DEVELOPMENT OF DIGITAL LEARNER CHARACTERISTICS MODEL FOR HIGHER VOCATIONAL COLLEGE STUDENTS IN GUANGXI

LUO YUN FANG

A thesis submitted in partial fulfillment of the requirements for the Degree of Doctor of Philosophy Program in Digital Technology Management for Education Academic Year 2024 Copyright of Bansomdejchaopraya Rajabhat University **Thesis Title** Development of Digital Learner Characteristics Model for Higher Vocational College Students in Guangxi

Author Mr.I

Mr.Luo Yunfang

Thesis Committee

Pony Hovadul Chairperson

(Associate Professor Dr.Pong Horadal)

m Committee

(Assistant Professor Dr. Kanakorn Sawangcharoen)

...... Committee /

(Associate Professor Dr. Sombat Teekasap)

Accepted by Bansomdejchaopraya Rajabhat University in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Digital Technology Management for Education

(Assistant Professor Dr. Nukul Sarawong)

..... President

(Assistant Professor Dr. Kanakorn Sawangcharoen)

Defense Committee

...... Chairperson

(Professor Dr.Apichart Pattaratuma)

..... Committee

(Associate Professor Dr.Supawat Lawanwisut)

..... Committee

(Associate Professor Dr.Duang-arthit Srimoon)

Thesis	Development of digital learner characteristics model						
	for higher vocational college students in Guangxi						
Author	Luo Yunfang						
Program	Digital Technology Management for Education						
Major Advisor	Associate Professor Dr.Pong Horadal						
Co-advisor	Assistant Professor Dr.Kanankorn Sawangcharoen						
Co-advisor	Associate Professor Dr.Sombat Teekasap						
Academic Year	2024						

ABSTRACT

This thesis present Development of Digital Learner Characteristics Model for Higher Vocational College Students in Guangxi.

The objectives of this research were: 1) To study the current situation of digital learner characteristics for Higher Vocational College Students in Guangxi. 2) To develop of digital learner characteristics model for Higher Vocational College Students in Guangxi. 3) To evaluate of digital learner characteristics model for Higher Vocational College Students in Guangxi. The sample is 21 experts who meet the requirements of Delphi method and 9 experts who meet the requirements of focus group method, and 80 non-computer science students who are engaged in the study of digital learner characteristics of students in Guangxi vocational colleges. Research instruments include: 1) Design questionnaire, 2) structured interview, and 3) evaluation form. The data were analysis by using percentage, Median, Mode, Inter-Quartile Range.

The research results show that:

1. The digital learner characteristics for higher vocational college students in Guangxi s are generally at a medium-low level.

2. For the digital learner characteristics model for higher vocational colleges students in Guangxi, the researchers proposed a total of 5 dimensions and 56 strategies, including 11 strategies for digital literacy and skills, 10 strategies for interactive collaboration, 11 strategies for independent learning ability, 13 strategies for digital learning ability, and 11 strategies for problem-solving ability.

3. The developed model has been evaluated and optimized. In the test implementation, the model has more advantages than the traditional method in cultivating students' digital learner characteristics.

Keywords: Digital Learner Characteristics, Digital Learner Characteristics for Higher Vocational College Students, Digital Learner Characteristics Model, Focus Group

Acknowledgements

Time always flies, and so does the study and life of a doctoral student. Therefore, I would like to express my deepest gratitude to all those who have guided, cared, encouraged and helped me during my doctoral studies.

First and foremost, I would like to express my deepest gratitude to my supervisors. I am very grateful to Dr.Pong Horadal, Dr.Kanakorn Sawangcharoen and Dr.Sombat Teekasap, who not only imparted extensive knowledge and research methods and experience in the courses, but also patiently and meticulously guided me in writing my thesis.

I would like to thank Bansomdejchaopraya Rajabhat University for providing a good learning environment and a strong academic atmosphere. Here, I benefited from various groundbreaking lectures and wonderful classes of professors. Special thanks to all the teachers in the Graduate School for their various help, especially the handling of visa and defense matters, which all took a lot of effort from the teachers.

Thanks to the class monitor and classmates in the class. The class monitor organized many learning and seminar activities, which made the students less lonely during their study in Bangkok and helped the students establish deep friendships. Thanks to all the experts who supported my research.

I would like to thank my family for their support and encouragement, and thank the leaders of my unit for their care and support.

Thank you!

Luo Yunfang

Contents

	Page
Abstract	i
Acknowledgements	iii
Contents	iv
List of Figures	vi
List of Tables	vii
Chapter	
1 Introduction	1
Rationale	1
Research Question	2
Objectives(s)	2
Scope of the Research	2
Advantages	3
Definition of Terms	3
Research Framework	5
2 Literature Review	6
Concepts of Digital	6
Learner for 21st century	8
Concepts of digital learner characteristics for Higher Vocational	
College Students	10
Digital literacy and skills	18
Interactive collaboration capabilities	21
Independent learning ability	24
Digital learning capabilities	28
Problem solving skills	31
Background of China's higher vocational colleges	34
Delphi Method	35
Focus Group	37
Related Research	38

Contents (Continued)

	Page
3 Research Methodology	45
Phase 1	47
The Population	47
Research Instruments	48
Data Collection	49
Data Analysis	49
Phase 2	52
The Population	52
Research Instruments	53
Data Collection	53
Data Analysis	54
Summary	55
4 Results of Analysis	56
Symbol and abbreviations	56
Presentation of Data Analysis	56
Result of Data analysis	57
5 Conclusion Discussion and Recommendations	98
Conclusion	98
Discussion	103
Recommendations	110
References	114
Appendixes	121
A List of Specialists and Letters of Specialists Invitation for IOC	
Verification	121
B Official Letter	131
C Research Instrument	133
D The Results of the Quality Analysis of Research Instruments	147
E Certificate of English	152
F The Document for Accept Research	154
Research Profile	156

List of Figures

Figure		Page
1.1	Research Framework	5
3.1	Research flow chart (Phase 1)	46
3.2	Research flow chart (Phase 2)	47
4.1	The digital learner characteristics model for vocational colleges	
	students in Guangxi (version 1)	85
4.2	The digital learner characteristics model for vocational colleges	
	students in Guangxi (version 2)	94

List of Tables

Table		Page
2.1	The results of the digital learners characteristics Higher Vocational College Students	17
3.1	Judgement of the degree of agree by Median	50
3.2	Judgement of the degree of Consensus by Inter-Quartile Range	51
3.3	Judgement of the degree of Consensus by Item-Objective Consistency	52
3.4	Conclusions of focus group experts on each strategy	55
4.1	Basic information of the 21 experts interviewed using the Delphi method	57
4.2	Personal information of the survey respondents	59
4.3	Results for Round 1: Current situation problems	60
4.4	Results for Round 1: Digital literacy and skills	61
4.5	Results for Round 1: Interactive collaboration capabilities	63
4.6	Results for Round 1: Independent learning ability	64
4.7	Results for Round 1: Digital learning capabilities	65
4.8	Results for Round 1: Problem solving skills	66
4.9	Results for Round 2: Digital literacy and skills	67
4.10	Results for Round 2: Interactive collaboration capabilities	69
4.11	Results for Round 2: Independent learning ability	71
4.12	Results for Round 2: Digital learning capabilities	72
4.13	Results for Round 2: Problem solving skills	74
4.14	Results for Round 3: Digital literacy and skills	75
4.15	Results for Round 3: Interactive collaboration capabilities	78
4.16	Results for Round 3: Independent learning ability	79
4.17	Results for Round 3: Digital learning capabilities	81
4.18	Results for Round 3: Problem solving skills	82
4.19	Result for discussion: Digital literacy and skills	88
4.20	Result for discussion: Interactive collaboration capabilities	90
4.21	Result for discussion: Independent learning ability	91
4.22	Result for discussion: Digital learning capabilities	92
4.23	Result for discussion: Problem solving skills	93

Chapter 1 Introduction

Rationale

The arrival of the digital era has changed the way of learning and the standard of talent evaluation. With the popularization and application of digital technologies such as the Internet, big data, and artificial intelligence, digital technologies are reshaping all walks of life, and the education industry is no exception. The use of digital technologies is subverting the previous learning methods. Students not only need to master the use of diversified digital learning platforms and tools, but also need to adapt to the self-learning methods and work skills in the digital age.

Digitalization of education is a trend, and all countries are investing in its deployment. The "21st Century Learning Framework" officially released by the United States in 2006 proposed that digital abilities are one of the core abilities of talents in the 21st century. The European Union released the "Digital Education Action Plan 2021-2027" in 2020. The action plan proposes to promote the development of a high-level digital education ecosystem, strengthen digital skills and literacy that adapt to digital transformation, and proposes a series of related actions. The United Kingdom released the "2021-2027 Digital Education Action Plan" in 2023. "Digital Transformation Framework for Higher Education", from knowledge production, knowledge development, knowledge application, knowledge exchange, digital culture. At the same time, China also released the "Education Informatization 2.0 Action Plan" in 2018 and "China Education Modernization 2035" in 2019. Accelerate the digitalization of education. Especially since the epidemic, digital teaching has become the norm and mainstream. Therefore, students must strive to become digital learners.

Through the understanding of the characteristics of digital learning of students in this unit and the research and analysis of relevant literature, it is found that the digital learning ability of students in higher vocational colleges is insufficient, especially the students in Guangxi higher vocational colleges who are subject to various conditions. Students' digital technology application, innovation ability, solution Digital learner characteristics such as problem solving abilities and digital learning abilities.

At present, there are many domestic studies on the construction and application of digital teaching, but the research on students' digital learning abilities is still in its infancy, especially for Higher Vocational College Students engaged in vocational education. Due to the lack of research, it is impossible to effectively evaluate the digital learning ability characteristics of Higher Vocational College Students, and there is a lack of effective models for cultivating the digital learner characteristics of Higher Vocational College Students.

Research Question

How to development of digital Learner characteristics model for Higher Vocational College Students in Guangxi?

Objectives(s)

1. To study the current situation of digital learner characteristics for Higher Vocational College Students in Guangxi.

2. To develop of digital learner characteristics model for Higher Vocational College Students in Guangxi.

3. To evaluate of digital learner characteristics model for Higher Vocational College Students in Guangxi.

Scope of the Research

Population

21 experts with qualified Delphi requirements and 9 experts with qualified Focus Group method from higher vocational colleges in Guangxi, as well as 80 noncomputer major students from Guangxi Vocational and Technical College.

The Variable

Based on the exploration and review of relevant literature, relevant theories and research analysis on the characteristics of digital learners, the digital learner characteristics for Higher Vocational student in Guangxi are as follows:

- 1. Digital literacy and skills
- 2. Interactive collaboration capabilities
- 3. Independent learning ability
- 4. Digital learning capabilities
- 5. Problem solving skills

Time

The research period of this study is from January 2023 to October 2024. Location

Guangxi, China

Advantages

1. To plan the cultivation of digital learner characteristics for students in higher vocational colleges in Guangxi, provide reference for cultivating digital learner characteristics of students in schools in other regions.

2. To provide strategy the digital learner characteristics students in Guangxi vocational colleges based on scholl research cases.

3. To provide an effective model for cultivating digital learner characteristics of students in other higher vocational colleges.

Definition of Terms

Digital

Digital is a science and technology that goes hand in hand with electronic computers. It refers to the use of certain equipment to convert various information, including pictures, text, sounds, images, etc., into binary numbers "0" and "0" that can be recognized by electronic computers. 1" technology for computing, processing, storage, transmission, dissemination, and restoration. Since computers are used to encode, compress, and decode information in operations, storage, etc., it is also called digital technology, computer digital technology, etc.

