learning tasks.</p>

Table 4.10 (Continued)

Factors Analysis	Learning Strategy
Weaknesses (W)	<p>W1.Students lack the ability to adjust to their optimal learning state;</p> <p>W2.There is inadequate use of strategies that leverage external support to address learning difficulties;</p> <p>W3. Students exhibit insufficient use of strategies for time management.</p>
PEST	<p>Political</p> <p>1.The Education Informatization 2.0 in our country emphasizes the students' ability for autonomous learning;</p> <p>2.The Data Security Law imposes restrictions on information collection by educational apps.</p> <p>Economic</p> <p>3.The proportion of paid knowledge and information available on the internet continues to increase;</p> <p>4.Students, under economic pressure, reduce external assistance in order to save costs when addressing learning difficulties.</p> <p>Social</p> <p>5.Generation Z students exhibit a characteristic of placing emphasis on learning experiences and immediate feedback;</p> <p>6. The improvement in information categorization abilities is limited, corroborating that 60% of students prefer communicative learning over independent organization in a socialized learning model.</p> <p>Technological</p> <p>7. The insufficient improvement in task estimation capabilities reflects the technical bottlenecks in the existing AI learning assistant's progress prediction algorithms.</p>

Table 4.10 (Continued)

Factors Analysis	Learning Strategy
Opportunities (O)	O1. The education informatization 2.0 in our country emphasizes students' ability for autonomous learning; O2. Generation Z students are significantly influenced by information technology.
Threats (T)	T1. The Data Security Law imposes restrictions on information collection by educational apps; T2. The proportion of paid knowledge is increasingly high; T3. The predictive capability of AI technology regarding task completion is limited.

Table 4.10 analyzes the internal and external environments faced by learning strategies, ultimately concluding that the internal strengths are manifested in: S1. Students possess certain information retrieval abilities; S2. Students have the ability to organize and classify information; S3. Students can develop study plans according to learning tasks. The internal weaknesses are reflected in: W1. Students lack the ability to adjust their optimal learning states; W2. The use of strategies to solve learning difficulties with external assistance is inadequate; W3. Students under utilize strategies for time management. The analysis of the external environment faced by learning strategies reveals that the external opportunities include: O1. The emphasis on students' autonomous learning capabilities in China's education informatization 2.0; O2. Generation Z students are significantly influenced by information technology. The external threats are manifested in: T1. The data security law restricts information collection by learning-related apps; T2. The proportion of paid knowledge is increasing; T3. The predictive capability of AI technology for task completion is limited.

2.2.2 SWOT Analysis of Learning Strategy Factors

Based on the results of the internal and external environmental analysis of learning strategies presented in Table 4.10, a comprehensive SWOT analysis is shown in the following Table 4.11:

Table 4.11 SWOT Analysis of Learning Strategies

S	W
<p>S1. Students possess a certain level of information retrieval skills;</p> <p>S2. Students have the ability to organize and categorize information;</p> <p>S3. Students can develop study plans based on assigned learning tasks.</p>	<p>W1. Students lack the ability to adjust to their optimal learning state;</p> <p>W2. There is inadequate use of strategies that leverage external support to address learning difficulties;</p> <p>W3. Students exhibit insufficient use of strategies for time management.</p>
O	T
<p>O1. The education informationization 2.0 in our country emphasizes students' ability for autonomous learning;</p> <p>O2. Generation Z students are significantly influenced by information technology.</p>	<p>T1. The Data Security Law imposes restrictions on information collection by educational apps;</p> <p>T2. The proportion of paid knowledge is increasingly high; T3. The predictive capability of AI technology regarding task completion is limited.</p>

The SWOT analysis of learning strategy factors highlights the following key points: 1) The strengths mainly lie in students' foundational abilities in information retrieval and organization, which are related to the contemporary context of university students. Additionally, students generally possess the capability to plan

and arrange tasks according to their learning objectives. 2) The weaknesses are manifested in students' inadequate self-regulation abilities, insufficient utilization of external resources, and relatively low efficiency in time management. 3) The opportunities presented by the external environment largely stem from the Ministry of Education's requirements for fostering students' autonomous learning, as well as the information era providing students with opportunities to access and process information. 4) The threats posed by the external environment primarily include restrictions from the national information security law on information collection by educational apps, resulting in limited information accessibility for students. Moreover, the prevalence of paid information online increases the cost of information acquisition, and current AI tools also come with certain limitations.

2.2.3 Learning Strategy Factors TOWS Strategy Analysis

Based on Table 4.12, the SWOT analysis matrix for learning strategies, the following is an analysis of the TOWS strategies concerning learning strategies:

1) SO Strategy (Strengths + Opportunities)

(S1, S2 + O2) By combining the foundational information retrieval abilities of students S1 and S2 with the sociotechnical context of Generation Z students represented by O2, we can further develop students' information acquisition skills;

(S1 + O1) Utilizing the capability that student S1 has to some extent in formulating study plans, in conjunction with the relevant requirements outlined in O1 national educational regulations, we will further promote activities aimed at enhancing students' autonomous learning abilities.

2) ST Strategy (Strengths + Threats)

(S1+T1) Students utilize their information retrieval capabilities to gather information from various learning networks, thereby expanding their channels for information retrieval;

(S2+T2) Leverage the advantage of S2 in classifying and organizing information to alleviate the shortcomings in T2 regarding the cost of knowledge resources.

(S3+T3) Students, with the aid of AI technology, formulate learning plans that continuously help them understand their abilities and create scientific and reasonable learning schedules.

3) WO Strategy (Weaknesses + Opportunities)

(W1+O1) In accordance with the requirements for constructing intelligent environments under the framework of Educational Information Technology 2.0, deploy learning state monitoring devices (such as eye trackers and EEG headsets) to provide real-time feedback on attentiveness data and to offer adjustment recommendations.

(W1+O2) Utilizing Generation Z's preference for digital communities, create online self-study rooms and demonstrate status adjustment techniques through 'study streamers' to form peer motivation effects; (W2+O1) Add an intelligent Q&A module on the National Smart Education Platform, using generative AI technology to provide 24-hour tiered problem-solving guidance, thus lowering the threshold for assistance; (W2+O2) Promote a 'online experts + offline teachers' collaborative model, providing cross-regional problem-solving support through a cloud-based teaching resource repository; (W3+O2) Generate dynamic timetables based on Learning Analytics (LA) technology, automatically matching Generation Z's fragmented habits with the course difficulty curve.

4) WT Strategy (Weaknesses + Threats)

(W1+T1) Teachers provide status suggestions by analyzing locally stored learning behavior data (such as response speed and error patterns). Under the framework of the Data Security Law, localized information processing technology is employed (without cloud uploads), only feedback on students' attention scores is provided rather than the original data, thereby mitigating the risks of sensitive information collection.

(W2+T2) Teachers actively assist students in overcoming learning difficulties while helping them identify high-cost-performance resources and recommending free learning materials.

(W3+T3) The teacher assists students in analyzing learning tasks and assessing completion time.

2.3 SWOT Analysis of Self-Efficacy and Development of TOWS Strategy

2.3.1 4M & PEST Analysis of Self-Efficacy Factors

Table 4.12 4M & PEST Analysis of Self-Efficacy Factors

Factors Analysis	Self-Efficacy
4M	<p>Manpower</p> <ol style="list-style-type: none"> 1. There is a significant gap in the need for self-encouragement in difficult conditions, reflecting a systemic deficiency in students' emotional regulation strategies; 2. The potential for improvement in peer motivation is limited. <p>Machine</p> <ol style="list-style-type: none"> 3. The performance dimension in responding to various tasks is the weakest, revealing the lack of conditional adaptability training features in the existing learning system; 4. The improvement needs identified in knowledge comprehension indicate a requirement to enhance real-time learning effect diagnostics technology. <p>Material</p> <ol style="list-style-type: none"> 5. The gap in the persistence dimension of goals is minimal, indicating that existing resources have partially met basic needs; 6. The contrast between the high baseline value of peer motivation items and the low demand for improvement suggests that the structured presentation of successful case studies can be optimized.

Table 4.12 (Continued)

Factors Analysis	Self-Efficacy
	<p>Method</p> <p>7. The significant gap in task adaptability urgently necessitates the introduction of a decomposition training method that incorporates incremental difficulties.</p>
<p>Strengths (S)</p>	<p>S1. The foundational sense of efficacy is stable, with an overall average of 3.44, particularly outstanding in the dimensions of 'goal persistence' and 'peer motivation,' indicating that students possess the basic learning beliefs to support their efforts; S2. The social comparison mechanism is effective, and there is limited potential for improvement in the expected value of peer observation items, reflecting a relatively mature existing alternative experience utilization model.</p>
<p>Weaknesses (W)</p>	<p>W1. The ability to cope with complex tasks is hampered by deficiencies in advanced self-regulation skills;</p> <p>W2. The lack of emotional regulation tools and the high demand ranking for self-encouragement indicate a systematic insufficiency in emotional management strategies.</p>
<p>PEST</p>	<p>Political</p> <p>1. Support for educational informationization policies: The current action of educational informationization 2.0 promotes the widespread adoption of intelligent learning tools, providing a policy foundation for the development of performance training systems based on AR/VR;</p> <p>2. Strengthening of data compliance regulation: The "Data Security Law" imposes strict requirements on the collection of data related to learning behavior monitoring, which may limit the application of precise assessment technologies such as eye tracking.</p>

Table 4.12 (Continued)

Factors Analysis	Self-Efficacy
PEST	<p>Economic</p> <p>3.The growth of investments in educational technology is projected to increase by 23% in 2025 compared to the previous year, creating capital conditions for the development of effective intervention tools such as peer incentive social platforms;</p> <p>4. The risk of a digital divide, as the high cost of intelligent training systems may hinder students in economically disadvantaged regions from obtaining equivalent enhancement resources.</p> <p>Social</p> <p>5.Characteristics of Generation Z learning indicate that students have a high acceptance of gamified learning, which can be utilized to strengthen advantages such as 'goal persistence';</p> <p>6. The mechanism of peer influence is deepening, with research showing that peer observation accounts for 38% of the explanation for self-efficacy; however, the existing 'peer motivation' factors indicate that this resource has not been fully developed.</p> <p>Technological</p> <p>7. Breakthroughs in adaptive learning technology and new generation AI algorithms have improved the accuracy of task decomposition to 89%, enabling targeted enhancements in addressing various task dimensions.</p>

Table 4.12 (Continued)

Factors Analysis	Self-Efficacy
Opportunities (O)	<p>O1. The dividends of informatization educational policies and the support of Education Informatization 2.0 provide policy backing for the development of intelligent efficacy training tools (such as AR scenario simulators);</p> <p>O2. The technological adaptability of Generation Z, where students exhibit a high acceptance of digital interventions, can be enhanced through gamified design (such as achievement systems) to strengthen direct experiential accumulation.</p>
Threats (T)	<p>T1. The compliance risks of data applications involve sensitive data such as eye-tracking and EEG, which are heavily restricted under the Data Security Law;</p> <p>T2. The limitations of AI assistance are evident, as the accuracy of the algorithm for decomposing complex tasks is only 82%, which may impact the effectiveness of incremental training.</p>

Table 4.12 analyzes the internal and external environments related to self-efficacy, ultimately concluding that internal strengths are reflected in: S1. Stability of fundamental efficacy; S2. Effectiveness of social comparison mechanisms. The internal weaknesses identified are: W1. Shortcomings in coping with complex tasks; W2. Lack of emotional regulation tools. Through the analysis of the external environment, it is concluded that the main external opportunities are: O1. Benefits of information technology education policies; O2. Technological adaptability of Generation Z. The main external threats identified are: T1. Compliance risks in data applications; T2. Limitations of AI assistance.

2.3.2 SWOT Analysis of Self-Efficacy Factors

Based on the results of the internal and external environmental analysis of self-efficacy presented in Table 4.12, the comprehensive SWOT analysis is shown in the following Table 4.13:

Table 4.13 SWOT Analysis of Self-Efficacy

S	W
S1. The basic sense of efficacy is stable; S2. The social comparison mechanism is effective.	W1. Complicated tasks should address shortcomings; W2. There is a lack of emotional regulation tools.
O	T
O1. Benefits of information technology education policy; O2. Technological adaptability of Generation Z.	T1. Compliance risks in data applications; T2. Limitations of AI assistance.

The SWOT analysis of self-efficacy factors highlights the following key points:

1) The strengths mainly include students having a foundational sense of self-efficacy, indicating that they possess basic learning beliefs; the potential for improvement in peer observation expectations is relatively small, reflecting a mature utilization pattern of existing alternative experiences.

2) The weaknesses are manifested in students' inadequate higher-level self-regulation abilities and insufficient self-emotional management skills.

3) The opportunities presented by the external environment primarily stem from the benefits of national information education policies, which provide a policy basis for developing efficacy training tools; Generation Z students show a high sensitivity and acceptance towards informatization and digitalization.

4) The threats generated by the external environment include the national cybersecurity law, which restricts the implementation of efficacy assessment tools, and the inherent limitations of AI-assisted tools.

2.3.3 Analysis of Self-Efficacy Factors Using TOWS Strategy

Based on the self-efficacy SWOT analysis matrix in Table 4.14, the following is an analysis of TOWS strategies concerning self-efficacy.

1) SO Strategy (Strengths + Opportunities)

(S1 + O1) The basic self-efficacy that students possess, when utilized through the policy dividends of educational informatization, can continue to develop social platforms that enable students to access more information, enhance their knowledge reserves, and further improve their self-efficacy.

(S2 + O2) In line with the preferences of Generation Z students, develop peer-incentive social platforms to enhance self-efficacy.

2) ST Strategy (Strengths + Threats)

(S1 + T2) A correct perspective on the functions of AI tools primarily relies on students' existing sense of self-efficacy, using AI as an auxiliary tool to accomplish their learning tasks and continuously enhancing their self-efficacy. (S2 + T1) Enhancing self-efficacy through peer observation while striving to mitigate the constraints of data application restrictions in data security laws on the assessment of self-efficacy.

3) WO Strategy (Weaknesses + Opportunities)

(W1+O1) Leverage the benefits of educational information technology policies to encourage enterprises to develop tools for handling complex learning tasks, assisting students in managing intricate learning challenges, and enhancing their confidence. (W2+O2) Develop emotional regulation tools based on the characteristics of Generation Z students to help them learn emotional regulation and become emotionally stable individuals.

4) WT Strategy (Weaknesses + Threats)

Teachers and student managers should actively assist students in coping with complex tasks, accurately assess students' self-efficacy, analyze the limitations

of tools such as AI, help students address related learning issues, achieve learning objectives, and enhance students' confidence.

2.4 SWOT Analysis of the Learning Environment and Formulation of TOWS Strategies

2.4.1 4M & PEST Analysis of Learning Environment Factors

Table 4.14 Analysis of Learning Environment Factors using 4M & PEST

Factors Analysis	Learning Environment
4M	<p>Manpower</p> <p>1. Insufficient Motivation for Peer Learning: The item "Attention to Role Model Behavior" shows the least need for enhancement, indicating that students' motivation to actively observe their peers is weak, and the alternative learning mechanism has not been fully activated.</p> <p>2. Marginalization of Family Influence: The item "Parental Expectations Influence" has the least room for improvement, reflecting that the impact of family education on the learning motivation of upper-grade students has significantly diminished.</p> <p>Machine</p> <p>3. The gap in focused study environments is significant. The demand for 'library study' has the largest gap, exposing the deficiency of intelligent attention maintenance systems in the current study spaces (such as EEG monitoring seats);</p> <p>4. The foundation for digital literacy is solid.</p> <p>"The current value of 'utilization of online resources' is the highest, and the demand for improvement is low, indicating that students possess basic information retrieval skills."</p>

Table 4.14 (Continued)

Factors Analysis	Learning Environment
4M	<p>Material</p> <p>5.Imbalance in the Supply of Cultural Resources The expectation for the 'campus cultural environment' is at its highest, indicating that the educational functions of existing cultural carriers (such as the school's history museum and academic lectures) have not been fully utilized;</p> <p>6.Insufficient Sharing of Teaching Materials The current value for 'sharing learning materials' is relatively high but has limited improvement, reflecting the presence of barriers to the use of sharing platforms or inconsistencies in resource quality.</p>
Strengths (S)	<p>S1. The existing foundation is relatively good, indicating that students are overall satisfied with the current learning environment;</p> <p>S2. The ability to utilize online resources is outstanding: 'Proficient use of online resources' currently has the highest score, demonstrating an advantage in digital literacy.</p>
Weaknesses (W)	<p>W1. Insufficient study focus environment: The current score for 'Library study concentration' is the lowest, indicating that the physical learning environment needs improvement;</p> <p>W2. Low attention to model learning behaviors: The demand for improvement in this indicator is ranked low, reflecting a lack of initiative.</p>
PEST	<p>Political</p> <p>1.The national "Three Comprehensive Educations" policy promotes the construction of campus culture;</p> <p>2.The Action Plan for Educational Informatization 2.0.</p>

Table 4.14 (Continued)

Factors Analysis	Learning Environment
PEST	<p>Economic</p> <p>3. Insufficient investment in library facilities;</p> <p>4. Diminishing marginal returns on family education investment.</p> <p>Social</p> <p>5. The trend of collaborative learning culture is significant;</p> <p>6. There are noticeable differences in intergenerational perspectives.</p> <p>Technological</p> <p>7. Intelligent teaching tools;</p> <p>8. The digital divide still exists.</p>
Opportunities (O)	<p>O1. The demand for environmental improvement is clear: there is a strong willingness to improve the library environment and campus culture;</p> <p>O2. There is significant potential for optimization in teaching methods: expectations for teachers' methods have risen considerably, indicating the potential for educational reform.</p>
Threats (T)	<p>T1. The persistence of external influences is weak: the improvement value of parental expectations is the lowest, reflecting that the role of familial education may be diminishing at the margin;</p> <p>T2. Peer interaction enhancement is limited: the demand for improvement in the sharing of learning materials is relatively weak, which may affect the effectiveness of collaborative learning.</p>

Table 4.14 analyzes the internal and external factors related to the learning environment, ultimately concluding that the internal strengths are: S1. The existing learning environment has a relatively good foundation; S2. The ability to utilize online resources is prominent. The internal weaknesses are: W1. Insufficient focus on the learning environment, indicating a need for improvement in the physical learning environment; W2. Low attention to exemplary learning behaviors. Through the analysis of the external environment, it is ultimately concluded that the main external opportunities are: O1. Clear demand for environmental improvements; O2. Significant potential for optimizing teaching methods. The main external threats are: T1. Weak continuity of external influences; T2. Limited enhancement of peer interaction.

2.4.2 SWOT Analysis of Learning Environment Factors

Based on the results of the internal and external environmental analysis of learning environment factors presented in Table 4.14, a comprehensive SWOT analysis is conducted as shown in Table 4.15.

Table 4.15 SWOT Analysis of the Learning Environment

S	W
S1. The existing learning environment is relatively good; S2. The ability to utilize online resources is outstanding.	W1. The lack of a focused learning environment indicates that the physical learning conditions require improvement; W2. There is a low level of attention towards exemplary learning behaviors.
O	T
O1. The demand for environmental improvement is clear; O2. There is significant room for optimizing teaching methods.	T1. The external influences are weak and persistent; T2. The enhancement of peer interactions is limited.

The SWOT analysis of environmental factors in education highlights the following key points:

1) The advantage mainly lies in the overall satisfaction of students with the existing learning environment, and students exhibit strong capabilities in utilizing online resources.

2) The disadvantage is that the physical learning environment that supports student concentration needs improvement; for instance, the satisfaction with the physical learning environments of dormitories and libraries is relatively low. Additionally, there is a low focus on learning from role models among students, which is related to generational differences.

3) The opportunities arising from the external environment primarily stem from students' clear demand for improvements to their environment, which points the direction for enhancing the learning environment. Moreover, there is considerable room for improvement in teaching methods.

4) The threats posed by the external environment mainly involve a gradual decrease in the sustained influence of external factors on students, a diminishing marginal effect of parental influence on students, and limited interactions among peers that contribute to the improvement of the learning environment.

2.4.3 Analysis of TOWS Strategies for Learning Environment Factors Based on Table 4.16, the SWOT analysis matrix for the learning environment, the following is an analysis of TOWS strategies pertaining to the learning environment.

1) SO Strategy (Strengths + Opportunities)

(S2+O1) Development of a digital learning platform: Leverage existing online resources to create an integrated intelligent system for library reservations and sharing of teaching resources, addressing the dual demand for a centralized learning environment and improvements in teaching methods.

(S1+O2) Culturally immersive teaching reform: In conjunction with high expectations of campus culture, design a "Mentor-Model" dual-track system, organically combining teacher method optimization with peer learning.

2) ST Strategy (Strengths + Threats)

(S1+T1) Home-school data interoperability mechanism: Establishing a learning behavior analysis platform to convert parental expectations into visualized learning suggestions, thereby enhancing the sustainability of external motivation.

(S2+T2) Intelligent Learning Space Renovation: Utilizing digital technology to upgrade the physical environment of libraries, addressing the issue of distraction through a seating sensor system, and alleviating the limitations of insufficient peer interaction.

3) WO Strategy (Weaknesses + Opportunities)

(W1+O1) 'Learning Ecosystem' Plan: In response to the shortcomings of library environments, we will establish a three-tiered space comprising a 'Core Learning Area - Collaborative Discussion Area - Quiet Meditation Space' to simultaneously enhance the sense of cultural identity on campus.

(W2+O2) Teaching Method Certification System: Through micro-teaching training, it assists teachers in mastering blended teaching skills, thereby narrowing the gap between the current status and expectations of teaching methods.

4) WT Strategy (Weaknesses + Threats)

(W1+T1) Optimize the design of classroom/library spaces to address the core issue of distraction. Establish a communication mechanism between parents and schools to translate parental expectations into specific educational support.

(W2+T2) Adaptive Learning System: Develop an AI assistant capable of recognizing learning preferences, which not only compensates for the lack of attention to role models but also offers personalized resource recommendations, thereby reducing reliance on peer sharing.