Learner for 21st Century

21st century learner is someone who is able to use digital technologies, has the skills and abilities to experiment and create innovative digital solutions, has the skills and knowledge to use the Internet safely and responsibly, and has the skills and opportunities to use digital technologies to collaborate with others. Others and are digital learners who have access to online content through technology, have the confidence and ability to embrace digital technologies and the internet, and have the skills, ability and agility to choose and use appropriate digital technologies for learning, life and work.

Digital Learner Characteristics

Digital learner characteristics refer to the characteristics that learners should have, which mainly include Innovation and creativity abilities, problem-solving abilities, digital technology and platform usage abilities, online digital learning abilities, characteristics such as value-added learners.

Digital Literacy and Skills

It is a collection of a series of digital qualities and abilities that students in the digital society should have in their study, work and life, such as digital acquisition, production, use, evaluation, interaction, sharing, innovation, safety and security, ethics and morals, etc.

Interactive Collaboration Capabilities

It refers to the ability of students to cooperate with others, communicate with others, learn patiently, express actively, help each other, and strive to better complete learning tasks in order to complete learning tasks.

Independent Learning Ability

Independent learning ability refers to thoughts, emotions and actions that are planned and continuously adjusted to achieve personal goals. It includes skills such as setting learning goals, focusing on teaching, being practical, using effective strategies to organize concepts, using resources effectively, managing time effectively, and maintaining positive beliefs about one's abilities.

Digital Learning Capabilities

Digital learning refers to a new learning model that establishes an Internet platform in the education field to allow students to learn through the Internet. It is also called D-learning.

Problem Solving Skills

Problem-solving ability refers to students' ability to use concepts, rules, certain procedural methods, etc. to analyze objective problems and propose solutions.

Higher Vocational College

Higher vocational colleges refer to schools that provide higher vocational education in China. Higher vocational education is an important part of higher education in my country, including higher vocational college education, higher vocational undergraduate education, and graduate-level vocational education. It is a type of higher education development, shouldering the mission of cultivating talents for economic and social construction and development. The enrollment targets for higher vocational college-level education are graduates of ordinary higher schools, secondary vocational schools and technical schools or persons with equivalent academic qualifications.

Delphi Method

The Delphi method, also known as the expert survey method, was initiated and implemented by the RAND Corporation of the United States in 1946. It is essentially a feedback anonymous letter inquiry method. The general process is to obtain expert opinions on the problems to be predicted. Sorting, summarizing, statistics, and anonymous feedback to experts, soliciting opinions again, focusing again, and giving feedback again until unanimous opinions are obtained.

Focus Group Method

This paper organized a Focus group(composed of experts) for orderly discussion to collect information and views on the subject of this study. This method is usually guided by a researcher, who guides Focus group members to share their views and experiences by asking questions and guiding discussions. The Focus group method is a common tool for understanding rquirements, evaluating models, or obtaining in-depth understanding of a problem.

Research Framework

The research framework is based on the community of inquiry model (Garrison et al., 2000), which incorporates the definitions and suggestions of digital learner characteristic model proposed by many experts and scholars, specifically, it constructs an overall model of student digital learner characteristics based on the characteristics of student digital learners, as shown in the figure below.



Figure 1.1 Research Framework

Chapter 2

Literature Review

Focusing on the research goal of improving the digital learner characteristics for Higher Vocational College students in Guangxi , a learning summary and analysis of the relevant literature, concepts, theories and related research results involved in this study was conducted, and the following main theories were sorted out based on the research theme:

- 1. Concepts of digital
- 2. Learner for 21st Century
- 3. Concepts of digital learner characteristics for Higher Vocational College

Students

- 4. Digital literacy and skills
- 5. Interactive collaboration capabilities
- 6. Independent learning ability
- 7. Digital learning capabilities
- 8. Problem solving skills
- 9. Background of China Higher Vocational College
- 10. Delphi Method
- 11. Focus Group
- 12. Related Research

Concepts of Digital

The most basic principle of digital technology is the "Binary System", which is a mathematical concept published by the German mathematician Gottfried Wilhelm Leibniz (1646–1716) in 1703: "Explication de l'Arithmétique Binaire". There are only two numbers in binary: "0" and "1". With the emergence of the first electronic computer ENIAC (Electronic Numerical Integrator and Computer), digital technology has developed rapidly. At the same time, with the development of the network and the Internet, digital technology has become ubiquitous, including transportation, home appliances, keys and other daily necessities and Life devices may all have chips, and all information basically exists in digital form. Work and life are inseparable from digital technology. Gordon, David T (2000) propsed that digital is a foundation of two processes. Digital information is recorded as a binary code that is a combination of numbers 0 and 1, also known as bits, which represent words and images. Digital technology can compress large amounts of information onto small storage devices so that it can be easily saved and transferred. Digitization also speeds up data transmission. Digital technologies have changed the way people communicate, learn and work.

Darren Lee Pullen (2009) propsed that The word "number" is derived from the Latin "digitus", "finger" and refers to one of the oldest counting tools. When information is stored, transmitted or forwarded in digital format, it is converted into numbers - into "zeros and ones" at the most basic machine level. In this study the term stands for technologies that rely on the use of microprocessors; therefore, computers and applications rely on computers (e.g., the Internet) as well as other devices (e.g., video cameras) and mobile devices (e.g., phones and personal digital assistants (PDAs)).

Wanji Bill (2020) proposed that numbers describe systems that generate and process binary data. Computers are essentially digital machines because they process information that is encoded as binary values, which are either positive numbers (represented as 1) or non-positive numbers (represented as 0). These values, called bits, are combined to form bytes, which serve as the basis of all computer systems.

Computer Hope (2022) propsed that an electronic signal sent as a binary digit of ON (digit one) or OFF (digit zero). Digital signals vary discontinuously between ON or OFF, whereas analog signals are continuous, like a wave. Since everything done on a computer is digital, the word "digital" appears frequently in computer terminology.

Kelly Johnston, et al.(2022) proposed that digital technologies are called tools, systems and devices that can generate, create, store or process data. The data processing and logic capabilities of digital technology are implemented through microprocessors programmed to perform various functions. Digital technology refers to devices such as personal computers and tablets, tools such as cameras, calculators and digital toys, systems such as software and applications, augmented reality and virtual reality, and intangible forms of technology such as the Internet.

Margaret Rouse (2023) propsed that digital refers to electronic technology that uses discrete values, usually zeros and ones, to generate, store, and process data. In digital technology, data is transmitted and stored as strings of zeros and ones, each called a bit. These bits are combined into bytes to represent data such as numbers, letters, images, or sounds. In conclusion, digital technology is the science and technology accompanying electronic computers. It refers to using certain equipment to convert various information, including pictures, text, sounds, images, etc., into binary that can be recognized by electronic computers. Technology that calculates, processes, stores, transmits, disseminates and recovers numbers "0" and "1". Digital technology can build more direct and efficient networks, breaking the flat connections between enterprises, individuals and people, and between people and things in the past. It can be used in various aspects such as education, transportation, and medical care to drive the development of the entire society. Especially since the COVID-19 epidemic, digital teaching and digital learning have become the main modes of education.

Learner for 21st Century

Georgia Jones (2013) propsed that 21st century learners are global citizens and lifelong learners who are creative and innovative, able to collaborate and communicate, have critical thinking and problem-solving skills, and are technologically literate.

Eliana Esther Gallardo-Echenique et al. (2015) proposed that the expression learner 21st century "is intended to refer broadly (combinedly) to all these labels (digital natives, Generation Y, Net Generation, etc.) assuming that the current generation of learners is so deeply affected by ICT that we must treated as 'number'". Furthermore, Rapetti and Cantoni (2010b) coined a new term "Learners in the Digital Age" (LoDE) and suggested that age is not the only factor to be considered. This LoDE perspective can be summarized into the following four aspects (Rapetti & Cantoni, 2010b): the focus is on people, so the first word refers to people, the perspective is anthropological-pedagogical, so the word chosen is "learning", In a knowledge society, it is not only young people who learn through ICT. Lessons to be learned from the label of "digital natives": the pervasiveness of digital technology in daily life has a great impact on the learning experience, but we should refuse to refer to "digital" Adjective applied to people and suggesting generational divisions.

Pearl Chidimma Akanwa (2019) propsed that 21st century learners refer to engaged learners, students who use information technology to complete specific tasks, such as using e-learning and learning management systems. They are less dependent on teachers and are proficient in the use of ICT. Lifelong learners participating in distance and online learning programs. Deirdre Butler, Dr Margaret Leahy (2020) proposed that digital learners learn through the use of digital technology tools that support, guide and transform their thought processes, enabling them to carry out activities that are often beyond their independent capabilities. In this way, learners can be viewed as designers, using technology as a tool to analyze the world, acquire information, interpret, organize and construct their personal knowledge, and demonstrate what they know to others. As a result, learners become more actively involved in information processing and construct shared personal and social understandings of the phenomena they are exploring.

Pirker, G, Martínez, R (2020) proposed that the digital learner is learning accompanied by technology or by instructional practice that makes effective use of technology. It includes various practices including blended and virtual learning. Digital learners realise the possibilities and potentials of digital technologies in their environments. They recognise the opportunities technology presents in their working and private life.

Juan J. Araujo, Dawn L. Araujo (2021) propsed that 21st century learners to be students under the age of 25 who are considered digital natives and who have reached school age within the past 20 years. 21st century learners need to know how to navigate the digital and information world. This requires the necessary skills to exist on the global stage. These include the ability to work in multiple modes and the ability to analyze and synthesize large amounts of information at your fingertips. 21st century learners value the authenticity of their learning environments and are adept at combining a variety of skills, including critical thinking, problem solving, and collaborative work.

Freeman (2023) propsed that 21st century learners refer to those who master digital technology, can actively carry out personalized learning, collaborative learning and project-based learning, have critical thinking, problem solving and creativity, and can use digital technology to connect with the world. student.

In conclusion, learners in the 21st century grew up with the development of digital technology and are often called the Internet generation. Digital learning is their mainstream learning mode. They are proficient in using digital technology and have the skills and abilities to experiment and create innovative digital solutions. , people with the skills and knowledge to use the Internet safely and responsibly, people with the skills and opportunities to use digital technologies who are able to work with others and are able to use digital learners, who are technically able to access online content, who have the confidence and competence Accept digital technologies and

the Internet and have the skills, ability and agility to select and use appropriate digital technologies for learning, life and work.

Concepts of Digital Learner Characteristics for Higher Vocational College Students

Begonia Gross, Lolanda Garcia, Ana Escofit (2012) proposed that the digital learner characteristics of Higher Vocational College Students are mainly: 1) digital literacy and skills, 2) digital learning ability, 3) independent learning ability and 4) interactive collaborative learning ability.

Digital literacy and skills refer to the skills to use information and communication technology and online learning platforms. It is also recommended that students' digital literacy and skills must be strengthened; digital learning ability refers to students' ability to use computers, tablets, smartphones and digital networks. Search for learning materials and materials, and be able to use learning platforms to carry out learning; autonomous learning ability means that students have the initiative to learn, have learning goals, can formulate learning plans according to the goals, and can achieve learning goals through self-regulation; interactive and collaborative learning ability means Able to ask questions, communicate, and communicate with classmates, other personnel, and teachers in an online learning environment to achieve more effective learning.

Ye Pinghao (2014) proposed that the digital learning characteristics of Higher Vocational College Students include: 1) digital learning awareness, 2) independent learning ability, 3) digital literacy and skills, 4) digital learning ability, 5) digital resource management ability, 6) interactive collaboration ability and 7) Problem-solving skills.

Digital learning awareness refers to the ability to actively use digital technology and learning platforms to carry out learning, and at the same time to be able to perceive the advantages of digital learning in learning and the convenience it brings to learners, and to have an active awareness of digital learning; autonomous learning ability is Refers to having clear learning goals and being able to manage one's own time to carry out learning and achieve learning goals; digital literacy and skills refer to students' ability to use computers and the Internet; digital learning ability refers to the ability to skillfully use digital tools and learning platforms to carry out Learning skills; digital resource management ability refers to the classification and management of digital learning resources such as teaching courseware, special websites, online forums, and literature materials; interactive collaboration ability refers to the ability to communicate, communicate, and communicate with other

people through digital learning platforms Study, and also ask teachers for advice through the platform, or study together in the form of a study group; problem-solving ability refers to the ability to solve problems encountered through original knowledge and skills, and using digital learning platforms and other methods.

Jiang Jilin (2015) proposed that the characteristics of digital learners in higher vocational colleges include: 1) digital literacy and skills, 2) independent learning ability, 3) digital learning ability, and 4) problem-solving ability.

Digital literacy and skills refer to students mastering the digital technology skills required for digital learning; autonomous learning ability refers to students' ability to have their own learning goals and control their own learning; digital learning ability refers to mastering the digital learning network environment and learning Ability; problem-solving ability refers to the ability to effectively solve problems encountered in learning.

Sun Jizu (2015) proposed that digital learning of Higher Vocational College Students has the following characteristics: 1) digital learning awareness, 2) digital literacy and skills, 3) interactive collaboration ability, 4) independent learning ability and 5) problem solving ability.

Digital learning awareness means that students have grown up in the digital learning system. They have digital learning awareness and a positive attitude toward digital learning, and are more willing to use digital methods to learn. Digital literacy and skills refer to students mastering digital technology and The ability to use digital technology to effectively carry out digital learning; the ability to interact and collaborate means that students can use digital learning tools and platforms to conduct effective learning means that students can collaborate to complete learning; the ability to autonomous learning means that students can choose a learning path that suits them, effectively plan, Monitor, adjust and evaluate learning strategies and conduct independent learning; problem-solving ability refers to students' ability to effectively solve problems encountered in the learning process.

Tanya Roscola (2016) proposed that the characteristics of digital learners of Higher Vocational College Students are: 1) digital literacy and skills, 2) knowledge sharers, 3) computational thinking, 4) independent learning ability, 5) problem solving ability and 6) interactive collaboration ability.

Digital literacy and skills refer to students mastering the hardware systems, software systems, digital tools and network platforms needed for digital learning; knowledge sharers refer to students uploading their own materials and learning gains during learning; computational thinking refers to students having the corresponding computer program processing and solving problems Problem thinking; autonomous learning ability means that students can set learning goals, self-arrange, and selfmanage to complete learning; problem-solving ability means that students solve problems and draw conclusions by asking questions, using digital and physical tools, and testing solutions; Interactive collaboration ability refers to students using technological tools to learn and explore together with other students.

Caitlin Riegel and Rosina E Mete (2018) proposed that the characteristics of digital learners of Higher Vocational College Students are: 1) digital literacy and skills, 2) independent learning ability and 3) digital learning ability.

Digital literacy and skills refer to students who are born in the digital age or after and are proficient in using mobile phones or other devices; autonomous learning ability refers to students who can use digital networks to independently carry out learning; digital learning ability refers to students who are intuitive learners, multitasking and fast tasks Switch, actively socialize, and learn multimedia-oriented.

infogram.com (2019) proposed that the characteristics of digital learners include: 1) autonomous learning ability, 2) computational thinking, 3) problem solving ability, 4) digital literacy and skills, 5) interactive collaboration ability and 6) digital learning ability.

Autonomous learning ability means that students are responsible for their own learning and can take the initiative to learn. They are full of motivation and believe that the current setbacks are worth it for future success. Computational thinking refers to creative thinking, a way of looking at problems or situations from a new perspective. way, creative thinking can be stimulated through unstructured processes such as brainstorming and structured processes such as lateral thinking; problem-solving ability refers to the ability to deal with difficult or unexpected situations in the classroom and complex learning challenges; digital literacy and skills refers to students' mastery of digital Various tools, software and platforms needed for learning; interactive collaboration ability means that they can use digital platforms to carry out mutual learning, and think that such learning is more interesting and effective; digital learning ability means that they are accustomed to obtaining information immediately, and be able to effectively use digital platforms for learning.

Gert Forstmann et al. (2019) proposed that the most important characteristics of digital learners are: 1) digital literacy and skills, 2) independent learning ability, 3) digital learning ability and 4) knowledge sharer. Digital literacy and skills refer to their ability to acquire multimedia content and use terminal devices and platforms; independent learning ability refers to their open consumption of knowledge, personal selection of knowledge sources, personalized control of knowledge progress, exchange of content with others, and better The ability to independently control the learning process; digital learning capabilities utilize collective knowledge and quickly search for relevant content for digital learning;

Knowledge sharers mean that they like to use the Internet to share their learning materials and results.

Pirker, G, Martínez, R (2020) proposed that the characteristics of digital learners of Higher Vocational College Students are: 1) digital literacy and skills, 2) interactive collaboration ability, 3) independent learning ability, 4) digital learning ability and 5) problem solving ability.

Digital literacy and skills mean that they are users of digital technology and they master the knowledge and skills of digital technology; interactive collaboration ability means that digital learners are social, and many of them use various social platforms to collect information, exchange opinions, Show their work or follow important sources, they like to interact with other learners, explore and discuss information and other users' experiences, have a high level of trust and draw their own conclusions; self-directed learning refers to the ability of digital learners to Learn independently under guidance, they prefer to build their own learning, and they can start learning at any point in the process; Digital learning ability means they can make good use of the Internet and technology to learn; Problem-solving ability means they can learn by mastering knowledge and experience to solve problems encountered in the learning process.

Jason Brown, Jena Feeney, Christina Van Itsum (2021) proposed that the characteristics of digital learners of Higher Vocational College Students include: 1) digital literacy and skills, 2) independent learning ability and 3) digital learning ability.

Digital literacy and skills refers to having the following computer and technology skills, being able to use devices to communicate with other systems to access data, upload, download, being able to create, send, reply to, use attachments using email, being able to create slides using presentation graphics, PowerPoint, etc. Presentations, ability to create multimedia presentations, ability to use word processing, navigate Blackboard and the Internet Navigate Windows or MAC operating systems, manipulate files using file managers, identify active printers, access installed file applications, create and delete directories and documents; autonomous learning ability means that they are committed to learning, have a positive attitude, are willing to accept challenges, have time management skills, play an active role in the learning process, control their own learning and achieve success; digital learning ability means that students are actively Take the initiative to carry out online learning and be able to master online learning tools and platforms for learning.

Tony Bates (2022) proposed that the digital characteristics of college or undergraduate school students in the digital era are: 1) digital literacy and skills, 2) digital learning ability, 3) independent learning ability, 4) problem solving ability, and 5) computational thinking.

Digital literacy and skills refer to students who have grown up with digital technology and have the ability to skillfully use mobile phones, tablets and social media, including Facebook, Twitter, blogs and wikis; digital learning ability refers to students who have mastered digital technology and now Digital learning resources and courses are relatively abundant, and they have the ability to learn flexibly in digital platforms and courses; autonomous learning ability means that students have clear learning goals, have their own learning plans after selecting a learning course, and can follow The ability to plan to complete learning goals; problem-solving ability means that during the learning process, students will use previously learned knowledge and skills, and then rely on accumulated experience to solve problems they encounter; computational thinking means that students Growing up in the digital age, I became accustomed to using digital technology to solve problems.

Tan Ying, Jiang Lan, Zhou Xiaomei (2022) proposed that the digital learning characteristics of Higher Vocational College Students mainly involve: 1) digital literacy and skills, 2) interactive collaboration ability, 3) digital learning ability, 4) problem solving ability and 5) digital learning consciousness.

Digital literacy and skills refer to students' ability to master the software and hardware equipment resources and related tools and software required for digital learning; interactive collaboration ability refers to their ability to conduct mutual assistance and collaborative learning through digital learning platforms; digital learning ability refers to their ability to learn online through online learning platforms Learning ability; problem-solving ability refers to their ability to independently solve problems solved by the learning process; digital learning awareness refers to their willingness to learn online. Ma Meng, Liu Yan, Cao Qingqing et al. (2022) proposed that the digital learning characteristics of Higher Vocational College Students include: 1) digital literacy and skills, 2) interactive collaboration ability, 3) independent learning ability, 4) digital learning ability,5) Problem solving skills and 6)Time management skills.

Digital literacy and skills refer to the ability to apply digital technology; interactive collaboration ability refers to the ability to cooperate and communicate, and the ability to learn together; independent learning ability refers to independent learning and time management capabilities; digital learning ability refers to the ability to search and collect information and conduct effective digital learning; Problemsolving ability refers to students' ability to solve problems encountered through digital learning tool platforms and questioning and communication; Time management skills refers to learning time management capabilities;

Tan Yulin, Su Yi (2023) proposed that based on the digital learning characteristics of students in higher vocational colleges, digital learning characteristics mainly include: 1) digital literacy and skills, 2) interactive collaboration ability, 3) independent learning ability, 4) digital learning ability and 5) problem-solving skills.

Digital literacy and skills refer to the digital technology skills required for digital learning; interactive collaboration ability refers to the ability to collaborate with each other and discuss learning together; autonomous learning ability refers to the ability to learn and manage learning independently, self-efficacy and learning strategies; digital learning ability It refers to the ability to collect and manage resources to effectively carry out digital learning; problem-solving ability refers to the ability to solve problems encountered during the learning process.

Xu Fengpan (2023) proposed that the digital learning characteristics of Higher Vocational College Students mainly include: 1) digital learning ability, 2) digital literacy and skills, 3) interactive collaboration ability, 4) independent learning ability, 5) problem solving ability and 6) learning resources management capabilities.

Digital learning ability refers to online learning ability, which refers to the ability to skillfully use various online learning platforms for learning; problem-solving ability refers to the ability to process information and solve problems, and be able to solve problems by oneself; learning resource management ability refers to the ability to manage learning resources and be able to The self-shaping of digital resources that has a great impact on online learning; autonomous learning ability refers to the ability to use digital platforms for self-learning; interactive collaboration ability refers to the ability to communicate and interact with each other in cyberspace, as well as

communicate with each other on online platforms Ability; digital literacy and skills refer to the ability to master digital technologies commonly used in digital learning.

Deng Fei, Deng Xue, and Han Dandan (2023) proposed that the digital learning characteristics of Higher Vocational College Students mainly include: 1) digital literacy and skills, 2) independent learning ability, 3) digital learning ability, 4) problem solving ability, 5) computational thinking and 6) Learn resource management skills.

Digital literacy and skills refer to the fact that students should master digital technology skills and be able to skillfully use various digital technologies, digital platforms and digital learning systems; independent learning ability refers to students' innovative ability to complete independent learning; digital learning ability refers to students' ability to adapt to open The ability to learn online requires mastering digital learning methods and learning to creatively improve learning effects based on the use of digital learning tools; problem-solving ability means that students must have their own learning thinking and problem-solving abilities; computational thinking refers to the use of digital learning environments Thinking ability; learning resource management ability refers to the ability to mine digital learning resources.