2.5 SWOT Analysis of Self-Regulation and Control Factors and Formulation of TOWS Strategy

2.5.1 4M & PEST Analysis of Self-Regulation and Control Factors

Table 4.16 4M & PEST Analysis of Self-Regulation and Control Factors

Factors Analysis	Self-Regulation and Control
4M	<p>Manpower</p> <p>1. Time Management Skills: The highest current score is in the dimension of time management, but the greatest expected improvement reflects learners' strong demand for efficient time planning;</p> <p>2. Willpower and Conflict Resolution Skills: The current score for 'sticking to uninteresting content' is the lowest, which bears similarity to the observed phenomenon of declining attention in studies of cognitive decline among middle-aged and elderly individuals.</p> <p>Machine</p> <p>3. The study progress tracking system is inadequate: the expected improvement value for the completion of current tasks is high.</p> <p>Material</p> <p>4. Utilization of Library Resources: The current score is the lowest among the items, but the demand for improvement is relatively weak, reflecting that the accessibility of resources is superior to the users' ability to utilize them.</p> <p>Method</p> <p>5. The application of other learning methods has achieved the best current status, validating the flexibility of the strategy, but there is still room for optimization.</p>

Table 4.16 (Continued)

Factors Analysis	Self-Regulation and Control
Strengths (S)	<p>S1. The flexibility of strategy is notable. The current status of 'utilizing other learning methods' received the highest score, indicating that respondents possess a strong multimodal learning adaptability, which aligns with the characteristic of strategy diversity exhibited by learners in human-intelligence interaction environments.</p> <p>S2. A solid foundation in time management. The high score in the time management dimension provides a strong starting point for subsequent interventions and meets the baseline requirements for task completion in the SRL implementation phase.</p>
Weaknesses (W)	<p>W1. Insufficient Willpower The lowest score in "Persisting in Uninteresting Content" reflects a weaker ability to inhibit executive functions.</p> <p>W2. Inefficient Resource Utilization The current utilization status of the library scores low both in actual and expected improvement, indicating inadequate resource conversion capabilities, necessitating the optimization of the human-intelligence collaborative evaluation mechanism.</p>
PEST	<p>Political</p> <ol style="list-style-type: none"> 1. The Ministry of Education has proposed requirements for the cultivation of 'Healthy Lifestyle' literacy; 2. The National Ministry of Education has incorporated self-control training into the psychological health education system. <p>Economic</p> <ol style="list-style-type: none"> 3. Increase investment in the research and development of AI-assisted systems;

Table 4.16 (Continued)

Factors Analysis	Self-Regulation and Control
PEST	<p>4. Increase investment in the digital transformation of existing learning resources.</p> <p>Social</p> <p>5. Intergenerational cognitive differences: The top two ranked time management needs are related to the fragmented learning characteristics of Generation Z, necessitating the development of learning planning tools compatible with mobile devices;</p> <p>6. Peer influence mechanisms.</p> <p>Technological</p> <p>7. AI-driven personalized planning systems;</p> <p>8. The integration of immersive technologies such as VR/AR into the field of education.</p>
Opportunities (O)	<p>O1. Potential of Technological Empowerment Demand for time management can be addressed through breakthroughs in AI-driven personalized planning systems, referencing the demand analysis module in the three-stage model of human intelligence interaction;</p> <p>O2. Policy Support Orientation Sleep management policies emphasize the correlation between self-control and healthy living, providing institutional support for willpower training.</p>
Threats (T)	<p>T1. Intergenerational Cognitive Differences The characteristics of fragmented learning may exacerbate the practical gap between time management and planning execution;</p> <p>T2. Risks of Technology Dependence Excessive reliance on intelligent assistance may weaken the existing advantages of "method flexibility," necessitating a balance in the retention of human intelligence's autonomy and collaboration.</p>

Table 4.16 analyzes the internal and external environments related to self-regulation and control factors, ultimately concluding that internal strengths are reflected in: S1. notable strategic flexibility; S2. solid time management foundation. Internal weaknesses include: W1. insufficient willpower; W2. low resource utilization efficiency. Through the analysis of the external environment, it is concluded that external opportunities primarily include: O1. potential for technology empowerment; O2. policy support orientation. External threats primarily involve: T1. intergenerational cognitive differences; T2. risks of technology dependence.

2.5.2 SWOT Analysis of Self-Regulation and Control Factors

Based on the results of the internal and external environmental analysis of self-regulation and control factors in Table 4.16, a comprehensive SWOT analysis is presented in the following Table 4.17:

Table 4.17 SWOT Analysis of Self-Regulation and Control Factors

S	W
S1. The flexibility of the strategy is outstanding; S2. The foundation of time management is solid.	W1. Insufficient persistence of willpower; W2. Low efficiency in resource utilization.
O	T
O1. Potential of technology empowerment; O2. Policy support orientation.	T1. Intergenerational cognitive differences; T2. Risks of technological dependence.

The SWOT analysis of self-regulation and control factors highlights the following key points: 1) The main advantage is that students possess a certain degree of strategic application ability and have a foundational understanding of time management. 2) The primary disadvantage is the persistent lack of willpower in students' learning, as well as the need to further improve the utilization of learning

resources. 3) The opportunities presented by the external environment mainly involve the widespread application of various technologies in the field of education, with immense potential for technological empowerment. Additionally, the government actively promotes the development of educational practices through policies that encourage research and development firms to use technology to enhance teaching effectiveness. 4) The threats arising from the external environment primarily include the numerous external distractions faced by Generation Z students, leading to a fragmentation of time that creates a gap in the execution of learning plans, consequently affecting the implementation of those plans. Furthermore, excessive intervention of technology in the educational sector may lead to a dependency on intelligent technologies, which could diminish students' flexibility and critical thinking abilities.

2.5.3 Self-Regulation and Control Factors TOWS Strategy Analysis

According to Table 4.17, the SWOT analysis matrix for self-regulation and control, the following is an analysis of TOWS strategies regarding self-regulation and control aspects:

1) SO Strategy (Strengths + Opportunities)

(S1+O1) Construction of a Multimodal Learning System: Utilizing AI empowerment to integrate students' learning strategy application abilities to build a multimodal learning system for students to choose from.

(S2+O2) Construction of Healthy Lifestyle + Learning Model: In conjunction with the time management skills possessed by students and the sleep management policies advocated by the government, we aim to create a time management model that integrates a healthy lifestyle with learning. This model will reasonably plan the allocation of time between study and daily life.

2) ST Strategy (Strengths + Threats)

(S1+T1) Forms Various Learning Methods: Based on the personal characteristics of contemporary university students, various learning methods and models are developed using modern tools to better adapt to the traits of today's students and achieve learning goals.

(S2+T2) Guide Students in Time Planning: Advise students not to overly rely on AI and other smart technologies, but to utilize their own learning methods and habits, combined with learning objectives, to manage their time and develop a time plan that aligns with their characteristics and actual circumstances to achieve efficient use of time.

3) WO Strategy (Weaknesses + Opportunities)

(W1+O1) Technology Facilitates Educational Reform: By leveraging the immense potential of technology to empower education, we can develop diverse learning resources, assist teachers in enriching teaching content, enhance the engagement of learning materials, and conduct mindfulness training to improve students' academic willpower.

(W2+O1,O2) Technology + policy guidance enhances resource utilization efficiency: Under the framework of the national sleep health policy, teachers guide students to fully utilize resources with the assistance of intelligent technology, thereby improving resource utilization efficiency.

4) WT Strategy (Weaknesses + Threats)

Mindfulness training integrated into continuous learning: An analysis of the psychological characteristics of contemporary college students, aimed at improving students' concentration and emotional well-being through mindfulness training, enhancing their willpower, and mitigating the threats posed by intergenerational differences.

(W2+T2) Teachers and student administrators guide students in autonomous learning: Teachers and student administrators should actively intervene in the process of students' autonomous learning, guiding them to make full use of learning resources and providing students with additional learning materials. Furthermore, it is essential to guide students to view technologies such as AI merely as supplementary tools, rather than as primary instruments. They should actively engage their personal initiative, think critically, and reduce their reliance on intelligent technologies.

By analyzing the five factors that influence the sustainable development of university students' autonomous learning ability in Shaanxi Province, a summary and analysis of the strategies corresponding to TOWS has been conducted, as shown in Table 4.18.

Table 4.18 Corresponding TOWS Strategy

Category	Aspect	Strategy
SO	Develop courses; Establish an information acquisition platform; Construct learning systems and models.	<ol style="list-style-type: none"> 1. Develop the "Core Literacy + AI Assessment" curriculum system; 2. Utilize AI technology to deploy a digital goal tracking system. 3. Enhance students' information acquisition abilities; 4. Formulate learning plans to promote students' self-directed learning capabilities; 5. Continue developing social platforms to enrich students' knowledge reserves; 6. Establish a peer motivation social platform to enhance self-efficacy; 7. Build a digital learning platform; 8. Implement cultural immersion teaching reforms; 9. Construct a multimodal learning system; 10. Establish a healthy lifestyle + learning model.

Table 4.18 (Continued)

Category	Aspect	Strategy
ST	Time management; Information management; Creating a study plan; Transforming the learning space.	<ol style="list-style-type: none"> 1.Introduce neuroscience-based time management tools; 2.Establish an internal training system. 3.Expand information retrieval channels; 4.Enhance the advantages of information classification and organization; 5.Develop a scientifically sound learning plan; 6.Properly understand the functionalities of AI tools; 7.Enhance self-efficacy through peer observation; 8.Mechanism for data exchange between home and school; 9.Transformation of intelligent learning spaces; 10.Formulate various learning methods; 11.Guide students in effective time planning.
WO	Integration of technology and education; Teaching methods; Emotional management.	<ol style="list-style-type: none"> 1. Integrate personalized technology to generate tiered learning packages; 2. Develop a parent-student autonomous learning data dashboard; 3. Deploy learning state perception devices (such as eye trackers and EEG headsets) to

Table 4.18 (Continued)

Category	Aspect	Strategy
WO	Integration of technology and education; Teaching methods; Emotional management.	<p>provide real-time feedback on concentration levels and push adjustment suggestions;</p> <p>4. Create online study rooms, demonstrating state adjustment techniques through 'learning anchors' to foster peer motivational effects;</p> <p>5. Promote a collaborative model of 'online experts + offline teachers';</p> <p>6. Generate dynamic schedules based on learning analytics technology (LA);</p> <p>7. Encourage enterprises to develop tools for handling complex learning tasks;</p> <p>8. Develop tools for emotional regulation;</p> <p>9. 'Learning Ecosystem' initiative;</p> <p>10. Teaching method certification system;</p> <p>11. Leverage technology to facilitate teaching reform;</p> <p>12. Enhance resource utilization efficiency through the integration of technology and policy guidance.</p>

Table 4.18 (Continued)

Category	Aspect	Strategy
WT	Teachers and student managers play a guiding role; Optimizing learning environments; The intervention of psychological tools; Controlling the duration of AI learning.	<ol style="list-style-type: none"> 1. Set a daily threshold for AI learning duration; 2. Develop a learning behavior analysis warning module; 3. Educators employ localized information processing technology (non-cloud uploading), only providing feedback on students' attention scores; 4. Educators actively assist students in overcoming learning difficulties; 5. Educators help students analyze learning tasks and assess completion time; 6. Educators and student managers should proactively assist students in dealing with complex tasks; 7. Optimize classroom/library space design and establish a parent-school communication mechanism; 8. Establish an adaptive learning system; 9. Integrate mindfulness training into continuous learning; 10. Educators and student managers guide students in autonomous learning.

3. Analysis of Structured Interview Information

The respondents of the structured interviews are consistent with the participants of the focus group interviews, and the analysis results of their personal information are detailed in Table 4.19.

For more information on the personal details of the interview respondents, please refer to Table 4.19.

Table 4.19 Basic Information of Interviewees from Structured Interviews

(n=20)

NO.	Position	Professional title	Years of work experience	School Name
1	Teacher	Associate Professor	12	Shaanxi University of Science & Technology
2	Teacher	Associate Professor	11	Yan'an University
3	Teacher	Associate Professor	13	Shaanxi University of Technology
4	Teacher	Associate Professor	10	Xijing University
5	Teacher	Associate Professor	12	Shaanxi Fashion Engineering University
6	Teacher	Associate Professor	14	Shaanxi Polytechnic Institute
7	Teacher	Associate Professor	15	Shaanxi Railway Institute
8	Teacher	Professor	15	Shaanxi Technical College of Finance & Economics
9	Teacher	Professor	16	Shaanxi Post and Telecommunication College

Table 4.19 (Continued)

(n=20)

NO.	Position	Professional title	Years of work experience	School Name
10	Teacher	Professor	18	Shaanxi Energy Institute
11	Student Administrator	Associate Professor	12	Shaanxi University of Science & Technology
12	Student Administrator	Associate Professor	11	Yan'an University
13	Student Administrator	Associate Professor	13	Shaanxi University of Technology
14	Student Administrator	Associate Professor	10	Xijing University
15	Student Administrator	Associate Professor	10	Shaanxi Fashion Engineering University
16	Student Administrator	Associate Professor	10	Shaanxi Polytechnic Institute
17	Student Administrator	Associate Professor	12	Shaanxi Railway Institute
18	Student Administrator	Associate Professor	14	Shaanxi Technical College of Finance & Economics
19	Student Administrator	Associate Professor	15	Shaanxi Post and Telecommunication College
20	Student Administrator	Professor	18	Shaanxi Energy Institute

The subjects of this interview encompass 20 higher education institutions from three regions in Shaanxi Province: Shanbei, Guanzhong, and Shannan, including 10 university administrators and 10 teachers. The purpose of the interviews is to explore the supporting factors for the sustainable development of autonomous learning capabilities among university students in Shaanxi Province. The selection criteria for these 20 experts are as follows: 1) possessing a master's degree or higher, 2) having over 10 years of work experience in universities, 3) being mid-level or higher administrative personnel with a background in educational disciplines, and 4) holding the rank of associate professor or above.

The analysis of the specific interview results is as follows: 4.1 An analysis of the personal information of respondents in the structured interviews, presenting data across dimensions such as school, job position, years of work in higher education, and title or rank.

According to the statistical results shown in Table 4.20, among the teachers who participated in the structured interviews, there are 4 professors, accounting for 20%; and 16 associate professors, accounting for 80%. There are 3 teachers with over 15 years of experience in higher education teaching or student management, accounting for 15%; those with 10-15 years of experience account for 85%.

4.2 Analysis of Structured Interview Results, presented in terms of frequency and percentage.

The details of the interviews are as follows:

The research team conducted 20 online face-to-face interviews. Each interview was conducted in a one-on-one format to ensure that the conversation content was not overheard by others, thereby protecting the respondents from interference by extraneous factors. A detailed analysis of the interview content can be found in Table 4.20.

Table 4.20 Structured interview results (N=20)

Suggestion		Interviewer1	Interviewer2	Interviewer3	Interviewer4	Interviewer5	Interviewer6	Interviewer7	Interviewer8	Interviewer9	Interviewer10	Interviewer11	Interviewer12	Interviewer13	Interviewer14	Interviewer15	Interviewer16	Interviewer17	Interviewer18	Interviewer19	Interviewer20	Frequency	Percentage
Strategies for Enhancing Learning Motivation																							
1	1. Teachers improve teaching methods to enhance students' motivation for learning.	√	√	√	√		√		√	√	√	√				√		√	√		√	13	65%
	2. The teacher designs some challenging tasks for the students.	√	√	√	√	√	√		√	√		√		√		√	√	√	√		√	15	75%
	3. Pay attention to students' intrinsic needs and interests, and encourage students to try new things.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√		√	18	90%
	4. Affirm the contributions and efforts of the students.	√	√	√	√	√	√		√	√			√	√	√		√				√	13	65%
	5. Enrich the teaching content.	√		√		√		√	√	√	√		√	√	√	√	√	√	√	√	√	15	75%

9Table 4.20 (Continued)

Suggestion	Interviewer1	Interviewer2	Interviewer3	Interviewer4	Interviewer5	Interviewer6	Interviewer7	Interviewer8	Interviewer9	Interviewer10	Interviewer11	Interviewer12	Interviewer13	Interviewer14	Interviewer15	Interviewer16	Interviewer17	Interviewer18	Interviewer19	Interviewer20	Frequency	Percentage
6. Allow students to set their own goals, emphasizing self-motivation.	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	17	85%
7. Strengthen communication with teachers, classmates, and parents.		√	√	√	√	√	√	√	√	√		√				√			√		12	60%
8. Provide students with sufficient learning resources.	√			√		√	√			√		√	√	√		√				√	10	50%
9. Studying the exemplary deeds of outstanding students to stimulate learning motivation.			√	√	√	√	√		√	√	√	√	√	√	√	√		√	√	√	16	80%
10. Parents should encourage their children more and establish appropriate expectations for them.			√		√	√	√	√	√	√	√	√		√			√			√	12	60%

9Table 4.20 (Continued)

Suggestion		Interviewer1	Interviewer2	Interviewer3	Interviewer4	Interviewer5	Interviewer6	Interviewer7	Interviewer8	Interviewer9	Interviewer10	Interviewer11	Interviewer12	Interviewer13	Interviewer14	Interviewer15	Interviewer16	Interviewer17	Interviewer18	Interviewer19	Interviewer20	Frequency	Percentage
Strategies for Enhancing Learning Strategies																							
2	11. Guide students to make a scientific and reasonable study plan.	√	√	√		√	√	√		√	√	√		√	√	√	√	√	√	√		15	75%
	12. Guide students to make effective use of after-school time.	√	√	√		√	√	√	√		√	√		√	√	√	√	√	√	√	√	17	85%
	13. Stimulate students' enthusiasm and interest in learning.	√	√	√	√		√	√	√	√				√	√	√	√		√	√	√	16	80%
	14. Balance study time with rest time.		√	√	√		√	√			√		√	√		√		√		√		11	55%
	15. Improve students' skills in obtaining learning information, and organize and classify information	√	√	√	√		√	√		√	√	√	√	√		√		√	√		√	15	75%

9Table 4.20 (Continued)

Suggestion	Interviewer1	Interviewer2	Interviewer3	Interviewer4	Interviewer5	Interviewer6	Interviewer7	Interviewer8	Interviewer9	Interviewer10	Interviewer11	Interviewer12	Interviewer13	Interviewer14	Interviewer15	Interviewer16	Interviewer17	Interviewer18	Interviewer19	Interviewer20	Frequency	Percentage
16. Improve your learning methods and find a learning method that works for you	√	√	√		√	√		√	√	√			√		√	√	√	√	√	√	13	65%
17. Able to eliminate learning obstacles with the help of external forces		√		√	√			√	√	√	√	√		√			√		√	√	12	60%
18. Learn to adjust your learning state in an appropriate way	√		√		√			√	√	√		√		√	√	√			√		11	55%
19. Be able to make effective use of time and improve the efficiency of time use	√				√	√		√				√				√			√	√	8	40%
Strategies for Enhancing Self-Efficacy																						
3 20. Let students practice make perfect and gain successful experience	√		√	√	√	√	√	√	√	√		√		√	√				√		13	65%
21. Learning and imitating role models are rewarded	√	√	√			√				√	√	√	√	√		√	√	√	√		13	65%

9Table 4.20 (Continued)

Suggestion	Interviewer1	Interviewer2	Interviewer3	Interviewer4	Interviewer5	Interviewer6	Interviewer7	Interviewer8	Interviewer9	Interviewer10	Interviewer11	Interviewer12	Interviewer13	Interviewer14	Interviewer15	Interviewer16	Interviewer17	Interviewer18	Interviewer19	Interviewer20	Frequency	Percentage
22. Affirmatory words and actions from others	√	√	√		√	√	√	√	√		√	√	√	√		√	√	√		√	16	80%
23. Positive Self-Talk		√	√	√	√	√	√	√	√		√	√	√	√	√			√		√	16	80%
24. Establish self-confidence	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20	100%
25. Often self-encourage	√	√	√	√	√	√				√					√				√	√	10	50%
26. Guide students to establish reasonable learning objectives and assist them in achieving these goals	√	√		√	√		√		√	√			√		√	√	√			√	12	60%
Strategies for Enhancing Learning Environment																						
4	27. Create a comfortable learning environment.	√	√	√		√	√	√		√	√	√	√	√	√		√	√		√	16	80%

9Table 4.20 (Continued)

Suggestion	Interviewer1	Interviewer2	Interviewer3	Interviewer4	Interviewer5	Interviewer6	Interviewer7	Interviewer8	Interviewer9	Interviewer10	Interviewer11	Interviewer12	Interviewer13	Interviewer14	Interviewer15	Interviewer16	Interviewer17	Interviewer18	Interviewer19	Interviewer20	Frequency	Percentage
28. Prepare the necessary study tools and materials.	√	√	√	√	√	√		√	√		√	√	√	√				√	√	√	15	75%
29. Eliminate Learning Distractions	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√		√	√	18	90%
30. Teach students according to their aptitude, and teachers improve teaching methods		√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	18	90%
31. Improve library facilities and equipment	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√		√	√		17	85%
32. Improve dormitory facilities and environment	√		√	√		√	√	√		√						√				√	9	45%
33. Beautify the campus environment and create a campus learning atmosphere	√	√	√	√		√	√	√	√		√	√	√	√	√	√	√	√	√		17	85%

9Table 4.20 (Continued)

Suggestion		Interviewer1	Interviewer2	Interviewer3	Interviewer4	Interviewer5	Interviewer6	Interviewer7	Interviewer8	Interviewer9	Interviewer10	Interviewer11	Interviewer12	Interviewer13	Interviewer14	Interviewer15	Interviewer16	Interviewer17	Interviewer18	Interviewer19	Interviewer20	Frequency	Percentage
	34. Improve laboratory equipment to ensure smooth progress of experimental projects	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20	100%
	35. Carry out diverse learning activities	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20	100%
	36. Create a good learning atmosphere	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	20	100%
Strategies for Enhancing Self-regulation and Control																							
5	37. Establish good time management habits	√		√	√	√	√	√			√	√	√	√	√	√	√	√	√	√	√	17	85%
	38. Work hard to develop your willpower	√	√	√	√	√		√	√	√	√		√	√	√		√		√		√	15	75%
	39. Cultivate yourself to complete the corresponding tasks within the specified time	√	√	√	√		√		√		√	√	√	√		√	√					12	60%

9Table 4.20 (Continued)

Suggestion	Interviewer1	Interviewer2	Interviewer3	Interviewer4	Interviewer5	Interviewer6	Interviewer7	Interviewer8	Interviewer9	Interviewer10	Interviewer11	Interviewer12	Interviewer13	Interviewer14	Interviewer15	Interviewer16	Interviewer17	Interviewer18	Interviewer19	Interviewer20	Frequency	Percentage
40. Learn to control your emotions	√	√	√		√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	18	90%
41. Learn to use a variety of learning methods to achieve learning goals	√	√		√		√	√	√	√			√			√		√	√			11	55%
42. Learn to embrace change and challenges, and be proactive in finding solutions	√	√	√			√	√	√	√	√	√	√	√	√	√			√	√	√	16	80%
43. Use learning strategies flexibly		√		√	√	√			√		√		√	√	√		√		√	√	12	60%

From the perspective of managers and teachers, through structured interviews, experts pointed out relevant suggestions for improving the sustainable development of college students' self-directed learning ability in Shaanxi Province, and the suggestions put forward by experts provide micro support for strategy design.

Remark:

Question 1: The current condition of college students' autonomous learning ability and sustainable development learning motivation in Shaanxi Province and how to improve their learning motivation?