Cen Shuibin, Wu Shaowei, Jia Shaoqiang, et al. (2023) proposed that the digital learning characteristics of Higher Vocational College Students are mainly reflected in: 1) digital literacy and skills, 2) independent learning ability, 3) digital learning ability and 4) problem solving ability.

Digital literacy and skills refer to digital technology skills for digital learning, including the ability to use hardware equipment, software tools and platforms; independent learning ability refers to the willingness to learn independently and the ability to control learning time and space independently; digital learning ability refers to the use of digital technology and High-quality network resources include the ability to explore and integrate resources for digital learning; problem-solving ability refers to the ability to independently solve problems encountered.

Scholar Digital learner characteristics	Digital literacy and skills	Interactive collaboration	Independent learning	Digital learning	Problem solving skills	Digital learning	Knowledge sharer	Computational thinking	Time management skills	Learning resource management skills
Begonia Gross et al. (2012)	\checkmark	\checkmark	\checkmark	\checkmark						
Ye Pinghao (2014)	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark				\checkmark
Jiang Jilin (2015)	\checkmark		\checkmark	\checkmark	\checkmark					
Sun Jizu (2015)	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark				
Tanya Roscola (2016)	\checkmark	\checkmark	\checkmark		\checkmark		\checkmark	\checkmark		
Caitlin Riegel et al. (2018)	\checkmark		\checkmark	\checkmark						
infogram.com (2019)	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark			\checkmark		
Gert Forstmann et al. (2019)	\checkmark		\checkmark	\checkmark			\checkmark			
Pirker, G, Martínez, R (2020)	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark					
Jason Brown et al. (2021)	\checkmark		\checkmark	\checkmark						
Tony Bates (2022)	\checkmark		\checkmark	\checkmark	\checkmark			\checkmark		
Tan Ying et al. (2022)	\checkmark	\checkmark		\checkmark	\checkmark	\checkmark				
Ma Meng et al. (2022)	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark				\checkmark	
Tan Yulin, Su Yi (2023)	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark					
Xu Fengpan (2023)	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark					\checkmark
Deng Fei et al. (2023)	\checkmark		\checkmark	\checkmark	\checkmark			\checkmark		\checkmark
Cen Shuibin et al. (2023)	\checkmark		\checkmark	\checkmark	\checkmark					
Total	17	10	16	15	13	3	2	4	1	3

 Table 2.1
 The results of the digital learners characteristics Higher Vocational College

 Students
 Students

According to Table 2.1, the researcher analyzed and synthesized literature, concepts, theories and research related to digital learners, including: Begonia Gross et al. (2012); Tony Bates (2022); Tanya Roscola (2016);Tan Yulin, Su Yi (2023);Xu Fengpan (2023);Deng Fei et al. (2023);Cen Shuibin et al. (2023), etc. The researchers used this criterion to consider the characteristics of digital learners and served as the research framework for this study. By selecting features with a frequency of 6 or more. It can be synthesized into the following five characteristics: 1) Digital literacy and skills, 2) Interactive collaboration capabilities, 3) independent learning ability, 4) digital learning capabilities, and 5) problem solving skills.

Digital Literacy and Skills

Zheng Min (2020) propsed that student digital literacy refers to the ability of students to form a good information awareness, master basic information knowledge, and have the information acquisition, analysis, processing, innovation, application and communication required for scientific research on the basis of professional learning. Basic ability to correctly evaluate information in information behavior, and to be strict with self-discipline and strictly abide by information ethics and related laws and regulations. Utilize your own information comprehensive ability to learn independently in this field and have the courage to assume the social development responsibilities that college students should have in the information environment.

Luo Yi (2021) propsed that student information literacy refers to the ability of college students to understand huge and complex information in the information ecosystem environment, select and collect information needed by society and their own development, and apply the acquired information in a creative and responsible way. The key is the formation of college students' information capabilities. The focus is on developing positive information awareness through digital learning and innovative thinking training, forming information social responsibility, and being able to integrate new information with existing information in the process of understanding, selecting, and using information. The ability to integrate the information knowledge system structure, evaluate the accuracy of information content in an independent, open, and interactive environment, think critically about information content, and use highly interactive technology to creatively carry out cooperative problem-solving, in the whole process of college students as a social Citizens' awareness of social responsibility and information ethics are fully and comprehensively reflected through information capabilities. Tang Ting (2021) propsed that digital literacy of Higher Vocational College Students is an effective integration of general skills and specific skills for future career development. It can promote their efficient application of digital technology for learning and work, and complex ability traits to achieve talent training goals. These capabilities and traits mainly include digital science knowledge, digital application capabilities, professional abilities, competitiveness, values and personal characteristics in the digital age.

Li Feng (2022) propsed that digital literacy and skills are a collection of digital acquisition, production, use, evaluation, interaction, sharing, innovation, security and ethics, and a series of qualities and abilities that citizens in a digital society should have in their study, work and life. Digital literacy and skills are key capabilities for people to survive in a digital society. Improving the digital literacy and skills of the entire people is a strategic task to comply with the requirements of the digital age, improve national quality, and promote the all-round development of people. It is also a strategic task for my country to move from a network power to a network power. the only way. As an important channel for information technology education, schools need to meet the future needs of society and develop the digital literacy and skills of all students.

Li Honglin, He Wei, Hu Junping et al. (2022) propsed that adopted the 2018 European Commission's definition of digital capabilities. Digital literacy and skills refer to "Digital capabilities refer to the confidence in digital technology in learning, work and social life, Use and engage critically and responsibly. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), security (including digital well-being and competencies related to cybersecurity), intellectual property-related issues , problem solving and critical thinking.

Zhou Yumeng (2022) propsed that digital literacy and skills are a collection of digital acquisition, production, use, evaluation, interaction, sharing, innovation, safety and security, ethics and morals, etc. All in all, digital literacy is a comprehensive concept that covers learning, living, and working environments, with more emphasis on the working environment, and is oriented to the capability requirements of digital society citizens.

Shang Xianli, Zhang Jun (2022) propsed that digital literacy and skills are enhanced versions of concepts such as digital literacy, digital skills, and digital capabilities. The connotation of digital literacy and skills can more comprehensively, appropriately and deeply explain the knowledge, skills, attitudes and understanding that the public should have in the digital era. In extension, digital literacy and skills can cover digital literacy, information literacy, media literacy, data literacy, Competencies involved in literacy such as computer literacy, Internet literacy, and ICT literacy.

Hu Junping, Cao Jin, Li Honglin et al. (2022) propsed that define citizen digital literacy and skills from two dimensions: composition and function. From the perspective of composition, the digital literacy and skills that citizens should possess include basic knowledge and skills related to digital technology, as well as the values, ethics, behaviors and ways of thinking advocated by the new era of digital civilization. From a functional perspective, citizens' digital literacy and skills are the adaptability, competence and creativity of citizens in a digital society to apply digital tools and participate in digital activities in study, work and life. They are the core literacy for the all-round development of citizens and the high level of digital economy. The social basis for quality development.

Zhou Yanyan (2023) propsed that digital literacy and skills of higher vocational track major students refer to digital knowledge and technical skills, with the application and fault emergency handling capabilities of smart devices, big data collection and analysis capabilities, new technology and new equipment application capabilities, information security awareness, etc. , promote students' digital awareness, digital technology learning and application, digital innovation, digital social responsibility and other digital literacy cultivation in stages and levels to enhance students' survivability, competitiveness and sustainable development capabilities in the digital society.

Wu Yurong (2023) propsed that refers to people's ability to use information technology confidently, critically and innovatively in study, work, leisure, and social participation. Compared with the well-known information literacy, digital literacy pays more attention to the innovation, application and application of information. Management capabilities can better reflect the characteristics of the information age. Nowadays, digital technology represented by mobile Internet, Internet of Things, cloud computing, big data, etc. has entered a new stage of development. The influence of digital technology has penetrated into all aspects of human society. How can students in higher vocational colleges reasonably use digital tools to Promoting learning, communication, collaboration and innovation has become an increasing concern for society. Zhou Rujun (2023) propsed that digital literacy refers to an essential survival skill for citizens of a digital society based on the digital society. It includes not only the ability to use digital technology in work, study and life, but also the emotions and emotions related to digital social life. Attitudes, qualities and values. It mainly includes elements such as "digital acquisition", "digital communication", "digital communication", "digital creation", "digital consumption", "digital security", "digital ethics", "digital norms" and "digital health".

Yu Zhimin, Li Ziang, Li Ming, Song Ze (2023) propsed that digital literacy refers to the knowledge, skills and attitudes possessed by individuals in the process of using information technology and digital media. It includes three aspects: information literacy, technical literacy and media literacy. Information literacy covers the ability to obtain, evaluate and utilize information; technological literacy covers the skills of using information technology and digital media, including the ability to use computers, networks and other digital devices; media literacy covers the understanding and evaluation of digital media Competencies, including awareness of the role, impact and security of digital media.

In conclusion, The comprehensive skills of digital literacy refer to a collection of digital qualities and abilities that citizens in a digital society should possess such as digital acquisition, production, use, evaluation, interaction, sharing, innovation, safety and security, and ethics and morals. It includes four major skills: digital awareness, computational thinking, digital learning and innovation, and digital social responsibility.

Interactive Collaboration Capabilities

Ding Qianying (2016) propsed that defines cooperative learning ability. Cooperative learning ability refers to certain characteristics that students display when completing group learning goals with their peers in group cooperative learning activities. It is the key to smooth group cooperative learning and individual lifelong development. Important guarantee. Its elements include two aspects: cooperative learning awareness and cooperative learning skills.

Miao Anying (2016) propsed that collaborative learning refers to learning conducted by learning groups or teams composed of students. Learners acquire knowledge, solve problems, and complete learning tasks together through collaborative communication, analysis and discussion with their peers. During the study period, each member's research results and collected information can be shared and exchanged to expand knowledge reserves and improve their own capabilities. The abilities of mutual assistance and collaborative learning specifically include information collection and screening abilities, problem solving and inquiry abilities, cooperative communication abilities and practical operation abilities.

Tang Nian (2018) propsed that mutual assistance and collaboration ability refers to the knowledge and skills, emotions, attitudes and values displayed by two or more people in the process of working together in the same direction to achieve a common goal. . Mutual assistance and collaborative learning ability refers to the ability of individuals to make progress and develop together with others, and to master knowledge and develop skills in cooperative interactions.

Liu Liyu (2019) propsed that the definition of interactive cooperative learning is a special form of cooperation, which is characterized by interaction and cooperation between students, teachers and students, and group learning is the main means for students to carry out collaborative learning activities around a common goal. Therefore, you can participate in "cooperative learning" in physical education classes under the guidance of physical education teachers. Students can improve their cooperation awareness and ability through division of responsibilities, close cooperation, mutual aid and group evaluation.

Chai Shuhong (2020) propsed that interactive collaborative learning refers to a model of collaborative learning in a digital network environment. It is a model designed to promote students to help each other and cooperate in heterogeneous environments to achieve common learning goals. It emphasizes being studentcentered and giving full play to The main role of students provides students with more opportunities for mutual communication and cooperation, allowing students to work together to maximize their own and other people's learning. Students in this process demonstrate the ability to cooperate with each other to complete learning. That is the ability of interactive and collaborative learning.

Zhang Xuan (2021) propsed that mutual aid and collaborative learning is a learning method that allows students to cooperate with others without being restricted by orders. This model fully highlights the dominant position of students in the classroom. The teacher is no longer a leader with the highest say in the Chinese teaching classroom, but a guide who stands on the same level as the students. The ability that students need to learn to communicate, exchange and cooperate, and help each other solve learning problems in this process is the ability of mutual assistance and collaborative learning. Li Wenwen, Du Yongmei (2021) propsed that mutual assistance and cooperative learning means that teachers should put students in the main position of teaching work under the guidance of the student-centered educational concept. At the same time, as educators and teaching activities Organizers and teachers must maximize their individual guiding role in the entire process to improve the efficiency and quality of students' independent cooperative learning. Independent cooperative learning generally has the following characteristics: First, students have strong purpose, enthusiasm, independence and autonomy in participating in teaching activities. Second, when solving problems encountered in the learning process, most students can truly use their subjective initiative, potential and talents to think proactively and explore the correct answers to the questions. Third, students can monitor their individual learning behavior at any time during independent cooperative learning, make timely corrections after discovering problems, and then effectively improve learning efficiency and learning ability through continuous self-reflection and evaluation.

Zhang Yan (2021) propsed that interactive collaborative learning, also called cooperative learning, refers to a learning method that has a clear division of labor, collaboration and goals, and jointly conducts inquiry activities in order to complete certain learning tasks. In this process, students are required to communicate, collaborate, help each other, learn from each other, and have the ability to think and research on their own. This is the ability of interactive and collaborative learning.

Liu Xuezhen (2022) propsed that mutual assistance and collaboration ability is the synthesis of psychological characteristics displayed by individuals when they successfully complete cooperative learning, including cooperative learning awareness, cooperative learning skills and cooperative learning results. Among them, cooperative learning awareness includes three dimensions: self-awareness, positive interdependence, and sense of responsibility; cooperative learning skills include social skills (mutual trust, accurate communication, patient listening, and constructive problem solving), and evaluation abilities (group self-evaluation and evaluation of others).), resource sharing, emotional regulation, and conflict management; the outcome of cooperative learning is whether the established goals are ultimately achieved through cooperative learning.

In conclusion, Interactive and collaborative learning ability means that in the digital age, students use digital technology, digital communication tools and digital learning platforms. On the one hand, they can use corresponding tool platforms to communicate with other learners in a timely manner when they encounter problems in their own learning process. Communicate and interact, ask teachers for advice, and form the ability to collaboratively learn to solve problems and improve learning efficiency; on the other hand, learning is conducted in a group manner, and members can effectively provide each other with effective learning help and support through the digital learning platform, and share members The ability to collect information, question the views and opinions expressed by group members, discuss, encourage and urge each other, coordinate the group learning atmosphere, and achieve good learning results.

Independent Learning Ability

Li Yan (2017) propsed that autonomous learning ability refers to "the learner's ability to consciously and independently use scientific learning methods to gain knowledge based on his or her own knowledge and skills, and then use the acquired knowledge to solve problems." Constructivism believes that the key to determining the acquisition of independent learning ability lies in the level of students' cognitive development; and the development of independent learning ability has a great relationship with classroom teaching methods. The traditional classroom teaching method based on indoctrination will restrict autonomy. Improvement of learning ability. Independent learning ability is an influence that runs through independent learning activities. It covers the ability to determine learning activities, self-evaluation and feedback capabilities, and metacognition and self-regulation abilities. and many other aspects. The ability to learn independently is not a person's talent, but mainly the result of acquired training.

Hou Jingwen (2018) propsed that autonomous learning ability is a kind of learning through self-discipline, self-management, rational use of learning resources, scientific planning of learning time, timely follow-up of learning progress, proactive adjustment of learning strategies according to one's own learning ability, and timely improvement of learning methods. ability. It mainly manifests itself in clarifying learning tasks, formulating scientific and reasonable learning time, tracking learning progress, testing learning effects, summarizing learning experiences, adjusting learning plans in a timely manner, improving learning strategies, and recording and evaluating learning status. Chen Guirong (2019) propsed that autonomous learning ability mainly includes the following elements: positive attitude, setting learning goals, formulating learning plans, mastering learning methods, learning to self-monitor, and knowing self-reflection.

Nguyen Thi Thanh Thuy (2020) propsed that Autonomous learning ability is a clever combination of independent learning and learning ability. At the same time, it is believed that independent learning ability is another name for independent learning. Independent learning is the concrete behavior of independent learning ability, and independent learning ability is the result of independent learning.

Qi Liu (2021) propsed that Independent learning ability is not only the ability of students to acquire knowledge independently during school, but also an important ability for students' lifelong development. It is the basic ability for students to quickly adapt and survive in any environment. Students with good independent learning ability can acquire and absorb knowledge in any environment and internalize it into their own necessary abilities or skills, thereby laying the foundation for their further development.

Gao Guichen (2022) propsed that autonomous learning ability refers to the ability of college students to independently determine learning goals, formulate learning plans, continuously adjust learning strategies according to learning content and progress, and conduct timely and correct evaluation of learning effects during the learning process.

Zhang Yue (2022) propsed that autonomous learning can be understood not only as a learning model in which learners actively choose learning content, methods, intensity, and result evaluation, but also as learners' abilities and habits to guide, manage, and adjust their own learning behaviors. Independent learning based on the construction of online teaching resources tends to emphasize that learners start from their own actual situation and formulate learning plans that meet their interests and needs. By independently determining online teaching content, learning methods, and learning intensity, combined with comprehensive learning evaluation, ultimately Complete the specific learning goals assigned by the teacher.

Dong Guoying, Yin Hong (2022) propsed that autonomous learning refers to learners independently formulating learning plans, selecting learning materials and learning methods, autonomously monitoring and completing the learning process, and evaluating their own learning results. Autonomous learning ability emphasizes students' ability to learn in this process the ability to take responsibility for learning. Zhang Anzhong (2022) propsed that autonomous learning ability is the ability displayed in the conscious and active learning process. It is a special learning ability based on general learning ability. The particularity of autonomous learning ability is mainly reflected in the aspect of autonomy. This autonomy runs through the entire process of learning activities, including self-orientation ability before learning activities, strategy application ability and self-monitoring ability during learning activities, and self-direction ability after learning activities. Evaluation skills.

Ping Qian, Xiao Ziwei (2023) propsed that autonomous learning ability is an aspect of metacognition, which includes people's knowledge or awareness in the cognitive process, the individual's ability to use self-regulation mechanisms to control individual cognitive processes, and in the autonomous learning process The learning control ability that learners have is the ability to autonomously learn. Based on the perspective of network autonomous learning, the autonomous learning ability structure is divided into four dimensions: learning goals and planning ability, learning strategy use ability, self-monitoring ability and self-evaluation ability.

Yu Yanyan, Zhao Liang (2023) propsed that Self-learning ability is divided into 5 dimensions: self-exploration, self-direction, knowledge acquisition, self-control and self-evaluation. Self-exploration ability is reflected in the ability to proactively discover problems in the daily learning process and consciously expand unknown areas of knowledge and skills. Self-direction ability is reflected in the ability to formulate learning goals at different stages and formulate learning plans that suit oneself around the learning goals. The ability to acquire knowledge is reflected in the ability to master the ways and methods to acquire knowledge, actively explore and use the Internet and other media to acquire knowledge and skills, combine one's own learning habits, grasp one's own learning rules, and formulate personal learning strategies. Self-control ability is reflected in the ability to make choices about learning content, effectively achieve learning goals, carry out learning according to the learning plan, and during the learning process, be able to stimulate one's own learning motivation and promptly correct thoughts and behaviors that deviate from the learning plan. Self-evaluation ability is reflected in the ability to regularly summarize learning results and reflect on learning methods after the completion of independent learning, continuously improve the independent learning process, and improve learning results.

Wang Tingting, Wang Yingxia, Han Dan et al. (2023) propsed that autonomous learning ability refers to a series of skills such as clarifying learning purposes during the learning process, formulating efficient learning plans, and evaluating learning effects. Different scholars have different understandings of autonomous learning, but it generally includes the following characteristics: initiative; independence; selfmonitoring; effectiveness; relativity.

Pan Junru (2023) propsed that autonomous learning is an attitude, a willingness and a psychology possessed by learners, which itself can be said to be an autonomous learning ability. Learners complete the psychological process of learning within an autonomous learning system. The ability of independent learning refers to a quality or psychological state that can complete independent learning tasks. It is a phenomenon of independent learning. Autonomous learning ability refers to the process in which learners have the willingness and ability to consciously determine learning content, choose learning methods and environments, manage learning time, monitor the learning process, and evaluate learning results according to their own learning situation.

In conclusion, Autonomous learning ability refers to the thoughts, emotions, and actions that are planned and constantly adjusted to achieve personal goals. It includes: Set learning goals, focus on teaching, be practical, use effective strategies to organize concepts, use resources effectively, and manage effectively Skills such as managing time and maintaining a positive belief in personal abilities. Autonomous learning ability is a relatively broad concept, Contains many interdependent elements. It is generally believed that self-directed learning ability includes the regulation of emotions, emotions, and attitudes Emotional abilities including control, as well as cognitive abilities including belief, perception, and understanding; In addition, self-directed learning ability It also includes metacognitive abilities such as memory, attention, and problem-solving for understanding. Metacognitive abilities enable individuals to Be able to make the most of their knowledge and skills.
Digital Learning Capabilities

Wang Bing (2017) propsed that digital learning ability refers to the learner's ability to use digital learning tools and resources to learn in a digital environment. Specific content includes the ability to obtain information, use information tools, process information, express information, play the role of information, collaborate with information, innovate information, and be immune to information.

Zhuang Rongxia, Yang Junfeng, Li Jihong et al. (2018) propsed that digital learning ability refers to the ability to use digital learning environments and digital learning resources to carry out digital learning, including communication and communication skills, innovative thinking skills, critical thinking, problem solving skills, self-directed learning skills, etc.

Luo Zhaobi (2018) propsed that in summary, the author believes that the key elements of digital learning ability are: the ability to rationally compare and understand the similarities and differences between digital learning environments and traditional learning environments, as well as their respective advantages and disadvantages, and the ability to actively learn and quickly adapt and master How to use various digital learning platforms and tools, be able to distinguish types of digital learning resources and efficiently utilize resources for learning, have learning habits and learning methods that are compatible with the digital learning environment, and be able to make full use of the digital environment for communication, sharing, and collaboration Learning and self-directed learning.

Yang Yue (2019) propsed that digital learning is a learning activity carried out using multimedia and network communication technology. In the digital age, learners need to have specific abilities to develop digital learning, that is, digital learning capabilities, in order to effectively carry out learning activities. Digital learning ability refers to the behavior of consciously using digital learning tools and digital resources to conduct digital learning in a digital learning environment.

He Qin, Wu Liangqi, Lu Juan (2020) propsed that digital Learning Competency is the ability of learners to use digital tools and digital resources to learn, or to conduct learning in a ubiquitous digital environment. The basic qualities of knowledge, skills, motivation and attitudes required for effective learning. Learning here includes formal learning and informal learning. Its components include digital awareness ability, information association, communication and collaboration ability, knowledge creation and sharing ability, learning resource management ability, selfmanagement ability, learning resource evaluation ability and learning effect evaluation ability. Li Tingting (2021) propsed that digital learning ability refers to a comprehensive ability of learners to use digital learning resources and tools to learn and communicate in a digital learning environment. Specifically, it includes elements such as cognitive processing, text reading, rich media integration, intention management, task management, partner management and time management.

Li Jiaxin (2021) propsed that in the context of information digitization, learners can only learn through digitalization if they can use digital learning platforms to obtain learning resources. This is digital learning ability. Digital learning capabilities include information acquisition capabilities, the ability to use information tools, information processing capabilities, information expression capabilities, the ability to play the role of information, information collaboration capabilities, information innovation capabilities, and information immunity capabilities.