Question 2: Regarding the current condition of the sustainable development of college students' autonomous learning ability in Shaanxi Province and how to improve their learning strategies?

Question 3: The current condition of self-efficacy of college students' self-learning ability and sustainable development strategy in Shaanxi Province and how to improve students' self-efficacy?

Question 4: On the current condition of the strategic learning environment for the sustainable development of college students' autonomous learning ability in Shaanxi Province and how to create a learning environment that is more conducive to the cultivation of autonomous learning ability?

Question 5: On the current condition of self-regulation and control of the sustainable development strategy of college students' autonomous learning ability in Shaanxi Province and how to improve students' self-regulation and control ability?

5. Formulate a sustainable development strategy to improve the autonomous learning ability of college students in Shaanxi Province

Combined with the TOWS strategy combination and the suggestions of expert structured interviews, the strategies of the two are integrated to formulate a sustainable development strategy for college students' autonomous learning ability in Shaanxi Province, as shown in Figure 4.2:

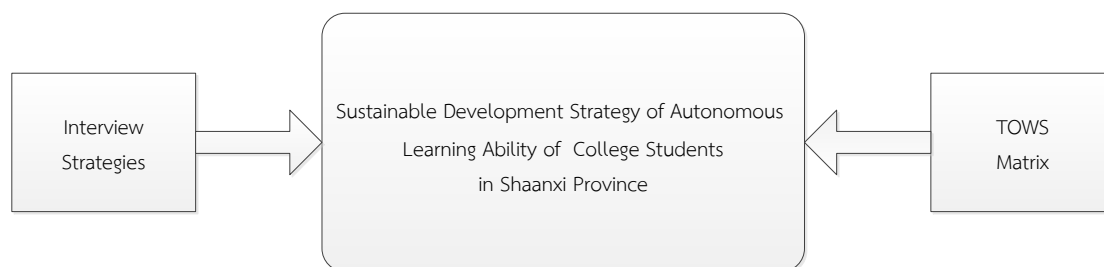


Figure 4.2 Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province

The specific strategies of the sustainable development strategy to improve the autonomous learning ability of college students in Shaanxi Province are shown in Table 4.21 below:

Table 4.21 List of strategies to improve the sustainable development of college students' autonomous learning ability in Shaanxi Province

NO.	Aspects of Strategies	Numbers of Measures
1	Learning motivation	10
2	Learning strategies	10
3	Self-efficacy	7
4	Learning environment	10
5	Self-regulation and control	9
Total		46

Table 4.21 provides a comprehensive overview of the strategic system aimed at improving college students' self-directed learning ability. Each strategy corresponds to a specific implementation measure, reflecting a design approach to achieving multi-domain target outcomes through a structured approach. The components of these strategies cover a wide range of focus areas, including stimulating learning

motivation, optimizing learning strategies, improving self-efficacy, improving the learning environment, and improving self-regulation and control.

The strategy to strengthen learning motivation consists of 10 measures aimed at improving students' motivation and motivation to learn. These measures may involve reforming teaching methods, enriching teaching content, arranging challenging learning tasks, paying attention to students' interests, and strengthening communication between teachers and students, as well as between students and parents. The strategy for optimizing learners' learning strategies consists of 10 measures, focusing on time management, learning methods, information utilization, etc. The strategy to enhance self-efficacy consists of 7 measures, including ability makes perfect, reward, and self-confidence. The strategy to improve the environment consists of 7 measures, which mainly include the physical environment, cultural environment, learning materials, etc. The strategy for improving self-regulation and control is composed of 9 measures, including willpower cultivation, positive attitude, emotional control, and time use.

Based on the information provided on the sustainable development strategy to enhance students' self-directed learning ability, the following is a structured outline of the comprehensive strategy developed after the TOWS matrix and the results of expert interviews:

1) Vision

The vision of cultivating college students' self-directed learning ability is to build a lifelong learning system, enhance personal competitiveness, and adapt to the rapidly changing needs of social development.

2) Mission

Cultivating students' self-directed learning ability is an important mission to complete higher education, aiming to respond to the rapidly changing needs of society and help students build the cornerstone of lifelong learning.

3) Objectives

a. Help students establish a self-driven learning framework by formulating learning plans and breaking down goals and tasks.

b. Guide students to master skills such as information retrieval and critical thinking, and make effective use of resources inside and outside the school.

c. Improve learning efficiency through metacognitive training (self-monitoring and adjustment), task prioritization, etc.

d. Transform theory into practical ability by participating in scientific research projects, social practice and other activities.

4) Strategic planning analysis

a. Make use of existing advantages, such as the professionalism of university teachers and intelligent technologies such as AI, to lay a solid foundation for the improvement of self-directed learning ability.

b. In view of the differences in the actual condition of various colleges and universities, the overall improvement of college students' self-learning ability in Shaanxi Province is further realized through resource sharing and school-school assistance policies.

c. Grasp the national policy requirements for the cultivation of students' self-directed learning ability in higher education, and work together with teachers and students to improve their self-directed learning ability through the joint improvement of teaching and learning methods.

d. Identify the obstacles encountered in the process of cultivating college students' self-directed learning ability, and eliminate the obstacles through the trinity of personnel participation, technical assistance, and policy guidance.

The strategic framework aims to orient university students towards lifelong learning by focusing on key areas, addressing current challenges, and leveraging existing opportunities. The specific strategies are as follows (Tables 4.22 to 4.26):

Table 4.22 Strategies for enhancing learning motivation of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Enhancing learning motivations	<ol style="list-style-type: none"> 1. Teachers improve teaching methods to enhance students' motivation for learning. 2. The teacher designs some challenging tasks for the students. 3. Pay attention to students' intrinsic needs and interests, and encourage students to try new things. 4. Affirm the contributions and efforts of the students. 5. Enrich the teaching content. 6. Allow students to set their own goals, emphasizing self-motivation. 7. Strengthen communication with teachers, classmates, and parents. 8. Provide students with sufficient learning resources. 9. Studying the exemplary deeds of outstanding students to stimulate learning motivation. 10. Parents should encourage their children more and establish appropriate expectations for them.

According to table 4.22, strategies for enhancing learning motivation of the autonomous learning ability of college students in Shaanxi Province, a total of 10 measures are proposed:

- 1) Teachers improve teaching methods to enhance students' motivation for learning.
- 2) The teacher designs some challenging tasks for the students.

- 3) Pay attention to students' intrinsic needs and interests, and encourage students to try new things.
- 4) Affirm the contributions and efforts of the students.
- 5) Enrich the teaching content.
- 6) Allow students to set their own goals, emphasizing self-motivation.
- 7) Strengthen communication with teachers, classmates, and parents.
- 8) Provide students with sufficient learning resources.
- 9) Studying the exemplary deeds of outstanding students to stimulate learning motivation.
- 10) Parents should encourage their children more and establish appropriate expectations for them.

Table 4.23 Strategies for enhancing learning strategies of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Enhancing learning strategies	<ol style="list-style-type: none"> 1. Guide students to make a scientific and reasonable study plan. 2. Guide students to make effective use of after-school time. 3. Stimulate students' enthusiasm and interest in learning. 4. Balance study time with rest time. 5. Improve students' skills in obtaining learning information, and organize and classify information 6. Improve your learning methods and find a learning method that works for you 7. Able to eliminate learning obstacles with the help of external forces 8. Learn to adjust your learning state in an appropriate way 9. Be able to make effective use of time and improve the efficiency of time use 10. Develop a curriculum system of "core literacy + AI assessment".

According to table 4.23, strategies for enhancing learning strategies of the autonomous learning ability of college students in Shaanxi Province, a total of 10 measures are proposed:

- 1) Guide students to make a scientific and reasonable study plan.
- 2) Guide students to make effective use of after-school time.
- 3) Stimulate students' enthusiasm and interest in learning.
- 4) Balance study time with rest time.
- 5) Improve students' skills in obtaining learning information, and organize and classify information.
- 6) Improve your learning methods and find a learning method that works for you.
- 7) Able to eliminate learning obstacles with the help of external forces.
- 8) Learn to adjust your learning state in an appropriate way.
- 9) Be able to make effective use of time and improve the efficiency of time use.
- 10) Develop a curriculum system of "core literacy + AI assessment".

Table 4.24 Strategies for enhancing self-efficacy of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Enhancing self-efficacy	<ol style="list-style-type: none"> 1. Let students practice make perfect and gain successful experience 2. Learning and imitating role models are rewarded 3. Affirmatory words and actions from others 4. Positive Self-Talk 5. Establish self-confidence 6. Often self-encourage 7. Guide students to establish reasonable learning objectives and assist them in achieving these goals

According to table 4.24, strategies for enhancing self-efficacy of the autonomous learning ability of college students in Shaanxi Province, a total of 7 measures are proposed:

- 1) Let students practice make perfect and gain successful experience.
- 2) Learning and imitating role models are rewarded.
- 3) Affirmatory words and actions from others.
- 4) Positive Self-Talk.
- 5) Establish self-confidence.
- 6) Often self-encourage.
- 7) Guide students to establish reasonable learning objectives and assist them in achieving these goals.

Table 4.25 Strategies for enhancing learning environment of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Enhancing learning environment	<ol style="list-style-type: none"> 1. Create a comfortable learning environment. 2. Prepare the necessary study tools and materials. 3. Eliminate Learning Distractions 4. Teach students according to their aptitude, and teachers improve teaching methods 5. Improve library facilities and equipment 6. Improve dormitory facilities and environment 7. Beautify the campus environment and create a campus learning atmosphere 8. Improve laboratory equipment to ensure smooth progress of experimental projects 9. Carry out diverse learning activities 10. Create a good learning atmosphere

According to table 4.25, strategies for enhancing learning environment of the autonomous learning ability of college students in Shaanxi Province, a total of 10 measures are proposed:

- 1) Create a comfortable learning environment.
- 2) Prepare the necessary study tools and materials.
- 3) Eliminate Learning Distractions.
- 4) Teach students according to their aptitude, and teachers improve teaching methods.
- 5) Improve library facilities and equipment.
- 6) Improve dormitory facilities and environment.
- 7) Beautify the campus environment and create a campus learning atmosphere.
- 8) Improve laboratory equipment to ensure smooth progress of experimental projects.
- 9) Carry out diverse learning activities.
- 10) Create a good learning atmosphere.

Table 4.26 Strategies for enhancing self-regulation and control of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Enhancing self-regulation and control	<ol style="list-style-type: none"> 1. Establish good time management habits 2. Work hard to develop your willpower 3. Cultivate yourself to complete the corresponding tasks within the specified time 4. Learn to control your emotions 5. Learn to use a variety of learning methods to achieve learning goals 6. Learn to embrace change and challenges, and be proactive in finding solutions 7. Use learning strategies flexibly 8. Establish a positive attitude 9. Psychological conditioning tools are involved

According to table 4.26, strategies for enhancing self-regulation and control of the autonomous learning ability of college students in Shaanxi Province, a total of 10 measures are proposed:

- 1) Establish good time management habits.
- 2) Work hard to develop your willpower.
- 3) Cultivate yourself to complete the corresponding tasks within the specified time.
- 4) Learn to control your emotions.
- 5) Learn to use a variety of learning methods to achieve learning goals.
- 6) Learn to embrace change and challenges, and be proactive in finding solutions.
- 7) Use learning strategies flexibly.
- 8) Establish a positive attitude.
- 9) Psychological conditioning tools are involved.

Strategy logic diagram has been developed based on the strategies outlined above, as shown in the diagram below.

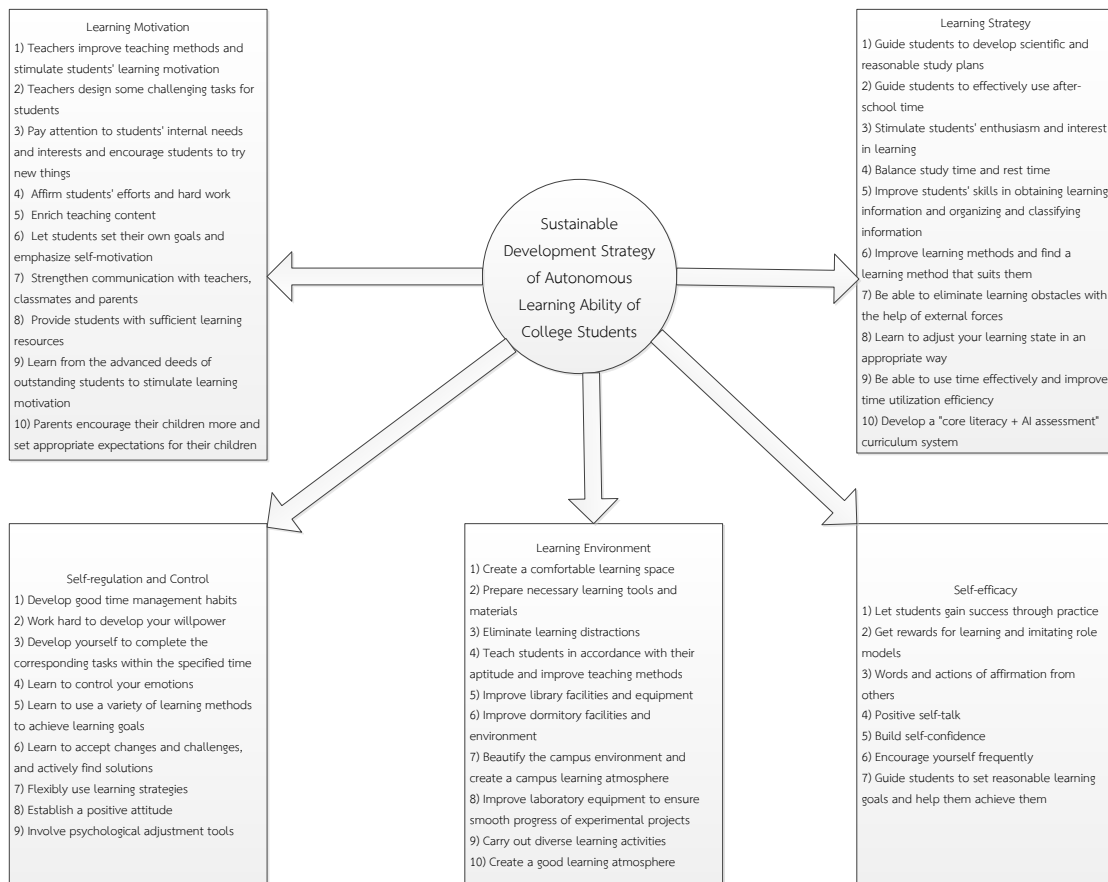


Figure 4.3 Strategies for enhancing the autonomous learning ability of college students in Shaanxi Province

Analysis results serving Research Objective 3: To evaluating the feasibility and adaptability of the sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province.

3.1 Evaluation and analysis of the feasibility adaptability and of the sustainable development strategy of college students' autonomous learning ability in Shaanxi Province

The analysis results at this stage are evaluated by 5 experts, who have been engaged in education and student management in colleges and universities in Shaanxi Province for more than 10 years and have the title of associate professor or above (Table 4.27).

The evaluation mainly adopts a five-level scoring scale, namely the highest, high, average, low, and lowest five grades, and each expert can only choose one.

Table 4.27 List of Strategic Evaluation Experts

NO.	Position
Expert 1	Shaanxi University of Science & Technology, Professor
Expert 2	Shaanxi University of Technology, Professor
Expert 3	Xijing University, Professor
Expert 4	Shaanxi Polytechnic Institute, Associate Professor
Expert 5	Shaanxi Railway Institute, Associate Professor

According to the average data interpretation standards proposed by Rensis Likert in 1932, the range of data interpretation is as follows:

- 4.50-5.00 indicates the highest level;
- 3.50-4.49 indicates a high level;
- 2.50-3.49 indicates an moderate level;
- 1.50-2.49 indicates a lower level;
- 1.00-1.49 indicates the lowest level.

Table 4.28 Analysis Results of Strategy Evaluation

Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province	Feasibility			Adaptability		
	\bar{X}	S.D.	result	\bar{X}	S.D.	result
Strategies for Enhancing Learning Motivations	4.64	0.497	highest	4.26	0.724	high
Strategies for Enhancing Learning Strategies	4.18	0.575	high	4.04	0.701	high
Strategies for Enhancing Self-Efficacy	4.23	0.754	high	4.40	0.538	high
Strategies for Enhancing Learning Environment	4.14	0.698	high	4.31	0.703	high
Strategies for Enhancing self- regulation and control	4.44	0.641	high	4.40	0.537	high
Total	4.33	0.633	high	4.28	0.641	high

As can be seen from Table 4.28, the average adaptability of the five strategic factors to promote the sustainable development of autonomous learning ability of college students in Shaanxi Province ranges from 4.04 to 4.31, and the average adaptability of the feasibility items ranges from 4.14 to 4.64, both of which are at a high to highest level, indicating that the research strategy is highly adaptable and feasible.

Table 4.29 Analysis results of strategy evaluation

Strategies for Enhancing Learning Motivations	Feasibility			Adaptability		
	\bar{X}	S.D.	result	\bar{X}	S.D.	result
1. Teachers improve teaching methods to enhance students' motivation for learning.	4.80	0.447	highest	4.20	0.837	high
2. The teacher designs some challenging tasks for the students.	4.80	0.447	highest	4.60	0.548	highest
3. Pay attention to students' intrinsic needs and interests, and encourage students to try new things.	4.60	0.548	highest	4.20	0.837	high
4. Affirm the contributions and efforts of the students.	4.40	0.548	high	4.20	0.837	high
5. Enrich the teaching content.	4.40	0.548	high	4.20	0.837	high
6. Allow students to set their own goals, emphasizing self-motivation.	4.80	0.447	highest	4.60	0.548	highest
7. Strengthen communication with teachers, classmates, and parents.	4.80	0.447	highest	4.00	0.707	high
8. Provide students with sufficient learning resources.	4.60	0.548	highest	4.00	0.707	high
9. Studying the exemplary deeds of outstanding students to stimulate learning motivation.	4.40	0.548	high	4.40	0.548	high
10. Parents should encourage their children more and establish appropriate expectations for them.	4.80	0.447	highest	4.20	0.837	high
Total	4.64	0.497	highest	4.26	0.724	high

It can be seen from Table 4.29 that the average fitness of the reinforcement learning motivation strategy elements for improving the sustainable development of the autonomous learning ability of college students in Shaanxi Province is between 4.0 and 4.6, and the average fitness of the feasibility items is between 4.4 and 4.8, both of which are at a high to highest level, which shows that the reinforcement learning motivation strategy has high adaptability and feasibility. This high level of fitness reflects the strategy's strong alignment with the cognitive and psychological characteristics of college students, making it more likely to stimulate continuous engagement in self-directed learning. The feasibility scores further indicate that the necessary infrastructure, teaching resources, and institutional support are largely in place to implement such strategies effectively.

Table 4.30 Analysis results of strategy evaluation

Strategies for Enhancing Learning Strategies	Feasibility			Adaptability		
	\bar{X}	S.D.	result	\bar{X}	S.D.	result
1. Guide students to make a scientific and reasonable study plan.	4.60	0.548	highest	4.60	0.548	highest
2. Guide students to make effective use of after-school time.	4.60	0.548	highest	4.00	0.707	high
3. Stimulate students' enthusiasm and interest in learning.	3.60	0.548	high	4.20	0.447	high
4. Balance study time with rest time.	3.80	0.837	high	3.80	0.837	high
5. Improve students' skills in obtaining learning information, and organize and classify information	4.60	0.548	highest	4.00	0.707	high

Table 4.30 (Continued)

Strategies for Enhancing Learning Strategies	Feasibility			Adaptability		
	\bar{X}	S.D.	result	\bar{X}	S.D.	result
6. Improve your learning methods and find a learning method that works for you	3.80	0.447	high	4.00	0.707	high
7. Able to eliminate learning obstacles with the help of external forces	4.60	0.548	highest	4.20	0.837	high
8. Learn to adjust your learning state in an appropriate way	4.80	0.447	highest	4.20	0.837	high
9. Be able to make effective use of time and improve the efficiency of time use	4.20	0.837	high	3.80	0.837	high
10. Develop a curriculum system of "core literacy + AI assessment".	3.20	0.447	high	3.60	0.548	high
Total	4.18	0.575	high	4.04	0.701	high

It can be seen from Table 4.30 that the average fitness of the strategic elements of the optimized learning strategy for improving the sustainable development of the autonomous learning ability of college students in Shaanxi Province is between 3.6 and 4.6, and the average fitness of the feasibility items is between 3.2 and 4.8, both of which are at a medium to highest level. There is only one item with an average fitness of 3.2, which shows that the strategy of optimizing learning strategies basically has high adaptability and feasibility.

Table 4.31 Analysis results of strategy evaluation

Strategies for enhance self- efficacy	Feasibility			Adaptability		
	\bar{X}	S.D.	result	\bar{X}	S.D.	result
1. Let students practice make perfect and gain successful experience	3.80	0.837	high	4.60	0.548	highest
2. Learning and imitating role models are rewarded	4.20	0.837	high	4.40	0.548	high
3. Affirmatory words and actions from others	4.40	0.548	high	4.00	0.000	high
4. Positive Self-Talk	4.20	0.837	high	4.20	0.837	high
5. Establish self-confidence	4.60	0.548	highest	4.80	0.447	highest
6. Often self-encourage	4.20	0.837	high	4.20	0.837	high
7. Guide students to establish reasonable learning objectives and assist them in achieving these goals	4.20	0.837	high	4.60	0.548	highest
Total	4.23	0.754	high	4.40	0.538	high

As can be seen from Table 4.31, the average fitness of the strategic elements of enhancing self-efficacy to improve the sustainable development of college students' autonomous learning ability in Shaanxi Province is between 4.0 and 4.8, and the average fitness of the feasibility items is between 3.8 and 4.6, both of which are at a high to highest level, indicating that the strategy of enhancing self-efficacy has high adaptability and feasibility.

Table 4.32 Analysis results of strategy evaluation

Strategies for enhance the learning environment	Feasibility			Adaptability		
	\bar{X}	S.D.	result	\bar{X}	S.D.	result
1. Create a comfortable learning environment.	4.60	0.548	highest	4.40	0.548	high
2. Prepare the necessary study tools and materials.	4.60	0.548	highest	4.20	0.837	high
3. Eliminate Learning Distractions	3.80	0.837	high	4.40	0.894	high
4. Teach students according to their aptitude, and teachers improve teaching methods	3.80	0.447	high	4.00	0.707	high
5. Improve library facilities and equipment	4.20	0.837	high	4.60	0.548	highest
6. Improve dormitory facilities and environment	3.80	0.837	high	4.40	0.548	high
7. Beautify the campus environment and create a campus learning atmosphere	4.20	0.837	high	4.20	0.837	high
8. Improve laboratory equipment to ensure smooth progress of experimental projects	4.20	0.548	high	4.30	0.837	high
9. Carry out diverse learning activities	3.80	0.837	high	4.40	0.894	high
10. Create a good learning atmosphere	4.20	0.837	high	4.20	0.548	high
Total	4.14	0.698	high	4.31	0.703	high

As can be seen from Table 4.32, the average fitness of the strategic elements of improving the learning environment for the sustainable development of college students' autonomous learning ability in Shaanxi Province is between 4.0 and 4.6, and the average fitness of the feasibility items is between 3.8 and 4.6, both of which are at a high to highest level, indicating that the strategy of improving the learning environment has high adaptability and feasibility.