Yang Yun (2021) propsed that digital learning capabilities are composed of learning awareness, technology, behavior and management capabilities. Digital learning awareness ability refers to the learner's ability to have a positive attitude towards the usefulness and ease of use of digital learning, including digital learning resource acuity, digital learning frequency, digital learning usefulness, digital learning intellectual property awareness, and digital learning sharing awareness., cognition of the significance of digital learning to lifelong learning and other factors. Digital learning technology ability refers to the learner's ability to apply information technology required for digital learning, including information retrieval ability, office software application ability, professional software application ability, software function mining ability and other elements. Digital learning behavioral ability refers to the learner's ability to apply cognitive strategies in the digital learning process, including the association of new and old knowledge, teacher-student interaction, peer learning exchanges, knowledge innovation, learning plans, learning resource storage, learning attention and other elements. Digital learning management ability refers to the learner's ability to apply management strategies in digital learning, including selfregulation ability, self-motivation ability, self-reflection ability, digital learning resource evaluation ability, digital learning effect evaluation ability and other elements.

Deng Fei, Deng Xue, Han Dandan (2023) propsed that digital learning ability is the basic ability required to adapt to the digital transformation of education. It is generated by learners in the process of using various network technology tools in order to adapt to the requirements of the digital learning environment and improve learning effects. The learning and practical ability of education and development is an important criterion for judging whether people can learn to use digital technology to learn. Specifically, digital learning capabilities include three aspects: the thinking ability to adapt to the digital learning environment, the ability to mine digital learning resources, and the ability to apply digital learning methods.

Chen Chunping, He Zigeng, Zhang Bin et al. (2023) propsed that digital learning capabilities refer to the basic knowledge, skills, motivation and attitudes required for learners to use digital tools and digital resources to learn, or to learn effectively in a ubiquitous digital environment. Traits. According to the way of using information and combined with the learning and cognitive characteristics of contemporary college students, the components of college students' digital learning abilities are divided into five levels: awareness, technology application, behavior, management and evaluation.

Liu Yang, Li Shu, Zhang Xu et al. (2023) propsed that digital learning ability refers to the individual's ability to effectively manage the learning process and learning resources by evaluating and selecting common digital resources and tools, and creatively solve problems to complete learning tasks and form innovative works. Ability. It includes three aspects: the ability to create a digital learning environment, the ability to collect and manage digital learning resources, and the ability to apply and innovate digital learning resources.

In conclusion, Digital learning refers to a new learning model that establishes an Internet platform in the field of education and allows students to learn through the Internet, also known as D-learning. Digital learning ability is a comprehensive learning ability for students to use digital technology to make full use of digital teaching platforms and digital teaching resources to conduct digital learning through the Internet. It mainly includes three elements: First, the ability to adapt to and manage the digital learning environment, such as the ability to skillfully use computers, networks and other facilities, the ability to skillfully use text, images, audio, video and other resources, and the ability to skillfully use various network teaching and learning software and platforms; the second is the ability to acquire and utilize digital learning resources, such as being able to skillfully use exploration engines to retrieve learning resources, being able to use various tools and software to process resources, being able to understand and reasonably evaluate resources, and being able to Association and construction of various types of resources; the third is the ability to use digital learning methods, that is, the ability to adapt to various digital learning methods.

Problem Solving Skills

Yang Bin (2016) propsed that students' problem-solving ability consists of six sub-abilities: the ability to understand problems, the ability to identify problems, the ability to express problems, the ability to solve problems, the ability to reflect after problem solving, and the ability to communicate problem solutions.

Luo Xuan (2017) propsed that generally speaking, problem-solving ability is the ability to correctly solve problems encountered in study and life through thinking. Problem-solving ability includes three aspects: first, the ability to discover problems, second, the ability to form new knowledge, and third, the ability to form problemsolving strategies. Among them, organizing and building new knowledge is the core.

Ma Lu (2020) propsed that problem-solving ability refers to the ability of students to use the acquired skills, knowledge, and thinking to flexibly handle complex problems and implement them based on the determined goals under moderate learning motivation and a good state of mind. High-level mental skills that can adjust and improve plans and reflect creativity.

He Xueyi (2020) propsed that problem-solving ability refers to the ability of individuals to use cognitive processes to understand and face real, interdisciplinary problem situations and seek solutions when there is no clear solution. The general problem-solving process is mainly summarized into four aspects: exploration and understanding, representation and modeling, planning and execution, monitoring and reflection.

Ou Peiling (2020) propsed that problem-solving ability (Problem-Solving Ability) refers to the ability of learners to activate their own reserved resources when facing problem situations created by instructors during the learning process, and to obtain other appropriate resources through effective channels. And comprehensively use the acquired resources to find a solution close to the problem goal, and the deep thinking stimulated can have certain transferability ability when encountering similar problems in the future.

Lu Jiajing (2021) propsed that problem-solving ability refers to the quality and ability displayed when facing problems. In the process of solving process problems, the ability to effectively handle problems is demonstrated. In real learning and life, problem-solving ability refers to being able to find methods and strategies to solve problems and solve them. Information technology problem-solving ability is the ability to analyze and think about specific problem situations in the information technology classroom, find methods and ideas to solve problems, and thereby solve problems. Sun Yuanqiang (2021) propsed that problem solving is a process. Students fully apply the knowledge they have learned and online and offline resources to understand problems, analyze problems, solve problems, reflect on problems, and communicate results. Problem-solving ability is a kind of ability that requires Cultivated through problem solving process.

Jiang Mengqian (2021) propsed that defines problem-solving ability as students' ability to find problems in different problems or problem situations they encounter, analyze problems based on existing knowledge and experience, and find solutions through independent or cooperative exploration and communication. Problem-solving strategies and methods, and the ability to ultimately solve the problem. It also includes problem-solving attitudes such as participation, effort, and autonomy displayed in the problem-solving process, as well as problem-solving qualities such as reflection, judgment, and creativity.

Wang Guifang (2021) propsed that problem-solving ability not only includes steps such as discovering problems and facts, defining problems, elaborating ideas, selecting and evaluating, planning, formulating ideas, and taking action, but also should build these steps on the basis of the basic process described earlier Above, create a cyclical process of discovering and solving problems, and be able to raise or analyze problems existing in simple and complex situations to design reasonable and effective solutions, and finally put them into practice to solve the corresponding problems. Problem-solving ability includes the ability to maintain a positive attitude when facing problems (learners can proactively discover and analyze problems in situations), and adopt correct problem-solving ideas and strategies (based on learned principles, basic operational knowledge and divergent thinking). foundation, propose appropriate work design plans) and problem-solving qualities (be able to adopt effective methods, plan and design work plans, complete the work, and optimize the work after in-group evaluation, group evaluation and teacher evaluation).

Liu Jiahao (2022) propsed that problem-solving ability refers to a person's ability to use his or her comprehensive knowledge and existing experience to effectively and successfully solve the problem when faced with a problem that has no direct solution. Educator Dewey divided this thinking process into five steps, namely problem definition, analysis, planning, execution and evaluation. Kou Xin, Liu Shuang, Xiao Fei (2022) propsed that the gap between the real situation and the ideal situation will cause problems. If the real situation reaches the theoretical situation or the ideal situation through a series of tools, methods and operations, this process is problem solving , the ability to complete this process effectively and in a timely manner is problem-solving ability.

Yu Zenghui (2023) propsed that the ability to solve problems is a clear manifestation of the value of students' thinking and is also the core requirement of the practical literacy of compulsory education at this stage. The establishment of comprehensive practical courses can effectively improve students' ability to solve difficult problems and promote students' positive psychological quality. Formation. Solving problems is a necessary ability and core literacy in the process of students' learning and development. It demonstrates students' core abilities of observing rules, analyzing problems, and proposing solutions. It has a profound impact on students' subsequent study and life, and even their work and employment.

In conclusion, Problem-solving ability refers to students' ability to use concepts, rules, certain procedural methods, etc. to analyze objective problems and propose solutions. Elementary abilities are manifested in the ability to discover general explicit problems, make preliminary judgments, and handle them simply; those with stronger abilities can easily discover hidden problems in the fields or scopes they are familiar with, have certain problem-finding skills, and possess A certain level of analytical ability, the ability to explore ways to solve problems based on phenomena, and find answers, can solve problems better; a higher level of problem-solving ability is actually to detect problems earlier and perceive the adverse effects of the outside world on oneself or work and life. Classroom can accurately predict various problems in the development process and nip them in the bud! At the same time, it can summarize the rules of problem occurrence and guide others to improve their ability to find problems.

Background of China's Higher Vocational Colleges

China

Higher vocational education is an important part of China's higher education, including higher vocational college education, higher vocational undergraduate education, and graduate-level vocational education. This is a type of higher education development that is responsible for cultivating high-quality skills for economic and social construction and development. The mission of skilled personnel. Higher vocational schools are schools that implement higher vocational education to cultivate high-quality technical and technical talents. They mainly include vocational universities, vocational and technical universities, vocational colleges and vocational and technical colleges, including public and private schools. As of June 2023, there are a total of higher vocational colleges across the country. There are 1,545 schools with more than 13 million students enrolled.

In recent years, the Chinese government has attached great importance to higher vocational education, and has successively issued policies and measures such as the "High-level Vocational Schools and Major Construction Plan with Chinese Characteristics" and the "Construction of Vocational Education Informatization Benchmark Schools" to comprehensively promote the construction and development of higher vocational colleges and comprehensively Implement education digitalization actions. At the same time, China attaches great importance to the cultivation of digital learning abilities of students in higher vocational colleges. According to the talent training requirements of higher vocational education, all non-computer majors must offer information technology courses. According to the "Information Technology Curriculum Standards for Higher Vocational Education (2021 Edition)", it focuses on cultivating students' digital learning capabilities in four dimensions: information awareness, computational thinking, digital capabilities, digital innovation and development, and information social responsibility. Especially since the COVID-19 epidemic, by focusing on building digital teaching platforms and resources, we have built digital teaching and learning platforms such as the National Vocational Education Smart Education Platform, the National Vocational Education Professional Teaching Resource Library Operation Platform, and Xueyin Online, and fully implemented digital teaching and learning platforms. and learning.

Guangxi

Guangxi is an autonomous region that implements national higher vocational education. Although it is a backward region in the west, higher vocational education has also achieved rapid development. As of now, Guangxi has a total of 49 higher vocational colleges, including 34 public colleges and private vocational colleges. 15 colleges and universities. According to data released by the official website of the Guangxi Education Department, there are currently 4 national "double-high" higher vocational colleges and 10 autonomous region "double-high" higher vocational colleges. The number of higher vocational colleges accounts for 56% of the number of universities in Guangxi. In 2022, the number of students enrolled in higher vocational colleges will reach more than 640,000.

To comprehensively improve the informatization support for vocational education, lead the innovation and development capabilities of Guangxi's vocational education, and accelerate the informatization development of Guangxi's vocational education, with the support of national policies, the Guangxi Department of Education issued the "Implementation Opinions on Accelerating the Informatization Development of Guangxi's Vocational Education" It is also proposed that by 2022, Guangxi will basically build 10 smart campus demonstration vocational colleges, cultivate 100 information integration innovation demonstration majors, build 1,000 information integration innovation demonstration courses, and train 10,000 people who are proficient in information teaching capabilities. Vocational education teachers should comprehensively improve the level of informatization development in vocational education, basically achieve the goal of covering all teachers with teaching applications, cover all students with learning applications, and cover all schools with digital campus construction. The level of informatization application and the information literacy of teachers and students will generally improve, building an "Internet+" The development goal of the "vocational education" large platform is to basically realize the comprehensive digitalization of teaching and learning.