Table 4.33 Analysis results of strategy evaluation

Strategies for enhance self-regulation and control	Feasibility			Adaptability		
	\bar{X}	S.D.	result	\bar{X}	S.D.	result
1. Establish good time management habits	4.40	0.894	high	4.60	0.548	highest
2. Work hard to develop your willpower	4.60	0.548	highest	4.40	0.548	high
3. Cultivate yourself to complete the corresponding tasks within the specified time	4.40	0.894	high	4.40	0.548	high
4. Learn to control your emotions	4.80	0.447	highest	4.80	0.447	highest
5. Learn to use a variety of learning methods to achieve learning goals	4.60	0.548	highest	4.60	0.548	highest
6. Learn to embrace change and challenges, and be proactive in finding solutions	4.80	0.447	highest	4.40	0.548	high
7. Use learning strategies flexibly	4.40	0.894	high	4.60	0.548	highest
8. Establish a positive attitude	4.60	0.548	highest	4.40	0.548	high
9. Psychological conditioning tools are involved	3.40	0.548	high	3.40	0.548	high
Total	4.44	0.641	high	4.40	0.537	high

It can be seen from Table 4.33 that the average fitness of the strategic elements of improving self-regulation and control ability for the sustainable development of college students' autonomous learning ability in Shaanxi Province is between 3.4 and 4.8, and the average fitness of the feasibility items is between 3.4 and 4.8, both of which are at the medium to highest level, and there is only one item with an average value of 3.4, which shows that the strategy of improving self-regulation and control ability basically has high adaptability and feasibility.

This study elaborates on a diversified strategy system for improving college students' autonomous learning ability. These strategies cover many important areas, including learning motivation, learning strategies, self-efficacy, learning environment, self-regulation and control. Each strategy includes specific measures to achieve the expected goals, reflecting the solution to comprehensively improve the sustainable development of college students' autonomous learning ability in Shaanxi Province through a systematic approach.

The steps to develop these strategies are mainly: assess the current condition - set clear goals - design an action plan - allocate necessary resources - implement the strategy. Evaluating the effectiveness of the strategy requires tracking progress, using qualitative and quantitative indicators to measure results, and making adjustments based on feedback.

In summary, this study outlines a set of strategies for improving the sustainable development of college students' autonomous learning ability, as well as a comprehensive approach to strategy formulation and evaluation. The key to the strategic plan is implementation, and effective implementation can ultimately achieve the desired goals.

Chapter 5

Conclusion Discussion and Recommendations

The objectives of this study include: 1) to study the current condition and expected condition of sustainable development of autonomous learning ability of college students in Shaanxi Province; 2) to develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province; 3) to evaluate the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

In order to achieve the above research objectives, this study uses questionnaire survey and interview methods to analyze the current condition and promoting factors of the sustainable development of college students' autonomous learning ability in Shaanxi Province. On this basis, combined with self-regulated learning theory, constructivist learning theory, hybrid learning theory, and the research results of many Chinese scholars such as Pang Weiguo, Liu Fang, Zhu Zude, Zhou Yangen, Sang Qingsong, Xiang Miao, Sun Jiawei, Jiao Xiyun on the sustainable development of college students' autonomous learning ability, five strategies for improving the sustainable development of college students' autonomous learning ability in Shaanxi Province were finally determined. These strategies were then evaluated by expert evaluation method. The specific contents are as follows:

Conclusion

This study employs a hybrid approach and is implemented in three phases, aiming to explore educational management strategies for the sustainable development of university students' autonomous learning abilities, as detailed below:

Phase 1: To study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province.

Phase 2: To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

Phase 3: To evaluate the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The details are presented as follows.

Phase 1: To study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province.

1.1 Personal information analysis of college students in Shaanxi Province, gender, from, subject, education type and current grade

According to Table 4.1, among the students who participated in the questionnaire, there were more female students than male students, more students from rural areas than urban areas, the most science students, more undergraduate students than vocational students, and the most sophomores.

1.2 Overall analysis: learning motivation, learning strategies, self-efficacy, Learning environment and self-regulation and control

The current condition and promoting factors of the sustainable development of autonomous learning ability of college students in Shaanxi Province are at a moderate level in five aspects. Among the five dimensions evaluated, the self-efficacy dimension ranks first ($\bar{X} = 3.44, S.D. = 0.848$), indicating that the current level of students' self-efficacy is relatively high. The current status of the learning environment dimension ranks fifth ($\bar{X} = 3.36, S.D. = 0.797$), indicating that students are dissatisfied with the current learning environment.

1.2.1 Results of studying the current condition and expected condition of learning motivation

The current condition of the six dimensions of learning motivation factors of college students in Shaanxi Province is at a medium to high level ($\bar{X} = 3.37, S.D. = 0.848$). The research results show that the current status value of "learning focuses on improving one's own quality, not limited to academic

performance" is at the highest level, and "in order to complete a certain homework in time, you will forget to eat and sleep and stay up all night" is at the lowest level. The expected condition of the six dimensions of learning motivation factors of college students in Shaanxi Province is at a high level ($\bar{X} = 4.00, S.D. = 0.802$), the corrected mean of PNI for learning motivation dimension reached 0.187, indicating that there was a low degree of improvement in all dimensions.

1.2.2 Results of studying the current condition and expected condition of learning strategies

The current condition and supporting factors of the learning strategies for promoting sustainable development of college students in Shaanxi Province are at a medium level ($\bar{X} = 3.40, S.D. = 0.787$). The research results show that "you know how to find the information you need" is the highest level, and "you often make study plans for each course" is the lowest level. The expected condition and supporting factors of the learning strategies for promoting sustainable development of college students in Shaanxi Province are at a high level ($\bar{X} = 3.93, S.D. = 0.754$), the total PNI modified value of the learning strategy reached 0.156, indicating that the gap between the current status and expectations of each dimension is small overall, but there is still room for improvement and improvement.

1.2.3 Results of studying the current condition and expected condition of self-efficacy

The current condition and supporting factors of promoting sustainable development in the self-efficacy of college students in Shaanxi Province are at a medium level ($\bar{X} = 3.44, S.D. = 0.800$). The research results show that "you can encourage yourself when you encounter difficulties in learning", "you can work hard towards the determined learning goals", "in learning, you will pay attention to the learning success and failure of classmates with similar abilities to motivate yourself", and the current status level is the same, tied for the highest, and "in the learning process, you think you can understand the knowledge in the book and the content taught by the teacher very well" is at the lowest level. The expected condition and supporting factors of promoting sustainable development in the self-efficacy of

college students in Shaanxi Province are at a high level ($\bar{X} = 4.03, S.D. = 0.763$), the PNI modified mean of the self-efficacy dimension reached 0.170, indicating that the gap between the current condition and expectations at each level is relatively small.

1.2.4 Results of studying the current condition and expected condition of learning environment

The current condition of the learning environment for college students in Shaanxi Province is at a medium level ($\bar{X} = 3.36, S.D. = 0.797$), among which the level of agreement with the viewpoint "You believe that teachers' teaching methods have a great influence on learning outcomes" is the highest, and the level of agreement with the viewpoint "You often go to the library to study so that you can do your homework in an environment where you can concentrate" is the lowest. The expected condition of the learning environment for college students in Shaanxi Province is at a high level ($\bar{X} = 4.16, S.D. = 0.683$), the total PNI correction value of the learning environment is 0.239, indicating that there is a certain degree of improvement needed in all dimensions at present, reflecting that there is still room for systematic improvement in the overall learning environment.

1.2.5 Results of studying the current condition and expected condition of self-regulation and control

The current condition of self-regulation and control ability of college students in Shaanxi Province is generally at a medium level ($\bar{X} = 3.42, S.D. = 0.794$), among which "when one method cannot meet your learning needs, you will make good use of other learning methods" has the highest level, and "you will make full use of library materials to assist your learning" has the lowest level. The expected condition of self-regulation and control ability of college students in Shaanxi Province is generally at a high level ($\bar{X} = 4.21, S.D. = 0.664$), the total PNI correction value for the self-regulation and control dimension was 0.230, indicating that there is some degree of need for improvement in all dimensions.

Phase 2: To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The sustainable development of autonomous learning ability among college students in Shaanxi Province includes five strategies and a total of 46 measures. These five aspects are: 10 measures to enhance learning motivation, 10 measures to optimize learning strategies, 7 measures to enhance self-efficacy, 10 measures to improve the learning environment, and 9 measures to strengthen self-regulation and control.

The 10 measures to enhance learning motivation are: 1) Improve teaching methods. 2) Design some challenging tasks. 3) Pay attention to students' internal needs and interests. 4) Affirm students' efforts. 5) Enrich teaching content. 6) Set goals. 7) Strengthen communication. 8) Provide learning resources. 9) Learn from the advanced deeds. 10) Parents encourage their children.

The 10 measures to enhance learning strategy are: 1) Guide students to develop study plans. 2) Guide students to use after-school time. 3) Stimulate students' enthusiasm. 4) Balance study time and rest time. 5) Improve students' skills of obtaining learning information. 6) Improve learning methods. 7) Eliminate learning obstacles. 8) Adjust learning state. 9) Use time effectively. 10) Develop a "core literacy + AI assessment" curriculum system.

The 7 measures to enhance self-efficacy are: 1) Success through practice. 2) Get rewards for learning and imitating role models. 3) Affirmation from others. 4) Positive self-talk. 5) Build self-confidence. 6) Encourage yourself frequently. 7) Set reasonable learning goals.

The 10 measures to enhance learning environment are: 1) Create learning space. 2) Prepare learning tools and materials. 3) Eliminate learning distractions. 4) Improve teaching methods. 5) Improve library facilities and equipment. 6) Improve dormitory environment. 7) Beautify the campus environment. 8) Improve laboratory equipment. 9) Carry out diverse learning activities. 10) Create a good learning atmosphere.

The 9 measures to enhance self-regulation and control are: 1) Good time management habits. 2) Develop willpower. 3) Develop yourself. 4) Control emotions. 5) Use a variety of learning methods. 6) Accept changes and challenges. 7) Use learning strategies. 8) Establish a positive attitude. 9) Psychological adjustment tools.

Phase 3: To evaluate the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The adaptability and feasibility of the 46 measures in five aspects of the sustainable development strategy for college students' autonomous learning ability in Shaanxi Province are at a high level.

1) The feasibility analysis results of 46 measures in five aspects of the sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province ranged (shown in table 4.23) from 4.14 to 4.64, all at a high and highest level, indicating that the strategy has high feasibility.

2) The adaptability analysis results of 46 measures in five aspects of the sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province ranged (shown in table 4.28) from 4.04 to 4.31, all at a high level, indicating that the strategy has high adaptability.

Discussion

Through the investigation of the sustainable development status and influencing factors of the autonomous learning ability of college students in Shaanxi Province, the study found that there are many problems in the learning motivation, learning strategy, self-efficacy, learning environment, self-regulation and control of college students in Shaanxi Province. By analyzing the mean and standard deviation of these factors, it is found that these indicators are at a medium level and need to be improved.

Subsequently, the researchers proposed a strategy system for the sustainable development of the autonomous learning ability of college students in Shaanxi

Province. By analyzing the mean and standard deviation of strategies such as improving learning motivation, improving learning strategies, improving the learning environment, enhancing self-efficacy, and improving self-regulation and control abilities, they found that each strategy was at a high or highest level of applicability.

Overall, university students' autonomous learning ability is at a slightly above-average level, with an average score of 4.28 (this type of scale typically uses a 5-point scoring system, where 1 = strongly disagree and 5 = strongly agree). This indicates that most students possess a certain level of autonomous learning awareness and foundation, but there is still significant room for improvement, and they have not yet reached a highly mature or stable state of autonomous learning.

A deeper analysis of specific items and influencing factors can be conducted from the following core dimensions:

Phase 1: To study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province.

Phase 2: To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

Phase 3: To evaluate the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The details are presented as follows.

1. To study the current condition and expected condition of autonomous learning ability of college students in Shaanxi Province.

Based on the research findings, this paper discusses the current conditions and expected conditions for the sustainable development of autonomous learning ability of college students in Shaanxi Province as follows:

Regarding learning motivation, there is a gap between the current state and expectations of the sustainable development of autonomous ability of college students in Shaanxi Province. Such as students lack motivation to complete a task.

Regarding learning strategies, there is a gap between the current state and expectations of the sustainable development of autonomous ability of college

students in Shaanxi Province. For example students find it difficult to adjust their learning state to its optimal level.

Regarding Self-efficacy, there is a gap between the current state and expectations of the sustainable development of autonomous ability of college students in Shaanxi Province. For example Students find it difficult to cope with various learning tasks.

Regarding learning environment, there is a gap between the current state and expectations of the sustainable development of autonomous ability of college students in Shaanxi Province. For example students believe that the learning environment affects learning outcomes.

Regarding self-regulation and control, there is a gap between the current state and expectations of the sustainable development of autonomous ability of college students in Shaanxi Province. For example students have a weak ability to schedule the most suitable study time according to their own learning needs.

2. To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The sustainable development strategy of autonomous learning ability of college students in Shaanxi Province proposed in this study mainly include five aspects: learning motivation, learning strategies, self-efficacy, learning environment, and self-regulation and control, totaling 46 strategies. The results show that the adaptability of these strategies is at a high or highest level, and they are all core elements for promoting the sustainable development of college students' self-directed learning ability.

1) In terms of learning motivation

Students' learning motivation is a key factor in the sustainable development of autonomous learning ability. Studies have shown that Pang Weiguo (2002) believes that cultivating students' autonomous learning ability can start from the factors that affect students' intrinsic learning motivation. Li Lu (2021) believes that the adaptive learning intrinsic motivation perceived by individuals can help them

develop good behavioral habits, improve their autonomous learning ability, and enhance learning effects.

2) In terms of learning strategies

Using various learning strategies can effectively improve autonomous learning ability and results. Yang Mei (2011) believes that the improvement of autonomous learning ability is the fundamental guarantee of autonomous learning. She expounds on ways to improve students' autonomous learning ability from the aspects of guiding students to do the right things, cultivating students to do things in the right way, requiring and helping students to do things well, etc.

3) In terms of Self-efficacy

There is a close relationship between self-efficacy and the cultivation of autonomous learning ability. The cultivation of autonomous learning ability needs to be based on enhancing self-efficacy. Research by Liu Fang (2009) and others shows that students' self-efficacy is proportional to their self-learning ability. The higher the students' self-efficacy, the stronger their self-learning ability. Correspondingly, students will also show strong autonomy in learning motivation, learning settings and self-regulation.

4) In terms of learning environment

Jiang Xin and Zhao Xiuwen (2013) proposed a path to cultivate college students' autonomous learning ability under the concept of lifelong learning. Colleges and universities should optimize talent training programs, improve teaching models, use various favorable information technologies, enrich students' extracurricular activities, broaden their horizons, broaden their thinking, carry out innovative activities, improve the learning environment in many ways, enhance students' autonomous learning ability, and further meet the needs of lifelong learning.

5) In terms of self-regulation and control

Mi Li (2008)'s research focuses more on the role of students themselves and self-evaluation in cultivating autonomous learning ability, pointing out that by changing students' concepts, improving learning initiative, and mastering correct

learning methods and techniques, students' collaborative learning ability can be cultivated. Various abilities such as self-monitoring ability and evaluation function also have a profound impact on the cultivation of students' autonomous learning ability.

3. To evaluate the feasibility and adaptability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The feasibility and adaptability evaluation results of the strategy were both at a high level, indicating that the strategy was formulated following an academic process and underwent systematic evaluation by experts to ensure its feasibility and adaptability. Fred Nickols (2000) believes that strategy is a complex network that provides general guidance for specific actions and is the thoughts, ideas, insights, experiences, goals, ambitions, memories, perceptions and expectations for the pursuit of specific ultimate goals. Porter (2020) pointed out that by measuring key performance indicators (KPIs), leaders can make data - driven decisions, thereby promoting innovation and enhancing organizational agility. Overall, strategic evaluation supports risk management, strengthens the accountability mechanism, and ensures that the strategies are continuously aligned with the external environment and organizational goals.

Recommendations

46 strategies have been developed to cultivate college students' autonomous learning abilities, but the overall level remains at a moderate level, still falling short of the expected development goals. There is a significant gap between the current condition and the expected condition, particularly in areas such as the learning environment, self-regulation and control, learning motivation, self-efficacy, and learning strategies. These factors collectively influence the sustainable development of college students' autonomous learning abilities.

This research has significant value for multiple stakeholders, including students, teachers, and higher education institutions. Schools provide the necessary environment and resources for student learning, teachers act as guides and mentors

for students' autonomous learning, and college students, as reserve talents for society, are builders of social development. The collaborative development of these groups is crucial for building a sustainable educational ecosystem for autonomous learning capabilities.

Expected outcomes include enhancing students' learning motivation, optimizing learning strategies, strengthening self-efficacy, improving the learning environment, and reinforcing self-regulation and control. In the long term, these measures will help students develop a sustainable awareness of autonomous learning, enhance their autonomous learning abilities, and cultivate individuals with social responsibility, adaptability, and continuous learning capabilities, thereby promoting educational modernization and sustainable social development.

General recommendation

1) Enhance learning motivation

The strengthening of learning motivation requires a balance between internal drive (interest, sense of achievement, self-growth) and external incentives (rewards, recognition, competition) to achieve long-term sustainable learning motivation. Encouragement from family, teachers, classmates and other people around students can continuously strengthen students' learning enthusiasm, while challenging tasks can also stimulate students' learning motivation.

2) Enhance learning strategies

Enhance learning strategies is not only the key to enhancing learning efficiency but also the core of cultivating students' lifelong learning competence. By systematically improving learning methods, students can transform from passive knowledge recipients into active knowledge constructors. On the basis of giving full play to students' subjective initiative, external support forces should be actively introduced through intelligent technologies. For instance, AI-assisted tools can be utilized for personalized learning path planning and precise diagnosis of weak points based on data analysis. Meanwhile, digital platforms such as mind-mapping software or spaced repetition systems can scientifically manage review rhythms, significantly improving memory retention. Additionally, intelligent learning companions and online

collaborative tools provide students with immediate feedback and resource support, building a "teacher-student-machine" collaborative learning ecosystem. This deep integration not only helps students efficiently accomplish learning tasks but also cultivates their problem-solving abilities in complex environments. Ultimately, through the dual empowerment of strategy and technology, the achievement of learning goals and the comprehensive enhancement of personal literacy are truly realized.

3) Enhance self-efficacy

Enhance self-confidence is a holistic process that begins with cultivating a positive internal dialogue and gradually extends to your external actions and achievements. Start by actively talking to yourself with kindness and encouragement, replacing self-doubt with affirmations of your capabilities and worth. Shift your focus from unattainable perfection to tangible progress by setting small, manageable goals that are within your reach. Each time you accomplish one of these minor objectives, you reinforce the belief in your own competence and build momentum. Celebrate these daily victories, no matter how insignificant they may seem, as they collectively contribute to a reservoir of successful experiences. Over time, this accumulation of proof transforms your self-perception, making you more resilient and less fearful of challenges. As your internal foundation strengthens, you will naturally project greater assurance in social and professional settings. Ultimately, this daily practice of self-empowerment creates a virtuous cycle, where confidence fuels success, and success further deepens your confidence.

4) Enhance learning environment

Enhance learning environment is a holistic endeavor that requires a dual transformation, working synergistically from the outside in and the inside out. First, we must upgrade the hardware infrastructure that forms the foundation of modern education. This will ensure that people have access to reliable technology and comfortable, ergonomically designed learning spaces. At the same time, we need to cultivate a positive and motivated spirit among students. To this end, we need to create a learning environment that encourages curiosity, self-discipline, and mutual

respect. Everyone must strive to enhance their self-cultivation, ethical standards, and sense of responsibility to collaboratively create a beautiful, nurturing, and intellectually stimulating learning environment. By bridging the gap between tangible resources and intangible values, we can ensure that the spaces we build not only facilitate the acquisition of knowledge but also inspire the holistic development of every individual. Ultimately, this synergy between external support and internal growth will empower learners to thrive and contribute positively to the world around them.

5) Enhance self-regulation and control ability

The path to effective self-directed and control learning begins with the foundation of self-emotional management. People need to learn to control their impulses and remain calm when facing challenges. By approaching every obstacle and condition with a positive, problem-solving attitude, setbacks can be transformed into valuable growth opportunities.

Recommendations for further research

1) Interdisciplinary integration research. Combining psychology, neuroscience and computer science, we build a comprehensive model of autonomous learning ability, and through model analysis, we find the best way to improve students' autonomous learning ability.

2) Policy-oriented research. Students' autonomous learning ability has become an important means to achieve students' lifelong learning goals. It is recommended that the state introduce policies to guide the education system to incorporate autonomous learning ability into the core literacy assessment system and raise the cultivation of students' autonomous learning ability to a core position.

3) Regional and international cooperative research. By learning from the successful experiences and practices of other regions and other countries in cultivating students' autonomous learning ability, we can analyze the main reasons for their success and draw lessons from them according to our own actual condition.

In summation, this research underscores that advancing student autonomous learning is not an isolated pedagogical adjustment but a systemic transformation

requiring coordinated action across scientific, policy, and international domains. By grounding practice in interdisciplinary science, anchoring reform in actionable policy, and enriching strategy with global wisdom, the study provides a comprehensive roadmap for building educational systems that nurture curiosity, resilience, and lifelong learning. The ultimate vision is the creation of a sustainable, equitable, and adaptive learning ecosystem, one in which every student is empowered to thrive in an increasingly complex and dynamic world.

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Appendices

Appendix A

List of Specialists and Letters of Specialists Invitation
for IOC Verification

List of Specialists Invitation for IOC Verification

NO.	Name	Position
1.	Wang Qing	Professor, Northwest Agriculture and Forestry University
2.	Ren Bohu	Associate Professor, Shaanxi Vocational and Technical College of Posts and Telecommunications
3.	Luxana Keyuraphan	Associate Professor of Bansomdejchaopraya Rajabhat University
4.	Thuskorn suwanjarus	Associate professor of Bansomdejchaopraya Rajabhat University
5.	Areeya juijumlong	Assistant professor of Bansomdejchaopraya Rajabhat University

List of Specialists Invitation for Strategies Evaluation

The following list is invited as an evaluation expert to evaluate the adaptability and feasibility of strategies on sustainable development of Autonomous Learning Ability of College Students in Shaanxi Province.

NO.	Name of Experts	Position/Office
1	Profess MR.Wang Huazhong	Shaanxi University of Science & Technology
2	Profess MR.Guo Shouku	Shaanxi University of Technology
3	Profess MRS.Li Haixia	Xijing University
4	Associate Professor MR.Gao Heyun	Shaanxi Polytechnic Institute
5	Dr.Liu Xuexue	Shaanxi Railway Institute

Appendix B

Official Letter

MHESI 0643.14/ ๐๕๕๓



Bansomdejchaopraya
Rajabhat University
1061 Soi Itsaraphap 15,
Itsaraphap Road, Hiranruchi,
Thonburi, Bangkok, Thailand
10600

26 August 2024

Subject: Invitation to validate research instrument
Dear Professor Wang Qing
Attachment: A Set of research instrument

Ms. Li Mei is a graduate student in the Doctor of Philosophy Program In Educational Management for Sustainable Development program of Bansomdejchaopraya Rajabhat University. She is conducting research entitled "Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province" under the supervision of the following thesis advisory committee:

1. Assistant Professor Dr. Sunate Thaveethavornsawat	Major Advisor
2. Associate Professor Dr. Narongwat Mingmit	Co-Advisor
3. Dr. Thanida Sujarittham	Co-Advisor

The thesis advisory committee recognizes your expertise in Educational Management for Sustainable Development and believes that your recommendations would be invaluable for the further refinement of this research instrument.

With your specialized knowledge, we kindly request your assistance in validating the attached research instrument. In this regard, we would like to take this opportunity to express our deepest gratitude and appreciation for your support.

Yours faithfully

(Asst. Prof. Dr. Tanaput Chanchaoren)

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Thonburi, Bangkok, Thailand
10600

26 August 2024

Subject: Invitation to validate research instrument
Dear Assistant Professor Ren Bohu
Attachment A Set of research instrument

Ms. Li Mei is a graduate student in the Doctor of Philosophy Program in Educational Management for Sustainable Development program of Bansomdejchaopraya Rajabhat University. She is conducting research entitled "Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province" under the supervision of the following thesis advisory committee:

1. Assistant Professor Dr. Sunate Thaveethavornsawat	Major Advisor
2. Associate Professor Dr. Narongwat Mingmit	Co-Advisor
3. Dr. Thanida Sujarittham	Co-Advisor

The thesis advisory committee recognizes your expertise in Educational Management for Sustainable Development and believes that your recommendations would be invaluable for the further refinement of this research instrument.

With your specialized knowledge, we kindly request your assistance in validating the attached research instrument. In this regard, we would like to take this opportunity to express our deepest gratitude and appreciation for your support.

Yours faithfully

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10600

26 August 2024

Subject: Invitation to validate research instrument
Dear Associate Professor Dr. Luxana Keyuraphan
Attachment A Set of research instrument

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Thonburi, Bangkok, Thailand
10600

26 August 2024

Subject: Invitation to validate research instrument
Dear Associate Professor Dr. Thuskorn suwanjarus
Attachment A Set of research instrument

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26 August 2024

Subject: Invitation to validate research instrument
Dear Assistant Professor Areeya Juljumlong
Attachment: A Set of research instrument

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16 October, 2024

Subject Invitation to join an interview as an expert

Dear Professor Zhang Yuan

Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert

Dear Professor Ma Juxia

Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert

Dear Associate Professor Zhang Jianjie

Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert
Dear Associate Professor Gao Xueming
Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert

Dear Professor Wang Jun

Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert
Dear Professor Huo Keke
Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert
Dear Associate Professor Si Yuna
Attachment Interview Form

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16 October, 2024

Subject Invitation to join an Interview as an expert

Dear Associate Professor Cai Yutian

Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert

Dear Associate Professor Liu Xueyi

Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert
Dear Professor Han Yanxiong
Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert

Dear Professor Zhang Culhua

Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert

Dear Associate Professor Liu Hul

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16 October, 2024

Subject Invitation to Join an Interview as an expert

Dear Associate Professor Yang Zhipeng

Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert
Dear Associate Professor Zhang Man
Attachment Interview Form

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16 October, 2024

Subject Invitation to Join an interview as an expert

Dear Associate Professor Zhang Yanju

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16 October, 2024

Subject Invitation to join an interview as an expert
Dear Associate Professor Shang Li
Attachment Interview Form

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16 October, 2024

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Dear Associate Professor Wang Meixia

Attachment Interview Form

Ms. Li Mei is a graduate student in the Doctor of Philosophy Program in Educational Management for Sustainable Development program of Bansomdejchaopraya Rajabhat University. She is conducting research entitled " Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province" under the supervision of the following thesis advisory committee:

- | | |
|--|---------------|
| 1. Assistant Professor Dr. Sunate Thaveethavornsawat | Major Advisor |
| 2. Associate Professor Dr.Narongwat Mingmit | Co-Advisor |
| 3. Dr. Thanida Sujarittham | Co-Advisor |

The thesis advisory committee, along with the student, recognizes your expertise in Educational Management for Sustainable Development. As such, the graduate school would like to formally invite you to participate in an interview as an expert, where your insights and suggestions will greatly contribute to the advancement of the student's research.

Thank you for considering this invitation.

Yours faithfully

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Thonburi, Bangkok, Thailand
10600

16 October, 2024

Subject Invitation to join an interview as an expert

Dear Associate Professor Wang Hualing

Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert
Dear Associate Professor LI Nan
Attachment Interview Form

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16 October, 2024

Subject Invitation to join an interview as an expert

Dear Associate Professor Ha Ben

Attachment Interview Form

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16 September, 2025

Subject Invitation to participate in the strategic assessment as an expert
Dear Professor Wang Huazhong
Attachment A Strategies Evaluation Form

Ms.Li Mei is a graduate student in the Doctor of Philosophy Program In Educational Management for Sustainable Development program of Bansomdejchaopraya Rajabhat University. She is conducting research entitled "Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province" under the supervision of the following thesis advisory committee:

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| 2. Associate Professor Dr.Narongwat Mingmit | Co-Advisor |
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The primary focus of this research is to enhancing the autonomous learning ability of college students in Shaanxi Province. In light of your expertise in this area, the Graduate School cordially invites you to serve as an expert reviewer for the in-depth examination of the strategies under consideration and to provide feedback on these strategies. Your insights will be instrumental in promoting Autonomous Learning Ability of College Students in Shaanxi Province. We sincerely value your time and consideration of this request.

Thank you for your kind considerations.

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16 September, 2025

Subject Invitation to participate in the strategic assessment as an expert
Dear Professor Guo Shouku
Attachment A Strategies Evaluation Form

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16 September, 2025

Subject Invitation to participate in the strategic assessment as an expert
Dear Professor Li Haxia
Attachment A Strategies Evaluation Form

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16 September, 2025

Subject Invitation to participate in the strategic assessment as an expert
Dear Associate Professor Gao Heyun
Attachment A Strategies Evaluation Form

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16 September, 2025

Subject Invitation to participate in the strategic assessment as an expert
Dear Dr. Liu Xuexue
Attachment A Strategies Evaluation Form

Ms.Li Mei is a graduate student in the Doctor of Philosophy Program in Educational Management for Sustainable Development program of Bansomdejchaopraya Rajabhat University. She is conducting research entitled "Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province" under the supervision of the following thesis advisory committee:

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Appendix C

Research Instrument

Questionnaire
Sustainable Development Strategy of Autonomous
Learning Ability of College Students in Shaanxi Province

Direction

1.This questionnaire is about the Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province. The purpose of this study is to study the current situation of the sustainable development of autonomous learning ability of college students in Shaanxi Province, to formulate strategies for the sustainable development of autonomous learning ability of college students in Shaanxi Province, and to evaluate the sustainable development of autonomous learning ability of college students in Shaanxi Province. Evaluating the adaptability and feasibility of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province

2.This questionnaire is a survey on the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province. It is divided into two parts. The first part is a survey on the personal information of the respondents who filled out the questionnaire, and the second part is a survey on the current situation of autonomous learning ability of college students in Shaanxi Province, with a total of 37questions.

3.Please check your opinion on the improvement of independent learning ability of college students in Shaanxi Province.

Thank you for your cooperation in filling out this questionnaire.

Mrs. Li Mei
Bansomdejchaopraya Rajabhat University

Part I: Respondent Status (Personal Information)

Please tick P in the columns that represent your opinion

1. Your gender:

Male Female

2. You are from:

Urban Rural area

3. Your subject:

Science Liberal Arts Engineering Art

4. Your education type is:

Undergraduate education Vocational education

5. Your current grade:

Freshman Sophomore Junior Senior

Assessment Items	Current situation					Expected situation				
	5	4	3	2	1	5	4	3	2	1
10.You know how to find the information you need										
11.You know how to classify and apply the information you obtain										
12.You can make the most of your study time										
13.you know how to use outside forces to overcome them										
Self-efficacy										
14.You can encourage yourself when you encounter difficulties in learning										
15.You think you can well understand the knowledge in the books and the content taught by the teacher										
16.You can handle any learning task										
17.You are able to work towards defined learning goals										
18.You will pay attention to the learning success or failure of classmates with similar abilities to yourself to motivate yourself										
Learning environment										
19.You can adapt to your dormitory living environment										
20.You often go to the library to study and do your homework in an environment that allows you to concentrate										
21.You can skillfully select and use network resources										

Assessment Items	Current situation					Expected situation				
	5	4	3	2	1	5	4	3	2	1
22.You think a good campus cultural environment is conducive to your study										
23.You will consciously pay attention to the learning behaviors of your role models and accumulate learning experience for yourself										
24.You think teachers' teaching methods have a great impact on learning outcomes										
25.You think it is important to share learning materials with classmates										
26.You think your parents' expectations have a great impact on your motivation to learn										
Self-regulation and control										
27.You can arrange the best study time according to your own learning needs										
28.You can complete independent learning tasks within the specified time										
29.You can continue to implement your original study plan when studying conflicts with other things										
30.You will make full use of library materials to assist your studies										
31.You will make good use of other learning methods when one method cannot meet your learning needs										
32.You still insist on doing it well when you encounter learning content that you are not interested in										

Thank you again for your participation and wish you all the best!

Interview Form for Situation of Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province

Direction:

1.This interview form is about how to formulate situation of sustainable development strategy of autonomous learning ability of college students in Shaanxi Province. The purpose of this study is to formulate situation of sustainable development strategy of autonomous learning ability of college students in Shaanxi Province and to evaluate the situation of sustainable development of autonomous learning ability of college students in Shaanxi Province.

2.This interview form is for expert review. It is divided into 2 parts.

3.Your comments on the interview form will help develop situation of sustainable development of autonomous learning ability of college students in Shaanxi Province. Answering this questionnaire will not affect you personally. The data provided will be an overview and the researcher aims to use the data for research purposes only.

Thank you for your support.

Mrs. Li Mei

A doctoral student in Educational Management for Sustainable Development
Bansomdejchaopraya Rajabhat University

Part I: Personal Information

Interviewer.....Interview Date.....

Interview Time.....Interviewee.....

Gender.....Age.....

Education background.....Position.....

Work place.....

Part II: How to Improve the Sustainable Development of Autonomous Learning Ability of College Students in Shaanxi Province?

<p>1. How to improve the learning motivation of college students in Shaanxi Province?</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p>2. How to improve the learning strategies of college students in Shaanxi Province?</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p>3. How to improve the self-efficacy of college students in Shaanxi Province?</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

4. How to improve the Learning environment of college students in Shaanxi Province?

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5. How to improve the self-regulation and control of college students in Shaanxi Province?

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Suggestion:

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Assessment Form for Validity

Questionnaire Validity Evaluation Form for the Current Situation of the Sustainable Development of Autonomous Learning Ability of College Students in Shaanxi Province

Research Title: Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province

Research Objectives:

1.To study the current situation of autonomous learning ability of college students in Shaanxi Province.

2.To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

3.To evaluate the feasibility of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

Assessor _____

Workplace _____

Position _____

Directions:

When using the questionnaire, please consider the consistency of the questionnaire about whether each of the current situation of autonomous learning ability of college students in Shaanxi Province. After considering it, please check in the corresponding box. Use the following criteria for consideration. Rating is +1. There is an opinion that "Corresponds to definition." Rating is 0. There is an opinion that "Not sure it corresponds to definition." Rating is -1. There is an opinion that "Inconsistent with definition."

No.	College Students' Autonomous Learning Ability in Shaanxi Province	Evaluation result		
		-1	0	1
Learning motivation				
1	You will study hard to be recognized by teachers, family and classmates.			
2	You hope that you can significantly improve your academic performance in a short period of time.			
3	You believe that learning focuses on improving one's own quality and is not limited to academic performance.			
4	You will forget to eat and sleep, and stay up all night to complete a certain assignment in time.			
5	You will work hard to achieve your learning goals.			
6	You will assign yourself more challenging learning tasks.			
Learning strategies				
1	You often develop study plans for each course.			
2	You know how to estimate the completion of your learning tasks.			
3	You will adjust your learning status to the best.			
4	You know how to find the information you need.			
5	You know how to classify and apply the information you obtain.			
6	You can make the most of your study time.			
7	you know how to use outside forces to overcome them.			
Self-efficacy				
1	You can encourage yourself when you encounter difficulties in learning.			

No.	College Students' Autonomous Learning Ability in Shaanxi Province	Evaluation result		
		-1	0	1
2	You think you can well understand the knowledge in the books and the content taught by the teacher.			
3	You can handle any learning task.			
4	You are able to work towards defined learning goals.			
5	You will pay attention to the learning success or failure of classmates with similar abilities to yourself to motivate yourself.			
Learning environment				
1	You can adapt to your dormitory living environment.			
2	You often go to the library to study and do your homework in an environment that allows you to concentrate			
3	You can skillfully select and use network resources.			
4	You think a good campus cultural environment is conducive to your study.			
5	You will consciously pay attention to the learning behaviors of your role models and accumulate learning experience for yourself.			
6	You think teachers' teaching methods have a great impact on learning outcomes.			
7	You think it is important to share learning materials with classmates.			
8	You think your parents' expectations have a great impact on your motivation to learn.			
Self-regulation and control				

No.	College Students' Autonomous Learning Ability in Shaanxi Province	Evaluation result		
		-1	0	1
1	You can arrange the best study time according to your own learning needs.			
2	You can complete independent learning tasks within the specified time.			
3	You can continue to implement your original study plan when studying conflicts with other things.			
4	You will make full use of library materials to assist your studies.			
5	You will make good use of other learning methods when one method cannot meet your learning needs.			
6	You still insist on doing it well when you encounter learning content that you are not interested in .			

Suggestions:

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Sign _____ Assessor

(_____)

Date ____ / ____ / ____

Effectiveness Evaluation Form of Interview Outline on situation of sustainable development strategy of autonomous learning ability of college students in Shaanxi Province

Research Title: Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province

Research Objectives:

1.To study the current situation of autonomous learning ability of college students in Shaanxi Province.

2.To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

3.To evaluate the feasibility of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

Assessor _____

Workplace _____

Position _____

Directions:

When using the interview, please evaluate whether the interview is correct about the strategies for the sustainable development of autonomous learning ability of college students in Shaanxi Province. After the evaluation, please tick the corresponding box. Please evaluate according to the following criteria: -1=does not match the definition, 0=not sure whether it meets the definition, +1=corresponds to the definition.

No.	Questions	Evaluation result		
		-1	0	1
1	How to improve the learning motivation of college students in Shaanxi Province?			
2	How to improve the learning strategies of college students in Shaanxi Province?			
3	How to improve the self-efficacy of college students in Shaanxi Province?			
4	How to improve the Learning environment of college students in Shaanxi Province?			
5	How to improve the self-regulation and control of college students in Shaanxi Province?			

Suggestions:

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Sign _____ Assessor

(_____)

Date ____ / ____ / ____

**Evaluation questionnaire for strategies on Sustainable Development
Strategy of Autonomous Learning Ability of College Students in Shaanxi
Province**

Instruction:

The tool used this time is a questionnaire to evaluate strategies for sustainable development of Autonomous Learning Ability of College Students in Shaanxi Province.

Please consider the questionnaire to evaluate all aspects of strategies for sustainable development of Autonomous Learning Ability of College Students in Shaanxi Province.

Please check each comment box, the score is as follows:

5 indicates the highest adaptability and feasibility.

4 indicates high adaptability and feasibility.

3 indicates average adaptability and feasibility.

2 indicates low adaptability and feasibility;

1 indicates the lowest adaptability and feasibility.

Appendix D

The Results of the Quality Analysis of Research Instruments

The Quality Analysis Results of Research Instruments

The consistency evaluation results of questionnaire survey on the current situation of Sustainable Development of Autonomous Learning Ability of College Students in Shaanxi Province.

No.	College Students' Autonomous Learning Ability in Shaanxi Province	Experts					IOC	Conclusion
		1	2	3	4	5		
Learning motivation								
1	You will study hard to be recognized by teachers, family and classmates.	1	1	1	1	1	1.00	consistent
2	You hope that you can significantly improve your academic performance in a short period of time.	1	1	1	1	1	1.00	consistent
3	You believe that learning focuses on improving one's own quality and is not limited to academic performance.	1	1	1	1	1	1.00	consistent
4	You will forget to eat and sleep, and stay up all night to complete a certain assignment in time.	1	1	1	1	1	1.00	consistent
5	You will work hard to achieve your learning goals.	1	1	1	1	1	1.00	consistent
6	You will assign yourself more challenging learning tasks.	1	1	1	1	1	1.00	consistent
Learning strategies								
1	You often develop study plans for each course.	1	1	1	1	1	1.00	consistent

No.	College Students' Autonomous Learning Ability in Shaanxi Province	Experts					IOC	Conclusion
		1	2	3	4	5		
2	You know how to estimate the completion of your learning tasks.	1	1	1	1	1	1.00	consistent
3	You will adjust your learning status to the best.	1	1	1	1	1	1.00	consistent
4	You know how to find the information you need.	1	1	1	1	1	1.00	consistent
5	You know how to classify and apply the information you obtain.	1	1	1	1	1	1.00	consistent
6	You can make the most of your study time.	1	1	1	1	1	1.00	consistent
7	you know how to use outside forces to overcome them.	1	1	1	1	1	1.00	consistent
Self-efficacy								
1	You can encourage yourself when you encounter difficulties in learning.	1	1	1	1	1	1.00	consistent
2	You think you can well understand the knowledge in the books and the content taught by the teacher.	1	1	1	1	1	1.00	consistent
3	You can handle any learning task.	1	1	1	1	1	1.00	consistent
4	You are able to work towards defined learning goals.	1	1	1	1	1	1.00	consistent
5	You will pay attention to the learning success or failure of classmates with similar abilities to yourself to motivate yourself.	1	1	1	1	1	1.00	consistent

No.	College Students' Autonomous Learning Ability in Shaanxi Province	Experts					IOC	Conclusion
		1	2	3	4	5		
Learning environment								
1	You can adapt to your dormitory living environment.	1	1	1	1	1	1.00	consistent
2	You often go to the library to study and do your homework in an environment that allows you to concentrate	1	1	1	1	1	1.00	consistent
3	You can skillfully select and use network resources.	1	1	1	1	1	1.00	consistent
4	You think a good campus cultural environment is conducive to your study.	1	1	1	1	1	1.00	consistent
5	You will consciously pay attention to the learning behaviors of your role models and accumulate learning experience for yourself.	1	1	1	1	1	1.00	consistent
6	You think teachers' teaching methods have a great impact on learning outcomes.	1	1	1	1	1	1.00	consistent
7	You think it is important to share learning materials with classmates.	1	1	1	1	1	1.00	consistent
8	You think your parents' expectations have a great impact on your motivation to learn.	1	1	1	1	1	1.00	consistent
Self-regulation and control								
1	You can arrange the best study time according to your own learning needs.	1	1	1	1	1	1.00	consistent

No.	College Students' Autonomous Learning Ability in Shaanxi Province	Experts					IOC	Conclusion
		1	2	3	4	5		
2	You can complete independent learning tasks within the specified time.	1	1	1	1	1	1.00	consistent
3	You can continue to implement your original study plan when studying conflicts with other things.	1	1	1	1	1	1.00	consistent
4	You will make full use of library materials to assist your studies.	1	1	1	1	1	1.00	consistent
5	You will make good use of other learning methods when one method cannot meet your learning needs.	1	1	1	1	1	1.00	consistent
6	You still insist on doing it well when you encounter learning content that you are not interested in .	1	1	1	1	1	1.00	consistent

The consistency evaluation results of effectiveness evaluation form of interview outline on situation of Sustainable Development of Autonomous Learning Ability of College Students in Shaanxi Province.

No.	Questions	Experts					IOC	Conclusion
		1	2	3	4	5		
1	How to improve the learning motivation of college students in Shaanxi Province?	1	1	1	1	1	1.00	consistent
2	How to improve the learning strategies of college students in Shaanxi Province?	1	1	1	1	1	1.00	consistent
3	How to improve the self-efficacy of college students in Shaanxi Province?	1	1	1	1	1	1.00	consistent
4	How to improve the Learning environment of college students in Shaanxi Province?	1	1	1	1	1	1.00	consistent
5	How to improve the self-regulation and control of college students in Shaanxi Province?	1	1	1	1	1	1.00	consistent

Reliability analysis of research instruments

Reliability

Scale: all variables

Case handling summary			
		N	%
case	effective	384	100
	Excluded ^a	0	0
	Total	384	384
a. List deletion based on all variables in this program.			

Cronbach reliability analysis results		
Number of items	Sample size	Cronbach α
32	384	0.986

From the above table, we can see that the reliability coefficient α value is 0.986, which is greater than 0.9, which means that the reliability quality of the research data is very high.

Explanation: Analyze the α coefficient. If this value is higher than 0.8, it means that the reliability is high; if this value is between 0.7 and 0.8, it means that the reliability is good; if this value is between 0.6 and 0.7, it means that the reliability is acceptable; if this value is less than 0.6, it means that the reliability is poor.