Delphi Method

The Delphi Method is a method that combines the experience and subjective judgment of multiple experts. It is essentially a feedback anonymous inquiry method. Its general process is to obtain expert opinions on the issues to be predicted. Organize, summarize, and make statistics, and then anonymously feedback to the experts, solicit opinions again, focus again, and feedback again until a unanimous opinion is obtained. Since this method was proposed by the RAND Corporation in the United States in the 1960s, it has been widely used in comprehensive evaluation practices in various fields (Xu Aiting, 2006). The specific evaluation application methods of the Delphi method are as follows:

1. Set up a project leadership team: Team members are responsible for designing, regulating, and providing feedback on the entire research process. Each stage is based on the previous stage. The composition of the team members has an important impact on the entire project.

2. Prepare an expert consultation form: The expert consultation form is an important tool for project evaluation and prediction using the Delphi method. Whether the consultation form is well designed or not will directly affect the quality of the research. An outline of questions should be formulated based on the research project, and corresponding background materials should be provided for experts' reference. Each round of correspondence forms should include feedback from the previous round of correspondence, the revised indicator system and evaluation indicators.

3. Selection of consulting experts: Experts generally refer to professionals who have been engaged in technical work in this field for more than 10 years. The number of consultants should be 15 to 50. The selection of experts is determined by the research subject, and the number of experts depends on the scale of the research project. The accuracy of the assessment or prediction is functionally related to the number of participants, that is, the accuracy increases as the number of experts increases.

4. Conduct rounds of expert consultation: The Delphi method usually involves 4 rounds of expert consultation. The improved Delphi method organizes experts to conduct pre-letter consultations before designing the formal expert letter inquiry form, so there are generally only 2 or 3 rounds.

5. Statistical analysis data: Evaluation indicators include expert positivity coefficient, expert authority coefficient, variation coefficient, Kendall harmony coefficient, etc. The expert positivity coefficient is expressed by the questionnaire recovery rate, which reflects the degree of experts' attention to the research. The expert authority coefficient: (Cr) is determined by the expert's judgment basis coefficient (Ca) and the expert's familiarity with the problem coefficient (Cs). The coefficient of variation (Vj) and Kendall's harmony coefficient (Kendall'sW) represent the degree of coordination of expert opinions. The smaller the coefficient of variation, the more consistent the opinions of experts are. The larger the value of Kendall's harmony coefficient, the better the degree of coordination among experts.

Focus Group

Focus groups are a widely used qualitative research method that is often used to gather insights and opinions about a research topic from a number of diverse participants. It requires an experienced moderator who can lead the participants in the discussion to have an active discussion around the research topic to lead the structured group discussion during the investigation process. Focus groups provide indepth qualitative data through participants fully sharing their thoughts, experiences and insights on the research topic in a group setting. It is easier to obtain valuable insights into the research topic than through individual interviews or surveys (Richard De A. Kruger and Mary Anne Casey, 2018).

Here are the steps to complete the classic focus group method:

1. Recruit participants: Carefully select a small group of participants, usually 6 to 10, who have extensive experience in the research topic and come from diverse backgrounds. Participants should represent a variety of perspectives and backgrounds relevant to the topic.

2. Prepare the focus group interview environment: including the conference room and main equipment used in the meeting process, such as microphones, pens, notebooks, and audio and video equipment.

3. Determine the moderator: An excellent moderator is a key factor in the success of the focus group interview method. Choose a moderator who will guide the conversation, ask open-ended questions, keep the discussion on track, facilitate the discussion, and ensure that all participants have an opportunity to contribute.

4. Prepare a discussion guide: This refers to preparing a summary of the topics to be covered in the group session for use by the facilitator, including a series of open-ended questions and prompts designed to explore various aspects of the research topic. The guide provides structure for the conversation while allowing participants the flexibility to express their opinions.

5. Conduct group discussions: During focus group sessions, participants engage in guided conversations. Moderators encourage participants to share their thoughts, listen to others, and respond to each other's comments. Dynamic interactions between participants often lead to deeper exploration of the topic.

6. Collect data: During the focus group meeting, the moderator or assistant should take detailed notes and record the content of the meeting in detail. At the same time, in order to better record the details of the meeting, audio or video equipment is usually used for recording with the consent of the participants. All records are the main source of data for subsequent analysis. 7. Meeting Minutes Analysis: Recorded discussions and notes are transcribed and analyzed to identify key thematic patterns and insights. Researchers looked for commonalities and differences in participants' responses to extract meaningful information.

8. Write a focus group interview report: The focus group findings are compiled into a report or presentation, often including direct quotes from participants. The report can be used to inform decision-making, develop strategies, or generate further research questions.

The investigative method of focus group interviews can be used in the following ways: to reveal group responses to a certain issue or phenomenon. Interviews allow you to formulate hypotheses and inferences about a study. Improve and perfect some quantitative research methods. Interpret and elaborate on the results of some other quantitative research methods. However, although focus group interviews have their advantages compared with other research methods, in actual research work, they should be combined with other methods, especially with some quantitative research methods, in order to reflect more objectively and accurately. The inherent laws of things (Hu Hao, 2010).

Related Research

Digital Learning Research Theory

According to the concept of digital learning, compared with traditional learning, digital learning has the characteristics of privately customized learning methods, massive high-quality learning resources, learning can be everywhere, and the achievement of every lifelong learner. At the same time, digital learners also need to have the ability to adapt to digital learning methods, the ability to digitally process tacit knowledge, and digital meta-learning capabilities. In order to clarify how to learn effectively in digital learning, the following introduces the basics of digital learning. theory.

Connectivist Theory

George Siemens (2005) proposed that connectivism theory mainly focuses on the learning that occurs during the interaction between learners and the external environment. Connectivism believes that the ability to learn quickly is more important than the ability to master knowledge content. With the penetration and development of the concept of lifelong learning, combined with the characteristics of the Internet age, in the future, keywords such as "informal learning" and "fragmented learning" will affect learners' lives. In the past, relevant theories that emphasized individual focus on knowledge content learning have been affected by challenge.

1. Connectivist view of knowledge and learning

Networks, connections and nodes are key words in connectivist epistemology. A node refers to an element that can connect any person or thing in the learning process. It can be a teacher, a campus library, or a question in a textbook. Connection refers to the connectivity relationship between nodes. The factors that affect the establishment of connections include: motivation, emotion, exposure, pattern, logic, and experience. The more difficult thing to understand is exposure, which refers to the degree of connection between a node and other nodes. That is to say, the greater the exposure of a node, the higher its influence. Pattern refers to the degree to which connections between nodes are identifiable. Logic refers to the way learners evaluate and understand connections. To sum up, connectivism advocates a dynamic and diversified view of knowledge. This theory believes that knowledge exists in fragmented form in the network era. This not only realizes distributed storage of knowledge, but also reduces the knowledge processing of a single node. At the same time, it can also facilitate a certain node to connect more nodes, ensuring that learners can adapt to the variability of problem-solving situations and adapt to various connections, reorganization, and reconstruction of knowledge.

Connectivism believes that learning is the process of building a learning network, that is, learners create new nodes through learning and exchange knowledge with external nodes to achieve the purpose of updating their own knowledge network.

2. Strategies and methods of connectivism

First of all, connectivists believe that no one can monopolize a part of knowledge in the Internet era, and we should shift from focusing on learners' internal cognitive processing and meaning construction processes to focusing on the construction methods of learning networks and the connection paths between nodes. On this basis, connectivism advocates whole-brain learning, that is, by establishing connections between the left and right brains and external resources, making full use of various information tools to help us analyze and understand knowledge, and then achieve optimal learning.

Secondly, connectivism believes that "the pipeline itself is more important than the knowledge in the pipeline." This conclusion is based on the characteristics of the current information explosion and the inability of individuals to monopolize some knowledge. It is also due to the increasing number of problems in the process of solving problems. It is caused by many interdisciplinary, interprofessional and even intercultural phenomena. From this, it is not difficult to see that in the learning advocated by connectivism, knowledge itself is not the ultimate goal, but the connection of knowledge is the goal.

New Constructivism Theory

Wang Zhuli (2011) proposed that the core concepts of the new constructivist learning theory can be summarized by the seven keywords of "situation, search, selection, writing, communication, innovation, and meaning construction". New constructivism advocates that "learning is construction, construction contains innovation, learning for innovation, innovation in learning, and innovation in learning." The new constructivist learning strategy advocates that knowledge connectivity is as important as personal meaning construction. "Construction" should also include knowledge innovation. Learners should organically combine the two with an inclusive attitude to jointly guide learning in the Internet era.

1. The view of knowledge and learning in the new constructivist theory

New constructivism believes that learning is a process of "grafting" knowledge, that is, "grafting" previous knowledge into the learner's mind. It should be noted that, first of all, "grafting" is not completely equivalent to active construction, but has a certain degree of "acceptance". Secondly, "grafting" does not start from scratch, but innovates and develops on the basis of original knowledge. In addition, the content of "grafting" is not only the knowledge of predecessors, but also includes information processed by computers and the Internet. Knowledge, the processing of this knowledge is not entirely personal meaning construction, but also includes the meaning construction of group consciousness and the "automatic processing" of the Internet. Finally, "grafting" cannot be completed at once. The classic knowledge structure is carefully constructed by countless experts and scholars according to a strict logical system. Similarly, knowledge in the Internet age is also "everyone gathers firewood" and has fragments. characteristics such as evolution and gradualness.

New constructivism advocates that learning should change from a pyramid shape to a spider web shape. Traditional learning starts from basic knowledge and proceeds step by step according to a well-established subject knowledge system, while learning in the Internet era stems from the intrinsic needs of learners. , is created to solve problems, and there is no need to start with basic knowledge step by step, but this does not mean that basic knowledge is no longer important. While there is room for learning, basic knowledge is also very necessary. It can be seen that in learning in the Internet age, everyone can construct his own personalized knowledge system based on his own needs and around specific cores.

2. Learning strategies and thinking methods of new constructivism theory

Part-time learning strategy, neo-constructivism compares the Internet to a knowledge bank. The essence of "part-time learning" is to continuously accumulate knowledge fragments (i.e., piece-by-piece writing), and through continuous rewriting and integration (i.e. individuality) (rewriting), gradually integrating fragmented knowledge and connecting it with the individual's original knowledge system, thereby achieving the purpose of breaking it into parts, and finally achieving knowledge innovation through creative reconstruction of fragmented knowledge. Among them, the key to "saving in small amounts" is to learn to choose, while the key to "taking in whole amounts" is to keep writing. Excavation of tacit knowledge and inclusive thinking. New constructivism focuses on the excavation and inclusive thinking of tacit knowledge. It believes that many components of innovation originate from tacit knowledge. For this purpose, it proposes the internal reading method and the indepth discussion method. The inclusive thinking advocated by new constructivism is the key for learners to grasp the connections between various kinds of knowledge and knowledge innovation. Specifically, inclusive thinking is a thinking method that integrates information and knowledge fragments. By finding the "reasonable side" of opinions and concepts, all types of information can form a complete threedimensional knowledge structure system.

Activity Learning Theory and Collaborative Learning Theory

Activity learning theory believes that "activities" and "social interactions" play a very important role in the development of people's advanced psychological functions. It believes that learning does not exist in isolation, but is an interactive process using diverse tools and groups in a certain social situation. Learning activities are a process of dynamic development. Learners continuously improve their cognitive structures by actively participating in activities. The basic unit of activity learning theory is activity, and the activity system includes three main components (subject, object, and community) and three secondary components (tools, rules, and division of labor).