The Record of Interview Results

Interviewee

Interviewer 1

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I think: 1) Teachers should improve their teaching methods; 2) Teachers should appropriately increase the challenge and difficulty of tasks assigned to students; 3) Teachers should pay attention to students' interests; 4) Teachers should acknowledge students' efforts; 5) Teachers should increase the interest of teaching content; 6) Teachers should set learning goals; 7) Teachers should provide students with learning resources.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I think: 1) Make a good semester plan; 2) Make full use of time at school; 3) Be enthusiastic about learning; 4) Master certain information technology skills; 5) Find a learning method that suits you; 6) Be able to adjust when you are not in a good state; and 7) Use modern technology to improve time utilization.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I think: 1) Teachers should help students master relevant skills; 2) Students should learn from outstanding classmates to improve their abilities; 3) Teachers should affirm students' behavior; 4) Students should build self-confidence; 5) Students should be able to encourage themselves; 6) Teachers should help students achieve their goals.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi

Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I think:1) The counselors organize students to clean the classrooms well to provide a comfortable learning environment for the students.2) Teachers prepare certain learning materials for students before class, both in paper and electronic versions.3) During class, it is necessary to keep the teaching building relatively quiet.4) The librarian should keep the library clean, hygienic and well-ventilated.5) The school's logistics department should maintain the student dormitories to ensure their comfort in terms of hardware.6) Strengthen the construction of campus hardware, such as campus greening, to provide students with a quiet and beautiful campus environment.7) Repair the experimental equipment in time.8) Invite famous people to give lectures.9) Organize more student activities to enhance cohesion.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Teachers should advise students not to put off until tomorrow what they can do today, and must set a deadline when assigning homework; 2) Encourage students to engage in appropriate physical exercise to improve their physical fitness and resilience; 3) Guide students to complete assigned tasks within the specified time; 4) Help students correctly recognize the consequences of their emotions and behaviors, and learn to manage them; 5) Set clear and appropriate learning goals and strive to achieve them; 6) Teachers should guide students to view changes correctly and adapt to them actively.

Interviewer2

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) different teaching methods should be adopted; 2) challenging tasks should be assigned to students; 3) teachers should cultivate students based on their interests; 4) students' efforts should be affirmed; 5) students should be guided to

set goals and encouraged to work towards them; and 6) in-depth communication should be strengthened.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) students can make full use of their after-school time; 2) teachers can inspire students' enthusiasm for learning; 3) students can achieve a balance between work and rest; 4) students can organize and classify relevant learning information; 5) students can develop their own set of learning methods; and 6) students can actively overcome learning obstacles.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Students can achieve success by imitating the behavior of successful people; 2) Students can regularly examine themselves, reflect, and have a dialogue with their own hearts; 3) Building self-confidence is crucial; 4) Use your own familiar methods to encourage yourself; 5) Set small goals for yourself and achieve them; 6) Gain affirmation from others by achieving small goals.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Classes should be organized with around 30 students to achieve small-class teaching; 2) The school should provide each class with necessary learning tools; 3) The school security department should strengthen patrols of teaching buildings and other learning areas to eliminate all noise; 4) Teachers should analyze the learning situation of each class before class and adopt different teaching methods for different classes; 5) The library should regularly purchase new books and materials; 6) The student affairs department should make good use of bulletin boards on campus to create a cultural campus atmosphere; 7) Laboratories should have dedicated personnel

for management and service; 8) Diverse student activities should be carried out to cultivate students' abilities; 9) More academic lectures should be held on campus.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Guiding students to establish clear, specific, and measurable goals. Breaking down large goals into smaller ones enhances students' sense of accomplishment, motivating them to continue. 2) Teachers should help students improve their attention span, cultivating their ability to concentrate in their daily lives. 3) Teachers should help students achieve their learning goals, enhancing their sense of accomplishment. 4) Counselors should guide students from a psychological perspective to learn to control their emotions and become emotionally stable individuals. 5) Encouraging students to actively face challenges and not shy away from them. 6) Students should choose learning strategies based on their individual circumstances, avoiding blind application. 7) Students should always maintain a positive and optimistic attitude.

Interviewer3

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) we should analyze students' characteristics and improve teaching methods; 2) we should appropriately increase the difficulty of learning content; 3) we should guide students to explore new things; 4) we should affirm students more; 5) the learning content should be combined with the points that students care about; 6) we should carry out more heart-to-heart talks; 7) we should set reasonable goals; 8) we should learn from outstanding deeds; and 9) parents should encourage their children more.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Developing a study plan is crucial; 2) Make full use of time outside of class; 3) Cultivate your interest in learning; 4) Avoid over-studying and pay attention to rest; 5) Strive to improve your information acquisition skills; 6) Appropriate learning methods can achieve twice the result with half the effort; 7) Adjust your learning state to its optimal level.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) We should practice our professional skills repeatedly until we become proficient; 2) We should guide students to learn from outstanding students, so that they can improve their own abilities and receive rewards; 3) Counselors should observe the strengths of each student and encourage them; 4) We should conduct regular self-examinations and evaluate ourselves correctly; 5) We should do more of what we are good at to build self-confidence; 6) When we lack motivation, we should encourage ourselves and tell ourselves that we can do it.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Prepare the necessary materials for the practical courses in advance according to their content; 2) Cultivate students' concentration and eliminate learning distractions; 3) Teachers should continuously innovate their teaching methods; 4) Strengthen the construction of library facilities; 5) Keep dormitories clean and tidy; 6) Continuously carry out campus cultural festival activities; 7) Introduce new experimental equipment according to teaching tasks; 8) Guide students to apply knowledge and carry out knowledge practice activities; 9) Teachers should lead students in scientific project research.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Guide students to prioritize tasks, enabling them to assign tasks based on their urgency and importance, and prioritize important and urgent tasks; 2) Guide students to develop and adhere to plans. Develop detailed plans to achieve goals, including specific action steps and timelines. Ensure the plans are feasible and consistently follow them. Even when encountering difficulties, strive to overcome them and do not give up easily; 3) Communicate effectively with those around you and promptly release unpleasant emotions; 4) Not all tasks can be completed alone; guide students to seek help when facing difficulties; 5) Accept change and strive to adapt to it.

Interviewer4

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) Establish clear learning goals; 2) Use different teaching methods to stimulate students' learning enthusiasm; 3) Increase the difficulty of assignments; 4) Cultivate students' spirit of exploration; 5) Give students more positive encouragement; 6) Strengthen communication; 7) Enrich teaching resources; 8) Learn from role models.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Learning goals should be combined with one's own circumstances to formulate a reasonable phased plan; 2) Passion and enthusiasm should be invested in learning; 3) Work-life balance should be maintained; 4) AI tools should be used to assist learning; and 5) AI technology should be used to eliminate learning obstacles.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Teachers should urge students to practice knowledge repeatedly, master it, and improve their skills; 2) Students should say a self-affirming

sentence to themselves in the mirror every day; 3) When the thought "I can't do it" comes to mind, students should be able to quickly adjust and turn it into "I can do it"; 4) Students should not deny themselves and should believe in themselves; 5) Students should set a small goal for themselves every day and achieve it.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Prepare the necessary materials for the practical courses in advance according to their content; 2) Cultivate students' concentration and eliminate learning distractions; 3) Teachers should continuously innovate their teaching methods; 4) Strengthen the construction of library facilities; 5) Keep dormitories clean and tidy; 6) Continuously carry out campus cultural festival activities; 7) Introduce new experimental equipment according to teaching tasks; 8) Guide students to apply knowledge and carry out knowledge practice activities; 9) Teachers should lead students in scientific project research.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe the following should be done: 1) Make a plan, list the tasks to be completed each day, and estimate the completion time for each task. Unless there are unforeseen circumstances, stick to the plan. 2) Cultivate self-discipline, as self-discipline is a key manifestation of willpower. Start with small things in daily life, such as getting up on time, eating regularly, and exercising regularly, gradually developing self-discipline. 3) Complete tasks within the allotted time. This requires not only concentration but also sufficient rest to recharge. 4) When faced with a set goal, try every possible method to achieve it. 5) Learn various learning strategies and find one that suits you. 6) Read more positive and uplifting materials.

Interviewer5

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) Parents should help their children plan their academic and life goals; 2) Children should learn from high-achieving students; 3) Children should communicate and exchange ideas more often; 4) Children should set goals; 5) Children should add new learning content; 6) Children should affirm their achievements; 7) Children should cultivate more interests; and 8) Children should appropriately increase the difficulty of tasks.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) We should plan our spare time reasonably; 2) We should learn successful learning methods and develop our own suitable learning methods; 3) We should use available resources to eliminate learning obstacles; 4) We should reduce our study time when we are not in a good learning state and resume our study activities when we are in the best state; 5) Time is scarce, so we should make full use of it.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Teachers should encourage students to start with simple tasks and repeat them to gain a sense of accomplishment; 2) Teachers should provide timely encouragement when students achieve small results; 3) Students should say positive things to themselves every day; 4) Students should interact with positive and optimistic people to help build a positive mental environment; 5) Students should read inspirational quotes and write them down; 6) Students should set small goals and achieve them to gain a sense of joy from the results.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi

Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Beautify the classroom environment to create a comfortable learning environment; 2) Before each course begins, teachers should explain to students the learning materials they need to prepare for the semester and urge them to prepare before class; 3) Before each class, teachers and students should be required to silence their mobile phones to eliminate interference with learning; 4) Through teaching and research activities, teachers should be guided to continuously improve their teaching methods; 5) Add safety sockets to meet students' computer usage needs; 6) Upgrade experimental software in a timely manner; 7) Strengthen practical teaching; and 8) Encourage students to innovate.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Learn to break down tasks, which makes large tasks easier to complete and helps maintain progress; 2) Strengthen physical exercise to cultivate willpower; 3) Communicate more with people who are emotionally stable and learn their techniques for stabilizing emotions; 4) Analyze various learning strategies and choose the one that best suits your own situation; 5) Consider problems from an optimistic perspective.

Interviewer6

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) Analyze students' characteristics and change teaching methods; 2) Assign challenging tasks; 3) Pay more attention to students' inner needs; 4) Affirm students' efforts; 5) Set appropriate goals; 6) Encourage more communication and exchange among students; 7) Provide students with learning resources in all aspects; 8) Learn from role models; 9) Parents should set appropriate expectations for their children based on their actual situation.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) A reasonable plan is half the battle; 2) Students should be guided to arrange more extracurricular practice and learning; 3) Various methods should be used to stimulate students' enthusiasm for learning; 4) Learning activities and entertainment activities should be balanced; 5) Learning information should be effectively filtered, retaining useful information and eliminating useless information; 6) Learning methods should be continuously adjusted according to one's own actual situation.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) While mastering knowledge, we should repeatedly practice to improve our abilities and apply them to achieve success; 2) We should observe the behavior of outstanding individuals and actively learn from them to improve our own abilities; 3) Teachers should use positive language and attitudes when communicating with students; 4) We should learn to treat ourselves like friends, and when we make mistakes or encounter setbacks, we should not rush to criticize ourselves, but rather give ourselves understanding and support; 5) We should have a full understanding of ourselves and strive to find our strengths; 6) When we encourage ourselves with positive language, we should also take corresponding actions to achieve our goals.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe the following should be done: 1) Increase the number of seats in the library to increase student capacity while ensuring sufficient study space; 2) Strengthen the construction of dormitory facilities; 3) Conduct more campus cultural activities to create a positive campus cultural atmosphere; 4) Encourage teachers to continuously

research and develop diverse teaching methods; 5) Establish good human-computer relationships in student management to create a harmonious learning environment; 6) Guide students to prepare their learning tools in advance; 7) Conduct regular inspections of laboratory hygiene; 8) Combine classroom teaching with online teaching; and 9) Conduct more student competitions.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Avoid procrastination; don't postpone tasks to the last minute, start early and proceed according to plan; 2) Learn to allocate time reasonably based on your abilities and the content of the task; 3) When feeling down, learn to shift your focus and don't dwell on negative emotions; learn to get out of it promptly; 4) Learn to use modern tools such as AI to achieve your goals; 5) Open your mind, embrace change and challenges with a positive attitude, and seek solutions; 6) Analyze the applicable conditions of various learning strategies and find the strategy that suits you best.

Interviewer7

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) We should believe in the power of role models and frequently show students the stories of outstanding students; 2) Parents should set reasonable expectations for their children; 3) We should collect more learning resources; 4) We should organize various forms of heart-to-heart talks; 5) We should have students set learning goals each semester; 6) The teaching content should be combined with current hot topics; and 7) We should explore students' interests in depth.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) one can develop a reasonable study plan based on the learning tasks and one's own situation; 2) one can make reasonable plans and use one's

after-school time; 3) one can enhance one's enthusiasm for learning; 4) one can pay attention to rest and exercise while studying hard; 5) one can quickly collect useful learning information; and 6) one can make full use of modern learning tools to improve time utilization.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Teachers should teach students to practice continuously and hone their skills until they become proficient; 2) Teachers should use gestures or simple comments to acknowledge students' efforts during lessons; 3) When encountering difficulties in learning or life, guiding students to engage in positive self-talk will help them tell themselves, "This is an opportunity for growth, and I have the ability to overcome it"; 4) Don't be ashamed of external praise, and don't think that others' praise is just empty flattery; believe in yourself; 5) Learn to break down the major goals of each semester into several smaller goals and strive to achieve them.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Establishing harmonious teacher-student relationships to create a good learning environment for students; 2) Using mobile phones reasonably to eliminate their interference with learning; 3) Enriching teaching methods and keeping pace with the times to meet students' needs for modern teaching tools; 4) Strengthening the humanistic care of library staff for students to create a happy learning environment; 5) Encouraging students to beautify their dormitory environment in their own preferred way to create a warm living and learning environment; 6) Displaying outstanding achievements on campus for all teachers and students to learn from, creating a strong learning atmosphere on campus; 7) Upgrading laboratory hardware as needed; 8) Guiding students to engage in pioneering learning with their major as the core; 9) Holding more science and technology competitions in various forms.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Learn to refuse unnecessary or unmanageable tasks to protect your time; 2) Parents should set an example of strong willpower for their children; 3) Learn to be tolerant and treat others with a forgiving heart when they hurt you; 4) Be able to flexibly apply appropriate learning methods according to the goals you want to achieve; 5) Be able to adjust yourself in a timely manner according to changes in the external environment; 6) Broaden your horizons and establish a positive mindset.

Interviewer8

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) AI should be used in teaching to stimulate students' learning enthusiasm; 2) The difficulty of homework should be increased; 3) Students should be guided to explore new things; 4) Students' efforts should be positively evaluated; 5) Teaching content should be combined with students' interests; 6) Learning goals should be set for each semester; 7) Students should communicate more with those around them to learn more about things; 8) Students should communicate more with their parents and correctly understand their parents' expectations.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Continuously summarize and form your own learning methods; 2) Be able to solve the difficulties encountered in learning through various means; 3) Be able to continuously adjust your learning state; 4) Find your own interests and continuously learn related knowledge; 5) Participate in more meaningful activities after class and summarize the knowledge points from them; 6) Analyze the actual situation and formulate a semester plan in combination with the course content.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Students should practice continuously until they can complete tasks independently. At the end of the self-study period, it is important to ensure that students can solve problems completely independently and meet the required standards; 2) When interacting with students in class, teachers should affirm their answers more often; 3) Students should learn to reflect on themselves every day and face their behavior positively; 4) Teachers or counselors can help students transform negative thoughts into positive ones.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Before the start of a course, teachers should inform students of the necessary learning materials and guide them to prepare in advance; 2) Faced with temptations outside the campus, teachers should help students resist these temptations and eliminate their interference with their studies; 3) Teachers should be able to change their teaching methods according to the nature of the course; 4) Dormitories are where students spend a lot of time, so counselors should pay attention to students' state in the dormitory and help them eliminate negative emotions in a timely manner if they find any; 5) More campus cultural activities should be carried out; 6) Laboratory management should be strengthened; 7) Students' learning perspectives should be broadened; 8) Competitions should be used to promote teaching and learning.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Teachers and parents should educate students to be responsible, and as college students, actively take on the responsibilities they should

bear; 2) Guide students to analyze the tasks they face, eliminate unnecessary tasks, keep only the ones that must be completed, and make good use of their time; 3) To a certain extent, students should have a contented mindset and learn to give up on things that are unattainable; 4) Once a learning goal is set, it should not be changed easily, and all means should be used to achieve it; 5) Students should actively respond to challenges, and actively seek help from teachers when they cannot solve the problem themselves.

Interviewer9

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) Incorporate diverse teaching methods into instruction to stimulate students' learning enthusiasm; 2) Assign challenging tasks after class; 3) Research students' interests at different stages; 4) Maintain a positive attitude towards students in most situations; 5) Expand teaching content; 6) Use goal-oriented motivation; 7) Maintain communication with those around you; 8) Organize students to watch inspirational videos; 9) Parents should encourage their children more.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Learn to collect valuable learning information; 2) Adjust your learning methods in a timely manner; 3) Seek help when encountering learning obstacles and overcome them; 4) Learn to manage your emotions and strive to adjust your emotional state; 5) Learn to divide your time and make full use of it; 6) Use various methods to tap into your learning enthusiasm.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Repetitive practice is essential for consolidating knowledge and improving skills, and students should be guided to practice repeatedly; 2) When

students make mistakes, teachers should use clever methods to help them correct their behavior and affirm their abilities; 3) Students should be guided to identify their negative thoughts and find ways to eliminate them; 4) Student administrators should help students understand themselves correctly and find their strengths; 5) Students should be helped to achieve small goals and experience the joy of success.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Ensure classrooms have sufficient lighting and ventilation; 2) Prepare necessary learning materials for students in advance; 3) Incorporate smartphone use into teaching activities to reduce unnecessary interference from smartphones; 4) Teachers should learn localized technologies and continuously improve their teaching methods; 5) Continuously upgrade library facilities and transform the library into a popular learning destination; 6) Conduct more cultural and sports activities on campus to create a vibrant campus environment; 7) Take good care of experimental facilities and equipment; 8) Break away from traditional classroom teaching methods and form an open learning format; 9) Establish an effective learning reward and punishment system.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Learning requires skill, and learning methods should be adjusted according to the difficulty of the learning tasks; 2) We should face various difficulties encountered in learning with a positive attitude; 3) We should learn to use modern technology and adapt to modern society; 4) We should use different learning methods to achieve different learning goals; 5) When our emotions are unstable, we can take a break; 6) We should encourage students to participate in more outdoor sports to hone their willpower.

Interviewer10

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) enrich learning resources; 2) guide students to read more inspirational stories; 3) help students correctly understand their parents' expectations; 4) increase the frequency of interaction between teachers and students; 5) set reasonable learning goals; 6) improve teaching content based on the teaching syllabus; 7) encourage students to challenge themselves with new things; and 8) integrate various teaching methods.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) We should develop a scientific study plan each semester and strive to achieve it; 2) We should participate in more practical activities in our spare time; 3) We should strive to cultivate our interest in learning; 4) We should be able to relax appropriately during our busy studies; 5) We should be good at using network technology to collect learning information; 6) We should be able to adjust ourselves in time when we are not in a good learning state and return to our best state; 7) We should be able to mobilize relevant resources to eliminate learning obstacles.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) While requiring students to practice repeatedly, teachers should help them discover the subtle differences in each repetition, achieving a spiral upward trend; 2) When students lack good ideas, teachers can guide them to learn from role models and imitate their behavior, ultimately helping them achieve success; 3) Guide students to humbly accept praise; 4) Guide students to encourage themselves when encountering difficulties, helping them achieve inner strength; 5) Teachers should

advise students not to be overly ambitious but lack practical skills, to start small, strive to solve small problems, and gain a sense of accomplishment.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) In classroom teaching, teachers can guide students to design different learning groups to create a collective learning space and atmosphere; 2) Teachers should enrich teaching content, increase the interest of the lectures, attract students' attention, and reduce external interference; 3) Teachers should continuously improve their teaching methods; 4) The library should have a diverse range of books and materials to meet the different needs of students; 5) Dormitory management personnel should pay attention to the management of public areas in student dormitories and provide convenience for students; 6) Teachers and students should take good care of experimental equipment; 7) Strengthen the supervision of students' online learning; 8) Invite industry personnel to give lectures to students to help them set employment goals.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Students should be guided to make full use of time such as waiting for a bus, waiting for class, or queuing to complete some trivial tasks or simple reading assignments; 2) Students should use their spare time to do part-time jobs to strengthen their willpower; 3) Students should complete the homework assigned in class and not procrastinate until after class, and teachers should play a good role in supervising them; 4) Students should try to control their emotions and learn to regulate their emotions in different situations; 5) Students should learn more new skills and adapt to new changes.

Interviewer11

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) Utilize multimedia technology to showcase various classroom teaching methods; 2) Assign homework beyond the syllabus to encourage students to think more; 3) Capture students' interests; 4) Develop learning plans and set reasonable learning goals; 5) Learn from outstanding examples; 6) Understand parents' expectations and strive to meet them.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Teachers should require students to develop a study plan for each course; 2) Students should be required to make full use of their after-class time by assigning homework; 3) Students should be able to collect useful learning information based on their own study plan and categorize and organize it; 4) Students should develop their own learning methods through continuous adjustment; and 5) Students should be able to find various ways to eliminate learning obstacles.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) When students encounter problems and are unable to solve them, teachers should guide them to learn from outstanding students, imitate their methods, and receive certain rewards; 2) When commenting on students' assignments, teachers should focus on positive aspects and use tactful language to explain the shortcomings; 3) Teachers should encourage students to engage in active self-dialogue and develop a positive mindset; 4) Teachers should encourage students to appropriately attempt to break through their own limitations and take risks to build self-confidence.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe the following measures should be taken: 1) Improve multimedia equipment in classrooms; 2) Prepare learning tools in advance, such as computers and drawing tools, according to the characteristics of the major and courses; 3) Students can use earplugs or noise-canceling headphones to help eliminate external interference during study; 4) Teachers should conduct teaching reform research and carry out teaching work in a variety of ways; 5) Library staff should control the temperature and humidity in the library to provide students with a good learning environment; 6) Student clubs can regularly carry out club activities to guide students to actively participate in activities and create a beautiful campus environment; 7) The school should strengthen the management of laboratories and provide services for students; 8) Strengthen students' practical learning activities; 9) Utilize campus media to promote knowledge and information.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Continuously summarize experiences during the learning process and form your own learning strategies; 2) Integrate more into positive and optimistic groups of people; 3) Improve your practical skills and solve various challenges you encounter; 4) Minimize the use of various social networking sites or apps and concentrate your energy on learning activities during study time; 5) When organizing group activities, student administrators should reduce activities that are not very meaningful and waste time.

Interviewer12

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) we should study students' needs and interests; 2) we should give students more affirmation; 3) we should continuously expand new knowledge around the teaching content; 4) we should set corresponding learning goals at different stages and work hard to achieve them; 5) we should strengthen communication among students; 6) teachers should introduce more learning resources to students; 7) we should spread the stories of outstanding students among students; and 8) parents should communicate more with their children and jointly plan their learning blueprint.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) We should regularly review our learning progress against our study plan; 2) We should learn to relax and adjust our state amidst heavy academic workloads; 3) In the context of the information age, we should learn to use information technology to obtain learning information; 4) When encountering learning obstacles, we should use modern technology to overcome them and open up learning channels; 5) We should be able to arrange our time scientifically and reasonably to improve the utilization rate of our time; 6) We should be able to adjust our learning state according to the situation.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) When students are at a loss, teachers can appropriately tell them some successful cases and let them imitate them; 2) Teachers should guide students to do targeted repetitive exercises; 3) Student managers should give students more approving looks; 4) When they have negative emotions, they should adjust their mindset in time and have positive self-talk; 5) Enhancing self-efficacy is mainly about building self-confidence and believing in oneself.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi

Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Counselors should focus on beautifying the classroom environment by placing green plants, which can also reduce students' visual fatigue and create a comfortable learning environment; 2) Before class, teachers should urge students to prepare their learning materials and tools in advance; 3) Class leaders should fully utilize their management role to maintain order during after-class learning, eliminate distractions, and maintain a quiet learning environment; 4) Teachers should improve teaching methods for different types of courses, organize different teaching formats, and create a good learning environment and atmosphere; 5) The library should provide as many semi-enclosed study seats as possible to create relatively independent spaces for students; 6) The campus environment should be continuously beautified to provide students with beautiful outdoor learning spaces; 7) New experimental equipment should be added according to teaching needs; 8) Online learning activities should be strengthened; 9) Learning competitions should be held among students.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Student administrators should take the lead in time management, and students will imitate and learn from them, gradually forming a habit; 2) Cultivate college students' awareness of solving their own problems and minimizing the need to ask others for help; 3) Guide students to categorize the tasks around them and complete them one by one according to their size and urgency; 4) When encountering unpleasant things, students should find an outlet for their emotions; 5) Students should master multiple learning methods to cope with different learning goals and tasks; 6) Students should view changes correctly and continuously improve themselves through learning; 7) Students should read more positive and uplifting information to cultivate a positive mindset.

Interviewer13

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) Assign more open-ended assignments to students to stimulate their creativity; 2) Observe more and understand students' interests; 3) Affirm students' efforts regardless of the outcome; 4) The teaching content should not be limited to the textbook; 5) Use goal-oriented motivation; 6) Push learning resources to students through multiple channels; 7) Introduce more inspirational stories to students.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) University learning is not only about classroom learning, but more importantly, about seizing the time outside of class for independent learning; 2) One should be enthusiastic about learning and constantly cultivate and maintain that enthusiasm; 3) One should also pay attention to rest while studying to ensure physical and mental health; 4) In the information age, it is necessary to master essential information skills to help improve learning efficiency; 5) One must find a learning method that suits oneself.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Encourage students to achieve small goals every day, and accumulate them to achieve big goals over time; 2) Guide students not to compare themselves too much with others, and to believe in themselves; 3) Guide students to learn to embrace themselves and have positive self-talk; 4) Student administrators should affirm students more often; 5) Encourage students to learn from successful experiences and emulate them.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi

Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) While focusing on the hardware facilities for learning, we should also pay attention to the software environment, especially interpersonal relationships among students. Teachers and counselors should pay special attention to the interpersonal relationships among students in the class, strive to coordinate relationships among classmates, and create a harmonious learning atmosphere; 2) For special materials required in practical courses, the school should prepare them for students in advance. For materials that students need to prepare themselves, they should be informed in advance; 3) In terms of student seating arrangements, students should maintain an appropriate distance to eliminate interference between deskmates; 4) Teachers should use modern and advanced tools in their lectures to meet the needs of modern students and create the best learning atmosphere; 5) The library should be divided into multifunctional zones, such as quiet study areas, collaborative discussion areas, and leisure reading areas, to provide students with different options for studying; 6) A teacher ethics and conduct ranking and outstanding student deeds can be displayed on campus, along with interactive electronic screens to display campus honors, forming a good campus learning atmosphere; 7) Experimental equipment should be checked during holidays to ensure the smooth conduct of teaching activities; 8) Learning interest groups should be formed; 9) A learning reward and punishment system should be established.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) We should learn to view problems from both positive and negative perspectives to cultivate a positive mindset and emotions; 2) We should set time limits for students to complete tasks and establish a reward and punishment system to reward those who complete tasks on time and punish those who do not; 3) We should cultivate students' willpower through physical exercise; 4) When assigning tasks, teachers should determine the completion standards in advance to avoid rework;

5) We should guide students to view changes correctly, analyze the opportunities within those changes, and guide them to seize those opportunities in a timely manner; 6) We should flexibly adjust and apply learning strategies according to the learning tasks.

Interviewer14

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) Make more use of online resources to recommend learning materials to students; 2) Use real-life inspirational stories to motivate students; 3) Parents should help their children make life plans based on their characteristics; 4) Guide students to set phased goals and achieve them through action; 5) Broaden students' knowledge; 6) Affirm students' efforts regardless of the outcome; 7) Explore students' potential needs in depth.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Before carrying out any activity, it is necessary to formulate a reasonable plan and to continuously review and adjust the plan based on the actual situation; 2) Use after-school time to learn more new skills; 3) Always maintain enthusiasm for learning; 4) When encountering a bottleneck in learning, analyze the reasons and seek external help to adjust and solve the problem; 5) When one's learning state is not good, one should use methods one likes to adjust one's state; 6) Make full use of time.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Guiding students to practice relevant skills repeatedly until they can summarize the techniques themselves and share them with others; 2) Guiding students to complete relevant tasks through imitation, and summarizing from the experience to transform it into their own knowledge and abilities; 3) Teachers should

provide more positive guidance to students in school to help them build an optimistic mindset; 4) Guiding students to shift their attention to how to solve problems can help them break free from negative emotions and stimulate their inner positive power; 5) Having a correct view of oneself and striving to discover one's own strengths.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) the learning space should be kept spacious and clean; 2) students should be informed of the learning guide in advance and advised to prepare necessary learning tools; 3) teachers should manage classroom discipline during lectures and reduce learning interference through human intervention; 4) an advanced RFID self-service book borrowing and returning system should be introduced to improve the efficiency of students borrowing and returning books; 5) the campus leisure areas should be improved to create outdoor reading areas; 6) intelligent laboratories should be established to keep pace with the times; 7) students should be encouraged to engage in interdisciplinary learning; and 8) a strong learning atmosphere should be fostered in the classroom.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Students should make good use of their spare time to engage with society, understand its changes and needs, and accept these changes; 2) Students should be encouraged to participate in more physical exercise; 3) Students should be guided to categorize their learning tasks and address similar problems together to avoid frequent switching and wasting unnecessary time; 4) Counselors should pay attention to changes in students and communicate with students who are in low spirits to help them overcome negative emotions; 5) Learning strategies should not be applied rigidly but adjusted according to the actual situation; 6) Students should strive to maintain a positive attitude at all times.

Interviewer15

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) change traditional teaching methods; 2) increase the difficulty of tasks; 3) cultivate students' interest in learning; 4) delve deeper into the teaching content to attract students' attention; and 5) stimulate learning motivation through evaluation activities.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Teachers and counselors can guide students in developing study plans; 2) After-school classes should organize club activities and encourage students to participate actively; 3) Schools should establish various clubs with diverse formats and encourage students to participate actively to stimulate their interest; 4) Learning should be fun and engaging, with a balance between work and rest; 5) AI skills lectures should be held for students to teach them how to use AI to assist in learning; 6) Learning experience exchange meetings should be organized for students to learn from each other's strengths and weaknesses and improve together; 7) Students should always maintain their best state of mind when studying.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Teachers should help students set small goals and achieve them through their own efforts; 2) Teachers should guide students to constantly encourage themselves and inspire their fighting spirit; 3) Maintain a healthy mindset and communicate more with positive people; 4) In order to better establish positive self-dialogue, we can spend some time each day recording our inner dialogue and reflecting on it; 5) Based on the learning content, teachers should assign a certain amount of

homework to students so that they can practice repeatedly and improve their proficiency.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Teachers should use modern AI tools to design classroom games to enhance the fun and relevance of learning; 2) Students should be guided to sit in the front row during class to improve their concentration; 3) Multiple smart classrooms should be established and made freely accessible to students; 4) Intelligent lighting systems should be installed in the library to automatically adjust the color temperature based on the intensity of natural light and reduce glare; 5) Local cultural elements should be incorporated into the campus, such as building a cultural corridor and a cultural wall; 6) Laboratory management and usage regulations should be improved; 7) Students should be encouraged to take more elective courses; and 8) Learning interest groups can be established in classes.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Students should be guided to use time management applications, time tracking tools, and other technologies to help with time management; 2) Students should improve their ability to handle unexpected situations and learn to deal with emergencies; 3) School counselors should introduce methods for stabilizing emotions from a psychological perspective; 4) When setting learning goals, corresponding methods for achieving those goals should be determined; 5) Students should actively explore new things and improve their ability to cope with changes; 6) Students should be able to flexibly use learning strategies for specific learning content.

Interviewer16

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) Use the internet to introduce learning resources to students; 2) Communicate more with outstanding students and learn from their learning experiences; 3) Communicate frequently with teachers; 4) Guide students to break down the overall goal into smaller goals and achieve them one by one; 5) Develop engaging and informative teaching content; 6) When facing results, emphasize students' efforts and hard work; 7) Based on the learned content, teachers should assign students tasks with a certain level of difficulty.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Each instructor should guide students in planning their course during the first class; 2) More practical activities should be conducted after class to enhance students' learning abilities; 3) Students should maintain an optimistic attitude and be enthusiastic about learning activities; 4) Students should communicate with classmates or teachers when they are not in a good learning state and adjust their state in a timely manner; 5) Students should analyze their learning tasks and allocate reasonable time to complete them.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) It is essential to help students build self-confidence. Teachers can use the success stories of previous students to inspire students to be confident in themselves. 2) Teachers should help students make learning plans and summarize their achievements at the end of each semester, continuously moving closer to the overall goal. 3) Positive self-talk should not only be limited to language but also reinforced through actions. 4) Students should receive more positive feedback from the outside

world. 5) When encountering problems that cannot be solved, students can first imitate the practices of successful people and summarize their experiences after achieving success.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Organizing students to design campus cultural and creative products, and transforming outstanding results into actual landscapes (such as painted manhole covers, graffiti on chairs, etc.), is both a display of achievements and a way to build a campus cultural atmosphere; 2) Through the civilized dormitory evaluation activity, student administrators can guide students to independently create a beautiful living and learning environment; 3) Adding ergonomic chairs and reading tables to the library to alleviate fatigue from prolonged sitting; 4) Teachers should pay attention to student evaluations, continuously analyze and reflect on the teaching process, improve teaching methods, and meet learning needs; 5) Introducing the use of mobile phones into teaching can reduce other distractions for students' learning; 6) Teachers and students should work together to maintain a good laboratory learning environment; 7) Teachers and students should work together to complete research projects; 8) The college should strengthen management and create a good learning atmosphere.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Student administrators should organize more outdoor activities to strengthen students' willpower, such as mountain climbing and cross-country races; 2) Students should avoid being overly perfectionistic and learn to complete tasks within reasonable limits; 3) Specific timeframes should be set for completing tasks; 4) Psychological tests should be conducted to help students understand themselves correctly and use scientific methods to control their emotions; 5)

Students should be encouraged to view problems from a positive perspective and maintain an optimistic attitude.

Interviewer17

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) we should study students' learning situation and improve teaching methods; 2) we should assign students creative and challenging tasks; 3) we should understand students' inner needs through psychological testing; 4) teachers should extend the teaching content; 5) we should inspire students' learning motivation with goal-oriented teaching; and 6) we should help students correctly understand their parents' earnest expectations.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Counselors should guide students to develop study plans and supervise their implementation; 2) After-school time should be used to guide students to engage with society, learn about its needs, and improve their skills to meet those needs; 3) A balance between work and rest is essential for improving learning efficiency; 4) Students should learn to collect and categorize learning information to enhance their learning efficiency; 5) Finding the right learning method is crucial; the best method is the one that suits you best; 6) When students are unable to overcome learning obstacles on their own, they should seek help from teachers to ultimately eliminate those obstacles.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) When arranging class activities for students, counselors should try to combine them with students' strengths to help them succeed and build self-confidence; 2) Counselors should have regular conversations with students and give

them more positive feedback; 3) Outstanding students should be organized to share their successful experiences, and teachers should guide students to learn from these experiences and apply them in practice; 4) Teachers should guide students to carefully analyze their strengths and weaknesses, and set achievable goals based on their actual situation. The achievement of multiple small goals will eventually accumulate into the achievement of a larger goal.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe the following should be done: 1) Integrate smartphones into teaching as a learning tool. Teachers can guide students to use smartphones to consult literature in class, expand their learning information, and eliminate the interference of smartphones on students; 2) Ensure adequate lighting in classrooms; 3) Teachers should create electronic files for students, analyze the trends in student performance, and appropriately adopt differentiated teaching methods; 4) Teachers can lead students in making minor modifications to the campus environment, such as using 3D printing technology to create directional signs and painting certain areas of the campus, which not only beautifies the campus environment but also cultivates students' practical abilities; 5) Strengthen the laboratory management mechanism; 6) Encourage students to participate in more subject competitions; 7) Rank students' learning outcomes in stages.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) I should carefully summarize my own learning characteristics, form my own set of learning strategies, and apply them flexibly; 2) I should strive to maintain my vitality and keep a positive attitude; 3) I should analyze the ways to achieve my goals and use appropriate methods to achieve them; 4) When my emotions are unstable, I should communicate with my teacher or counselor in a timely manner

and adjust my emotions as soon as possible; 5) At the end of each day, I should calm down and reflect on my behavior and make necessary adjustments and improvements.

Interviewer18

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) We should utilize modern technology to diversify teaching methods and meet the diverse needs of students; 2) We should design challenging tasks for students based on their learning progress; 3) We should study the needs and interests of students at different stages; 4) We should appropriately add fresh topics to the teaching content; 5) We should set clear learning goals for the new semester; and 6) We should encourage students to emulate the best learners.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) AI technology should be used to help students develop learning plans; 2) After-school time should be used for part-time jobs to improve practical skills; 3) Students should be given more encouragement to stimulate their interest in learning; 4) While lecturing, teachers should also introduce students to methods for obtaining learning information to help them learn how to learn; 5) Teachers should help students find learning methods that suit them.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Encourage students to continuously learn new skills or delve deeper into their areas of strength to increase their confidence and build self-assurance; 2) Frequently tell themselves positive things and give themselves positive self-affirmations such as "I can do it, I can do it"; 3) Provide students with examples of successful students from our school and encourage them to learn from them; 4) Guide

students to view problems positively, to see society from a positive perspective, and to give them more positive feedback.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) The school's logistics department can plant seasonal flowers around the teaching buildings to beautify the campus, enhance its aesthetic appeal, and improve the mood of teachers and students; 2) Ensure the normal operation of network facilities in the library area to facilitate students' online learning; 3) Teachers should create a free-spirited learning environment, guiding students to minimize tension and engage in learning in a relaxed state; 4) Teachers should recommend learning websites to students, guiding them to utilize online resources to broaden their learning content; 5) Counselors should urge students to clean classrooms, maintaining a clean and tidy environment to create a comfortable learning environment; 6) Experimental equipment should be maintained and serviced promptly; 7) More practical teaching activities should be conducted; 8) Learning interest groups should be established as needed.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) Encourage students to participate in various competitions, guide them to view winning and losing correctly, and improve their resilience; 2) Carefully analyze the tasks they need to complete, and delegate some tasks to others to reduce their burden and save time; 3) Guide students to view the function of the school's psychological center correctly, and encourage them to actively communicate with mental health teachers to relieve their unpleasant emotions; 4) In order to complete learning tasks, students should adjust their learning methods according to the characteristics and nature of the tasks; 5) Teachers should assign students appropriate and challenging learning tasks and guide them in completing them.

Interviewer19

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) we should tell students about the deeds of role models; 2) we should provide students with more learning resources related to their majors; 3) we should encourage more communication and exchange among students; 4) we should set reasonable goals; 5) we should study the teaching content and expand on it appropriately; and 6) we should give students positive feedback.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) Guiding students to balance work and rest during learning is essential for achieving optimal learning outcomes; 2) Teachers should observe students' characteristics during lectures and use different methods to cultivate their learning interest; 3) In addition to classroom instruction, teachers should provide guidance to students after class; 4) University time is limited, and teachers should guide students to make the most of their time; 5) Teachers should pay attention to students and guide them to adjust their learning when they are not in a good state; 6) Teachers should advise students that when they encounter difficulties in their studies and cannot solve them on their own, they must seek help from classmates and teachers to overcome the difficulties; 7) In this ever-changing era, developing effective plans is still very necessary.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) Teachers should assign more practical learning tasks to students and emphasize continuous experimentation and summarizing practical skills; 2) Students should be guided to learn from the practices and experiences of successful people when encountering problems, and apply these practices and experiences to practice, adjust continuously, and ultimately achieve success; 3) Appropriately reviewing

one's past achievements helps build self-confidence; 4) When one's motivation is insufficient, one should learn to motivate oneself, such as by reading about the success stories of famous people or listening to inspirational songs.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) The library should solicit students' opinions on book needs and purchase diverse learning resources for them; 2) To beautify the campus environment, in addition to focusing on the campus's hardware facilities, attention should also be paid to the campus's cultural atmosphere; 3) Teachers should continuously learn and improve their teaching methods to meet diverse needs as much as possible; 4) Teachers should guide students to be enthusiastic about their studies and reduce external temptations and distractions; 5) Before the start of each semester, counselors should hold class meetings to guide students in preparing for the new semester's studies; 6) Experimental equipment should be checked before each experimental task begins; 7) Students should be included in teachers' research projects to participate in the research; 8) The assessment methods for students should be reformed to encourage students to study.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) We should not blindly or excessively trust various learning strategies, but flexibly adjust them according to the learning task; 2) We should design small incentive mechanisms to motivate ourselves to maintain good time management habits; 3) Teachers should pay attention to students' changes during class, communicate with students in a timely manner, and guide students to alleviate negative emotions; 4) Teachers should introduce students to the changes and challenges in today's society in class and guide students to prepare for them.

Interviewer20

1.Regarding the current situation and problems of learning motivation in Shaanxi Province's college students' self-learning ability sustainable development strategy and how to improve their learning motivation.

I believe that: 1) Assign homework tasks appropriately ahead of time, in conjunction with the learning content; 2) Develop diversified teaching methods; 3) Interest is the best teacher; 4) Use the achievements of outstanding students to stimulate learning motivation; 5) Parents should strengthen communication with their children to help them correctly understand their parents' good intentions and expectations.

2.Regarding the current status and problems of learning strategies for the sustainable development strategy of self-learning ability of college students in Shaanxi Province, and how to improve their learning strategies.

I believe that: 1) University class time is limited, and most of the after-class time needs to be guided to be planned reasonably and made full use of the time to improve one's abilities; 2) Interest is the best teacher, so it is necessary to fully explore and cultivate students' interests; 3) Mastering information technology is crucial, and at the same time, one should learn to use information technology to collect learning information and improve learning efficiency; 4) Continuously adjust one's learning methods; 5) When facing learning obstacles, one should mobilize various resources to eliminate them; 6) Plan reasonably and make full use of university time.

3.Regarding the current status of self-efficacy in the sustainable development strategy of self-learning ability of college students in Shaanxi Province and how to improve students' self-efficacy.

I believe that: 1) students should be guided to start with small things and achieve small goals step by step; 2) when they have negative emotions, they should be encouraged to keep moving forward; 3) they should start from their best areas, enjoy the joy of success, and improve their self-confidence; 4) they should constantly reflect on themselves and have positive dialogues with themselves; 5) they should use their abilities to help others and gain praise and recognition from others.

4.Regarding the current status of the learning environment for the sustainable development strategy of college students' self-directed learning ability in Shaanxi Province and how to create a more favorable learning environment for cultivating self-directed learning ability.

I believe that: 1) Relevant school departments should continuously upgrade and renovate the hardware environment of classrooms to meet the needs of modern teaching and learning; 2) Teachers should recommend excellent online resources to students through online push notifications and guide students to preview and learn in advance; 3) Teachers should strengthen classroom management; 4) AI tools should be introduced into classroom teaching to continuously improve teaching methods; 5) Training for dormitory administrators should be strengthened to create a better dormitory environment for students; 6) Laboratories should be upgraded and renovated during holidays; 7) Teachers should guide students to participate in social practice activities; and 8) The learning achievements of outstanding students should be exhibited.

5.Regarding the current situation of self-regulation and control of college students' self-learning ability in Shaanxi Province and how to improve students' self-regulation and control abilities.

I believe that: 1) We should apply the learning strategies we have mastered flexibly; 2) We should adapt to social changes by constantly changing ourselves; 3) Counselors can organize more class activities to help students release learning pressure and stabilize their personal emotions; 4) We should encourage students to participate in some challenging outdoor sports or competitions; 5) When we are tired from studying, we can relax appropriately and then get back to studying.

Appendix E
Certificate of English

**BS
RU** BANSOMDEJCHAOPRAYA
RAJABHAT UNIVERSITY

This is to certify that

Mrs. Li Mei

Achieved BSRU English Proficiency Test (BSRU-TEP) level

C1

Given on 15th August 2025



(Assistant Professor Dr Kulsirin Aphiratvoradej)

Director

Appendix F

The Document for Acceptance Research



**The Editorial Board of International Education Studies
Canadian Center of Science and Education**

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November 26, 2025

Dear Li Mei,

Thanks for your submission of paper to *International Education Studies*.

We have the pleasure to inform you that your manuscript has been accepted for publication. It will be published on the Vol. 19, No. 3, in June 2026.

Title: Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province

Authors: Li Mei, Sunate Thaveethavornsawat, Narongwat Mingmit & Thanida Sujariththam

If you have any questions, please do not hesitate to contact with us.

Sincerely,

Chris Lee

On behalf of,
The Editorial Board of *International Education Studies*
Canadian Center of Science and Education

Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province

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Abstract

The objectives of this research were 1) to investigate the current status, expected development, and influencing factors of autonomous learning ability among college students in Shaanxi Province; 2) to formulate a sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province; 3) to assess the feasibility of implementing this strategy. The research sample includes 384 questionnaire respondents (college students in Shaanxi Province) and 20 interview experts, all from the higher education sector in Shaanxi Province, selected through random proportion sampling. The research tools include: 1) questionnaires; 2) interviews; 3) evaluation Form. Data analysis was conducted using percentages, means, standard deviations, and content analysis.

The research results show that: 1) the current status of autonomous learning ability among college students in Shaanxi Province is at a moderate level; 2) the sustainable development strategy for the autonomous learning ability of college students in Shaanxi Province includes five aspects: learning motivation, learning strategies, self-efficacy, learning environment, and self-regulation and control, there are 46 measures in total; 3)The adaptability and feasibility assessment results of each strategy are at a relatively high level, with the highest level being "high".

Keywords: Development of strategies, Sustainable development, Autonomous Learning Ability, Shaanxi Province

1.Introduction

UNESCO proposed that "lifelong learning is the concept of survival in the 21st century. Without the awareness and ability of lifelong learning, it is difficult to survive in the 21st century." In 2015, UNESCO adopted and released the "Education 2030 Framework for Action" at its headquarters in Paris, which clearly aims to "get opportunity for everyone to learn for life". Improving autonomous learning ability is an important way to achieve lifelong learning goals. As an important learning ability for college students, autonomous learning ability has been valued by more and more scholars. Many colleges and universities place the cultivation of college students' autonomous learning ability in an important position in the goal of talent cultivation. Under the guidance of the educational thought of "students as the main body" and the concept of "lifelong education", autonomous learning ability has also become one of the key research directions of scholars at home and abroad.

Yin Haiqiang (2020) believes that the cultivation of autonomous learning ability is of great significance to college students' college study and future development. "It determines the sustainable development potential of college students in the future."

Wen Li (2022) through research on the innovation of the English autonomous learning model, found that autonomous learning can not only improve scholars' self-management, but also enable scholars to rationally use diversified information channels to collect learning resources, and then adjust their own learning status in a timely manner to improve learning efficiency.

Many studies on how to improve college students' autonomous learning ability. These studies are based on different disciplinary perspectives. Psychology focuses on the impact of personal psychological factors on college students' autonomous learning ability (Bandura,1993; Wang Jingqiong, 2010; Xu Jinfen, 2014). Education focuses on the impact of teaching on college students' autonomous learning ability (Yu Li, 2010; Wu Yuanyuan, 2011; Liu Huadong, 2016; Feng Qihong, 2017).

This study conducted a survey of several universities in Shaanxi Province and found that the educational concept of autonomous learning in some universities has not yet been fully formed. There are many areas where teachers' teaching designs to

cultivate university students' autonomous learning abilities are not optimistic. The actual teaching of autonomous learning abilities still has many shortcomings.

1.1 Research Questions

The main research questions of this project are:

1. What is the current situation and expected situation of the autonomous learning ability of college students in Shaanxi Province?

2. What are the sustainable development strategies for the autonomous learning ability of college students in Shaanxi Province?

3. What is the feasibility of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province?

1.2 Research Objectives

1. To study the current situation and expected situation of autonomous learning ability of college students in Shaanxi Province.

2. To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

3. To evaluate the feasibility of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

1.3 Literature Review

The researchers analyzed the literature, concepts, theories, and research related to college students' autonomous learning ability.

1) Definition of strategy

Many scholars have explored the concept and definition of strategy. Research has been conducted from different angles and different decision-making purposes.

M Treacy & F. Wiersema (1995) believe that the basic composition of strategy is through three "laws of value", namely operational excellence, customer intimacy and product leadership;

Michael Porter (1996) strategy is what an enterprise does the essence of the combination of methods (policies) and ultimate goals to achieve goals is to connect a company with its environment and build a comprehensive and systematic strategic analysis system from value chain, competitive strategy and other systems;

Fred Nickols (2000) believes that strategy is a complex network that provides general guidance for specific actions and is the thoughts, ideas, insights, experiences, goals, ambitions, memories, perceptions and expectations for the pursuit of specific ultimate goals.

Strategy involves analyzing external and internal factors to plan and make decisions that align with goals and visions (Popov, 2023).

2) Concept of Autonomous Learning of College Students

David Little (D. Little, 1991) believes that autonomous learning refers to the ability of learners to decide and implement independent behaviors during the learning process.

Professor Pintrich, 2000 (from The University of Michigan) believes that autonomous learning is a way of learning, and his research on autonomous learning tends to think that autonomous learning is a learning process.

The scholar Pang Weiguo (2003) mainly elaborated the connotation of autonomous learning from four levels. "Ability to learn" means that learners have the ability to carry out autonomous learning behavior in the learning process.

3) Evaluation of college students' autonomous learning ability

Xie Jiashu (2004) and other scholars have compiled the college students' learning autonomy scale, which is suitable for measuring the autonomous learning ability of Chinese college students.

Yuan Hongmei (2006) believes that the learning autonomy scale includes four dimensions: self-regulation, learning strategies, content and environment, and learning motivation.

Hu Jiehui (2011) is mainly divided into six aspects: learning motivation, learning confidence, learning strategy knowledge, target content, strategy knowledge and learning skills.

Wang Tian (2014) through the study of previous questionnaire independently compiled the questionnaire about college students' autonomous learning, the questionnaire mainly around the learners in autonomous learning in learning willingness, learning methods, learning time, learning results and learning environment, the content of the five aspects of the survey.

Zhang Lifeng and Xiang Rong (2023) constructed an autonomous learning ability evaluation index system by sorting out the research on autonomous learning ability by domestic and foreign scholars and combining the outstanding characteristics of the training of design professionals in Sino-foreign cooperative education, including 3 dimensions and 7 items. Secondary indicators and 25 third-level indicators.

Zhou Liqiu and Wu Ling (2024) explored the autonomous learning ability of college students' ideological and political theory. They can clarify the evaluation ideas of college students' autonomous learning ability of ideological and political theory from three dimensions: evaluation subject, evaluation content, and evaluation method, and divide the content dimensions of ability evaluation into: There are four levels of learning awareness ability, strategic coordination ability, reflective evaluation ability and theory application ability.

2.Method

This research used a mixed method. Mainly includes questionnaire survey research and interview research. This research is divided into 3 phases.

Phase 1: To study the current situation of autonomous learning ability of college students in Shaanxi Province.

The Population:

The total number of students in this study is 148,789 from 10 universities in Shaanxi Province. These 10 schools are representative and are distributed in the three regions of northern Shaanxi, central Shaanxi (guan zhong) and southern Shaanxi.

The Sample Group:

The researcher used Krejcie and Morgan's Table (1970) to determine the sample size. The sample size was 384.

Research Instrument:

Questionnaire.

After designing a questionnaire and conducting an IOC test on it, the questionnaire was distributed to 10 universities in Shaanxi Province. A total of 400 questionnaires were distributed, and finally 384 valid questionnaires were obtained.

Data Collection:

- 1) Ask for permission for data collection.
- 2) Collect data from the assigned students using the developed questionnaire.

Data Analysis:

Descriptive statistics, frequencies, and percentages were used to analyze demographic variables. Descriptive statistics, means (\bar{X}), and standard deviations (S.D.) were used to analyze variables related to the sustainable development of autonomous learning ability among Shaanxi university students. To minimize the influence of irrelevant variables, an in-depth analysis of the components of the effectiveness of the sustainable development of autonomous learning ability among Shaanxi university students was conducted.

Phase 2: To develop a sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The Population/The Sample Group:

The subjects of this study are 20 college administrators and teachers from 10 colleges and universities in Shaanxi Province, among which each school selects 1 college administrator and 1 teacher.

Research instrument:

Structured interview. A total of 20 university administrators and teachers from 10 institutions were interviewed.

Data Collection:

Interview.

1. Summarize the analysis results of the questionnaire on the status quo of college students' autonomous learning ability in Shaanxi Province, and formulate the interview outline.

2. 10 universities as interview schools. A total of 20 university administrators and teachers were interviewed, and one university administrator and one teacher were selected from each school..

3. Select interviewees according to requirements.

4. Conduct an interview. The researchers distributed an interview outline to interviewees.

5. Interview data analysis. After the interview, organize the content of the interview.

Data Analysis:

Content analysis.

Phase 3: To evaluate the feasibility and applicability of the sustainable development strategy of autonomous learning ability of college students in Shaanxi Province.

The Population/The Sample Group:

Evaluation Expert. The evaluation experts in this study are 5 experts from 10 universities, including 3 experts from undergraduate colleges and 2 experts from vocational colleges.

Research instrument:

Evaluation Form. The evaluation form is mainly used to evaluate the feasibility and adaptability of the strategy.

Data Collection:

Evaluation Expert. 5 experts evaluated the feasibility and adaptability of the strategies and collected and summarized the evaluation results.

1. Design an evaluation form and check its correctness, feasibility and applicability.

2. Invite 5 experts to participate in the strategy evaluation.

3. After the evaluation, analyze the evaluation content and data.

Data Analysis:

Using the mean value and standard deviation to analyze the adaptability and feasibility evaluation of the strategy of improving college students' autonomous learning ability for sustainable development in Shaanxi Province.

3.Results

In the study “Sustainable Development Strategy of Autonomous Learning Ability of College Students in Shaanxi Province”, the researcher studied the documents concerning the following.

Part I: Analysis of the basic personal information of the respondents in the questionnaire

The results of the analysis of the basic personal information of the respondents in the questionnaire are based on gender, place of origin, discipline, level, and current grade.

A total of 384 valid participants were involved in this study. Among the respondents, 99 were boys, accounting for 25.78%; 285 were girls, accounting for 74.22%. 104 students from urban areas, accounting for 27.08%; 280 students in rural areas, accounting for 72.92%. 160 science students, accounting for 41.67%; 155 liberal arts students, accounting for 40.36%; 43 engineering students, accounting for 13.8%; 16 art students, accounting for 4.17%. 249 undergraduates, accounting for 64.84%; 135 higher vocational students, accounting for 35.16%. 24 freshmen, accounting for 6.25%; 261 sophomores, accounting for 67.97%; 94 junior students, accounting for 24.48%; 5 senior students, accounting for 1.3%. This sample is randomly selected from the selected 10 universities according to the proportion of students, which meets the requirements of random proportional sampling.

Part II: Analysis of the overall situation and expectations of the sustainable development of college students' autonomous learning ability in Shaanxi Province

From the current situation, the overall sustainable development level of college students' autonomous learning ability in Shaanxi Province is above average, ($\bar{X}=3.40, S.D.=0.805$). Among the five dimensions of the assessment, the self-efficacy dimension ranked first ($\bar{X}=3.44, S.D.=0.848$), indicating that the current level of students' self-efficacy is relatively high. The self-regulation and control dimension ranked second ($\bar{X}=3.42, S.D.=0.794$). The learning strategy dimension ranked third ($\bar{X}=3.40, S.D.=0.787$), indicating that the current use of learning strategies is at a moderate level. The learning motivation dimension ranked fourth ($\bar{X}=3.37, S.D.=0.848$), indicating that the level of students' learning motivation was relatively low. The learning environment dimension ($\bar{X}=3.36, S.D.=0.797$) is ranking fifth, indicating that students are not satisfied with the existing learning environment.

The standard deviations for all dimensions ranged from 0.79 to 0.85, indicating that although there was some variation in teachers' responses, the data were relatively concentrated around the mean. This consistency indicates that the results of the survey are reliable and the questionnaire design is valid. The PNI correction

further reveals areas that students feel need to be strengthened. According to the ranking of PNI values from high to low, the most anticipated aspects of students were the improvement of learning environment (0.239) and self-regulation and control (0.230), followed by learning motivation (0.187), and finally self-efficacy (0.170) and learning strategies (0.156). This suggests that while all areas are considered important for the sustainable development of self-directed learning skills, students find self-regulation and control and the learning environment to improve the most urgent. Overall, these data clearly show the room for improvement in the sustainable development of college students' self-directed learning ability in Shaanxi Province.

Analysis of current situation of learning motivation(n=384)

Overall, the corrected mean of PNI for learning motivation dimension reached 0.187, indicating that there was a low degree of improvement in all dimensions. However, from the perspective of specific factors, there is still a gap between the current situation and expectations, and there is still room for improvement and improvement. The higher PNI value highlights the importance and urgency of improving students' learning and the goals and meanings of learning that need to be improved and improved. Lower values indicate that some areas have met the expected standards to a greater extent.

Analysis of current situation of learning strategies(n=384)

Overall, the total PNI modified value of the learning strategy reached 0.156, indicating that the gap between the current status and expectations of each dimension is small overall, but there is still room for improvement and improvement. A higher PNI value highlights the importance of adjusting the optimal learning state and making full use of learning time, while a lower value indicates that students' ability to find information, organize and classify information is relatively mature, and there is little room for improvement.

Analysis of current situation of self-efficacy(n=384)

Overall, the PNI modified mean of the self-efficacy dimension reached 0.170, indicating that the gap between the current situation and expectations at each level is relatively small. A higher PNI value highlights the importance of students coping with various learning tasks and encouraging themselves when encountering difficulties,

while a lower value indicates that students have basically achieved the expected results in terms of textbook knowledge and teacher teaching knowledge, learning and learning goals from classmates of the same level. This analysis helps to clarify students' subjective evaluation of their ability to complete learning tasks during independent learning, so as to support the sustainable development of their autonomous learning ability.

Analysis of current situation of learning environment(n=384)

Overall, the total PNI correction value for the learning environment was 0.239, indicating that there is some level of need for improvement in all dimensions. A higher PNI value highlights the importance of library learning environment, campus cultural environment, and teachers' teaching methods, while a lower value indicates that the learning environment factors such as current role models and parents' expectations basically achieve the expected results. This analysis helps to identify key areas for development, so as to create a good learning environment and improve the sustainable development of college students' self-directed learning ability.

Analysis of current situation of self-regulation and control(n=384)

Overall, the total PNI correction value for the self-regulation and control dimension was 0.230, indicating that there is some degree of need for improvement in all dimensions. The higher PNI value highlights that there is still a certain degree of room for improvement and strengthening in arranging the best learning time, completing learning tasks independently within a specified time, and using a variety of learning methods, while the lower value indicates that students are doing relatively well in terms of learning persistence and the use of library materials, and basically achieve the expected results. This analysis helps to identify key areas for development, so as to strengthen the degree of self-regulation and control, and improve the sustainable development of college students' autonomous learning ability.

Part III: Interview and analysis results of sustainable development strategies for autonomous learning ability of college students in Shaanxi Province.

Based on the results of questionnaires and interviews, this analysis revealed that the sustainable development of autonomous learning ability among Shaanxi

university students urgently requires optimization across a range of dimensions, including learning motivation, learning strategies, self-efficacy, learning environment, and self-regulation and control. This includes 46 specific measures. A detailed list of these strategies is provided in Table 1.

Table 1 List of strategies to improve the sustainable development of college students' autonomous learning ability in Shaanxi Province

NO.	Aspects of Strategies	Numbers of Measures
1	Learning motivation	10
2	Learning strategies	10
3	Self-efficacy	7
4	Learning environment	10
5	Self-regulation and control	9
Total		46

The specific strategies are as follows (Table 2 to Table 6):

Table 2 Strategies for enhancing learning motivation of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Strategies for enhancing motivations	1. Teachers improve teaching methods to enhance students' motivation for learning.
	2. The teacher designs some challenging tasks for the students.
	3. Pay attention to students' intrinsic needs and interests, and encourage students to try new things.
	4. Affirm the contributions and efforts of the students.
	5. Enrich the teaching content.
	6. Allow students to set their own goals, emphasizing self-motivation.
	7. Strengthen communication with teachers, classmates, and parents.
	8. Provide students with sufficient learning resources.

9. Studying the exemplary deeds of outstanding students to stimulate learning motivation.

10. Parents should encourage their children more and establish appropriate expectations for them.

Table 3 Strategies for optimize learning of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Strategies for optimize learning	<ol style="list-style-type: none"> 1. Guide students to make a scientific and reasonable study plan. 2. Guide students to make effective use of after-school time. 3. Stimulate students' enthusiasm and interest in learning. 4. Balance study time with rest time. 5. Improve students' skills in obtaining learning information, and organize and classify information 6. Improve your learning methods and find a learning method that works for you 7. Able to eliminate learning obstacles with the help of external forces 8. Learn to adjust your learning state in an appropriate way 9. Be able to make effective use of time and improve the efficiency of time use 10. Develop a curriculum system of "core literacy + AI assessment".

Table 4 Strategies for enhancing self-efficacy of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Strategies for enhancing self-efficacy	<ol style="list-style-type: none"> 1. Let students practice make perfect and gain successful experience 2. Learning and imitating role models are rewarded 3. Affirmatory words and actions from others 4. Positive Self-Talk

-
5. Establish self-confidence
 6. Often self-encourage
 7. Guide students to establish reasonable learning objectives and assist them in achieving these goals
-

Table 5 Strategies for improving the learning environment of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Strategies for improving the learning environment	<ol style="list-style-type: none"> 1.Create a comfortable learning environment. 2.Prepare the necessary study tools and materials. 3.Eliminate Learning Distractions 4.Teach students according to their aptitude, and teachers improve teaching methods 5.Improve library facilities and equipment 6.Improve dormitory facilities and environment 7.Beautify the campus environment and create a campus learning atmosphere 8.Improve laboratory equipment to ensure smooth progress of experimental projects 9.Carry out diverse learning activities 10.Create a good learning atmosphere

Table 6 Strategies for improving self-regulation and control of the autonomous learning ability of college students in Shaanxi Province

Strategies	Measures
Strategies for improving self-regulation and control	<ol style="list-style-type: none"> 1.Establish good time management habits 2.Work hard to develop your willpower 3.Cultivate yourself to complete the corresponding tasks within the specified time 4.Learn to control your emotions 5.Learn to use a variety of learning methods to achieve learning goals

6.Learn to embrace change and challenges, and be proactive in finding solutions

7.Use learning strategies flexibly

8.Establish a positive attitude

9.Psychological conditioning tools are involved

4.Discussion

1)Discussion on learning motivation

Students' learning motivation is a key factor in the sustainable development of autonomous learning ability. Studies have shown that Pang Weiguo (2002) believes that cultivating students' autonomous learning ability can start from the factors that affect students' intrinsic learning motivation. Li Lu (2021) believes that the adaptive learning intrinsic motivation perceived by individuals can help them develop good behavioral habits, improve their autonomous learning ability, and enhance learning effects.

At present, the learning motivation of college students in Shaanxi Province is at a moderate level. Enhancing students' learning motivation is crucial to improving their autonomous learning ability, independent practice and independent innovation ability.

2)Study on learning strategies

Using various learning strategies can effectively improve autonomous learning ability and results. Yang Mei (2011) believes that the improvement of autonomous learning ability is the fundamental guarantee of autonomous learning. She expounds on ways to improve students' autonomous learning ability from the aspects of guiding students to do the right things, cultivating students to do things in the right way, requiring and helping students to do things well, etc.Guo Wenting (2025) believes that teachers can dynamically plan learning paths through the "AI teaching assistant" function, disassemble knowledge points through "intelligent video slicing", and help students build a closed loop of "self-study - evaluation - improvement".Tan Fangli (2025) believes that educators can enhance students' learning outcomes by guiding them to use AI tools correctly, ensuring that AI technology effectively promotes students' English learning.Huang Hui (2025) believes that AI, as a "strategic

partner," assists students in formulating solutions and guides them to integrate technical solutions with social values. This process not only activates students' learning motivation but also significantly enhances their critical thinking skills and social situational awareness.

Currently, the effect of using various learning strategies by college students in Shaanxi Province is at a moderate level. In order to further enhance students' autonomous learning ability, it is necessary to guide students to use various skills and experiences in learning to improve their learning ability.

3) Discussion on Self-efficacy

There is a close relationship between self-efficacy and the cultivation of autonomous learning ability. The cultivation of autonomous learning ability needs to be based on enhancing self-efficacy. Research by Liu Fang (2009) and others shows that students' self-efficacy is proportional to their self-learning ability. The higher the students' self-efficacy, the stronger their self-learning ability. Correspondingly, students will also show strong autonomy in learning motivation, learning settings and self-regulation.

At present, the self-efficacy of college students in Shaanxi Province is at a moderate level, indicating that there is still room for improvement in students' evaluation of their own abilities. By improving students' self-efficacy, we can further promote the improvement of students' autonomous learning ability.

4) Discussion on learning environment

Jiang Xin and Zhao Xiuwen (2013) proposed a path to cultivate college students' autonomous learning ability under the concept of lifelong learning. Colleges and universities should optimize talent training programs, improve teaching models, use various favorable information technologies, enrich students' extracurricular activities, broaden their horizons, broaden their thinking, carry out innovative activities, improve the learning environment in many ways, enhance students' autonomous learning ability, and further meet the needs of lifelong learning.

At present, the learning environment of college students in Shaanxi Province still has room for improvement. The learning environment of students should be

improved from both internal and external aspects to promote the improvement of their learning ability.

5) Discussion on self-regulation and control

Mi Li (2008)'s research focuses more on the role of students themselves and self-evaluation in cultivating autonomous learning ability, pointing out that by changing students' concepts, improving learning initiative, and mastering correct learning methods and techniques, students' collaborative learning ability can be cultivated. Various abilities such as self-monitoring ability and evaluation function also have a profound impact on the cultivation of students' autonomous learning ability.

The stronger the self-regulation and control ability, the stronger the ability of students to concentrate on autonomous learning will be, and the better the school effect will be. At present, there is still room for improvement in the self-regulation and control ability of college students in Shaanxi Province, so it is necessary to improve the ability of self-regulation and control by improving learning methods and relying on external forces.

5.Recommendation

1) Strengthen learning motivation

The strengthening of learning motivation requires a balance between internal drive (interest, sense of achievement, self-growth) and external incentives (rewards, recognition, competition) to achieve long-term sustainable learning motivation. Encouragement from family, teachers, classmates and other people around students can continuously strengthen students' learning enthusiasm, while challenging tasks can also stimulate students' learning motivation.

2) Optimize learning strategies

The optimization of learning strategies can effectively improve learning efficiency. While giving full play to students' subjective initiative, it can also effectively use the external forces available at the intelligent technology level to complete learning tasks and achieve goals.

3) Enhance self-efficacy

Build self-confidence from the inside out, actively talk to yourself and encourage yourself, start from small goals and constantly achieve them, and gain successful experience day by day.

4) Improve the learning environment

From hardware to software, build and improve the learning environment from the outside to the inside. The construction of a good learning environment requires the efforts of teachers, managers, students, schools, families, society and other aspects. Therefore, while increasing investment in environmental transformation, we must call on everyone in society to improve their self-cultivation and create a beautiful learning environment together.

5) Improve self-regulation and control ability

Starting from self-emotional management, look at everything you encounter with a positive attitude, manage time, flexibly use various strategies, make full use of various effective methods to achieve learning goals, and enhance self-willpower.

6. Research limitations and Research prospects

1) Research limitations

Due to the numerous universities in Shaanxi Province, the varying levels of these institutions, and the limited research capabilities and time of the author, this paper only conducted a questionnaire survey on the self-regulated learning abilities of students from a sample of universities. The research findings are subject to certain limitations. Additionally, there are few relevant research papers on the self-regulated learning abilities of college students in Shaanxi Province, leading to a scarcity of reference materials. Consequently, there is considerable room for improvement in this study, necessitating further research in the future.

2) Research prospects

As the main force driving the future development of society, college students' learning abilities have a significant impact on societal progress and development. Therefore, educators in higher education institutions should place greater emphasis on cultivating students' autonomous learning abilities. Additionally, with the advancement of technology, it is essential to integrate cutting-edge scientific and technological methods into the process of fostering students' autonomous learning

abilities. By utilizing modern technological tools, educators can provide students with a wealth of learning resources, stimulate their enthusiasm for learning, and enhance their autonomous learning abilities and creativity.

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