Collaborative learning refers to the division of labor between multiple people to complete different parts of the same learning task. Through collaborative work, the problem is finally solved and the goal is achieved. In the process of active learning, collaborative learning means the division and integration of learning tasks, the diversity of learners' professional backgrounds, and the communication and cooperation between learners, so as to achieve the purpose of learning. Building a learning community is the starting point for digital learning. After building a learning community, it is necessary to choose an appropriate information environment and tools, select appropriate collaboration methods, and recommend learning resources.

Activity theory defines subjects, objects, communities and their relationships from a social and cultural perspective. Learners are the subjects where learning occurs, teaching content and teaching environment are the objects of learning, and teachers are the main components of the learning community. Subject, object and community together constitute the ring part of collaborative learning. As an important form of digital learning, online collaborative learning is both a means and an end. Online collaborative learning focuses on the renewal of internal cognitive structures and the cultivation of collaboration and innovation capabilities. Therefore, the collaborative learning evaluation system based on activity theory should pay more attention to the process of activity implementation and the changes in the cognitive structure of the actors.

Main Modes of Digital Learning

Li Kedong (2001) proposed that in a digital learning environment, learners' learning does not rely on teachers' lectures and textbooks, but uses digital learning platforms and digital learning resources to carry out consultation discussions and cooperative learning between teachers and students. , and learn through the collection and utilization of resources, exploring knowledge, discovering knowledge, creating knowledge, and displaying knowledge.

Experiential Learning Based on Activity Theory

Based on activity theory, the design and execution of teaching activities are centered around teaching objectives, and the development of learning activities from the perspective of students is centered around learning objectives. In order to achieve the object (goal), the subject (learner) needs to use tools (learning tools) and symbols (learning materials and learning resources), based on rules (teaching plan or learning plan)) and by the community (teachers, learning partners, etc. and other participation The teaching/learning links designed by the author) form the final learning results through independent and collaborative learning activities.

Project-Based Collaborative Participatory Learning

Project-based collaborative participatory learning revolves around a specific project. Learners set their own topics according to the specific requirements of project learning and work in groups. By selecting and utilizing learning resources, they acquire more complete and specific knowledge through practical experience,

internalization and absorption, and investigation and experimentation, form skills, and ultimately obtain develop. Project-based collaborative participatory learning mainly includes four parts: content, activities, situations and results. Content refers to illstructured problems in real-life situations. Activities refer to a series of exploratory actions that learners use certain technical tools and methods to solve problems encountered during project implementation. Situation refers to supporting students in carrying out projects. In the project learning environment, the results refer to the concepts, principles, operations, skills, methods and other knowledge related to the project theme that learners master through inquiry activities during the project learning process or at the end of the learning.

Blended Learning Based on Flipped Classroom

In the process of digital learning, blended learning based on flipped classroom is the most common and the most easily accepted learning model by learners. Flipped classroom, also known as "inverted classroom" or "reversed classroom", is a teaching model that inverts and resets the knowledge transfer and knowledge internalization links in the traditional teaching process. It is also a brandnew hybrid teaching model. learning method. In flipped classroom, the transfer of knowledge is completed before class with the assistance of information technology, that is, students learn new knowledge in advance through materials distributed by teachers before class; while the internalization of knowledge is done in class through the interaction between teachers and learning partners. It is completed with assistance, that is, students use class time to solve problems through teacher answering questions and collaboration between groups.

Self-Directed Learning

Independent learning is a modern learning method corresponding to traditional receptive learning. With learners as the main body of learning, learners make their own decisions and are not dominated by others or interfered by the outside world. Through reading, listening to lectures, research, observation and practice, individuals can achieve continuous changes in behavior. During the learning process, learners independently establish goals, select learning content and learning tools for independent learning.

Inquiry-Based Learning

Inquiry-based learning (hands-on inquiry based learning, HIBL) refers to selecting and establishing topics from subject areas or real life, and creating situations similar to academic research in teaching. Students actively discover problems and learn by doing, Exploratory activities such as experiments, operations, investigations, collection and processing of information, expression and communication, etc., to acquire knowledge, cultivate abilities, develop emotions and attitudes, especially to develop the spirit of exploration and innovation ability. It advocates students' active participation. Inquiry-based learning is an active learning process, which mainly refers to a learning method in which students apply the knowledge they have learned to solve practical problems.

Chapter 3 Research Methodology

According to the research topic, in order to better achieve the research objectives, the research process is mainly divided into two stages. In the first stage, the Delphi method is used to study the current situation of digital learner characteristics for higher vocational colleges students in Guangxi and develop a digital learner characteristics model for higher vocational colleges students in Guangxi. In the second stage, the focus group method is used to evaluate the digital learner characteristics model for higher vocational colleges students in Guangxi. The researcher has the following procedures:

- 1. The Population
- 2. Research Instruments
- 3. Data Collection
- 4. Data Analysis



Figure 3.1 Research flow chart (Phase 1)



Figure 3.2 Research flow chart (Phase 2)

Phase 1:

Employ the Delphi technique to achieve objective 1 and objective 2

The Population

The researcher uses Purpose Sample and selects 21 experts with the following qualifications:

Expert Conditions:

1. Those who have been engaged in digital teaching research in the Institute of Digital Education for 5 years or more, have a master's degree or above and the title of associate professor or above; 2. Those who have been engaged in digital teaching research in higher vocational colleges or higher education schools for 5 years or more, and have a master's degree or above and a professional title of associate professor or above;

3. Those who have been engaged in digital teaching in higher vocational colleges for more than 5 years, have a master's degree or above and the professional title of associate professor or above.

Research Instruments

Interview

In order to develop and study the digital learner characteristic model for students, the Delphi method was used as a research tool. According to the research results and analysis of relevant literature and the research needs of the Delphi method, an open-ended questionnaire on the digital learner characteristic model for higher vocational colleges students in Guangxi was developed. Open questionnaire

Open-ended Interview Formation Process

Step 1: Analyze relevant literature, relevant theories and national policies to obtain the current status of digital learner characteristics for higher vocational colleges students in Guangxi .

Step 2: Based on the characteristics of digital learners of students, design an open interview form for digital learner characteristics of students in higher vocational colleges.

Step 3: Send the open interview form to 5 experts for testing

Step 4: Collect data from the open interview form and modify the interview form.

Step 5: Send the open interview form to 21 experts

Likert Scale Questionnaire

According to the analysis results of relevant literature and interview forms, the Likert scale of the digital learner characteristics model for higher vocational college students in Guangxi is established, and the scoring criteria are:

- 5 Strongly agree
- 4 Agree
- 3 Neutral
- 2 Disagree
- 1 Strongly disagree

The Likert Evaluation Form Formation Process

Step 1: Based on the analysis results of relevant literature and interview forms, a model of digital learner characteristics for higher vocational colleges students in Guangxi was constructed.

Step 2: A Likert rating scale for digital learner characteristics of students in vocational colleges was established.

Step 3: The consultant reviewed the evaluation form and modified the content according to the consultant's suggestions.

Step 4: 3 experts evaluated the objective consistency index (IOC (Rovinelli and Hambleton, 1977)). The evaluation was carried out according to the following criteria, and the consistency index (IOC) was 0.60 to 1.00.

+1 = Ensure that the content is relevant to the topic

0 = Unsure that the content is relevant to the topic

-1 = The content deviates from the topic

Step 5: Form a Likert scale for digital learner characteristics of students.

Step 6: Send the evaluation form to 21 experts to fill in, modify the Likert rating scale according to the experts' opinions, and repeat 3 rounds.

Data Collection

According to the research objectives and method steps, the researchers first invited 21 experts at the request of the experts, explained to the experts the work that they hoped to complete in cooperation with the research, and distributed to the experts a public survey on the current status of student digital learner characteristics and a Likert scale, etc. Questionnaire, and ask experts to cooperate in completing the questionnaire.

After receiving the questionnaire, the experts completed the questionnaire evaluation and predicted answers based on the research objectives and experience.

The researcher collects the questionnaires submitted by experts and analyzes and integrates the experts' suggestions and experiences. The analysis results include the consistency, difference and weight of the experts' suggestions and experiences. The survey collected three different versions of questionnaires submitted by 21 experts.

Data Analysis

According to the Delphi method adopted in the study, after collecting expert questionnaires, an analysis of expert suggestions was carried out. The concentration suggested by experts in research is usually analyzed through the median (Md) and interquartile range (IQR). Among them, the larger the median (Md), the more important the component is, and when the interquartile range (IQR) is used to reflect the concentration of expert opinions, the smaller the value, the higher the concentration of expert opinions, and the higher the value. The higher the concentration of expert opinions, the worse the concentration of expert opinions. In the data reflecting the concentration of experts, the meaning represented by the median is unacceptable.

1. Median (Md)

The median is the middle score among the ratings data provided by all experts in sequence.

The median refers to the rating value in the middle position after the ratings provided by all experts are arranged in order. The median can describe the central tendency of expert opinions, and then explain its meaning according to the standards established by Wang Jixin, Cui Yongpeng, et al. (2020), as follows.

Degree of Agree	Median (<i>Md</i>)	
Highest	4.0 <md≤5.0< td=""><td></td></md≤5.0<>	
High	3.0 <md≤4.0< td=""><td></td></md≤4.0<>	
Medium	2.0 <md≤3.0< td=""><td></td></md≤3.0<>	
Low	1.0 <md≤2.0< td=""><td></td></md≤2.0<>	
Lowest	0.0 <md≤1.0< td=""><td></td></md≤1.0<>	

Table 3.1 Judgement of the degree of agree by Median

In the study, the calculation method of the Median value is that when experts score the digital learner characteristic strategies of students in Guangxi vocational colleges, if the median of all experts' scoring results is between $4.0 < Md \le 5.0$, it means high recognition, $3.0 < Md \le 4.0$ means relatively recognized, $2.0 < Md \le 3.0$ means recognition, $1.0 < Md \le 2.0$ means disapproval, and $0.0 < Md \le 1.0$ means very disapproval.

2. Mode (*Mo*)

The Mode is the value with a clear central trend point in the statistical distribution, that is, the value with the highest number of occurrences or frequencies. It is the positional average and represents the general level of the data, which is not affected by extreme variable values. The mode is mainly used to measure the

concentration trend of categorical data, but it can also be used to measure the concentration trend of ordinal and numerical data.

3. Inter-Quartile Range (IQR)

This study adopts the view of Holden and Wedman et al. (1993). When the inter-quartile range is less than or equal to 0.6, the item reaches a high degree of consensus; if the inter-quartile range is between 0.6 and 1, the item reaches a moderate degree of Consensus; if the inter-quartile range is greater than 1, there is no consensus on the item. If more than 75% of the questions reach a level above high consensus, the survey can be concluded. evaluation value in shown Table 3.2

Degree of Consensus	Inter-Quartile Range (IQR)
High	0.0≤ <i>IQR</i> ≤0.6
Medium	0.6< <i>IQR</i> <1.0
Low	1.0≤ <i>I</i> QR

Table 3.2 Judgement of the degree of Consensus by Inter-Quartile Range

In this study, the experts gave scores to the strategies for improving the digital learner characteristics of students in Guangxi vocational colleges. The Inter-Quartile Range value IQR<0.6 between the scores given by the experts indicated a high degree of consensus, 0.6 < IQR < 1.0 indicated a medium degree of consensus, and IQR>1.0 indicated a low degree of consensus.

3. Index of Item Objective Congruence (IOC)

In order to ensure the validity of the data, the researchers used the itemobjective consistency (IOC) test to evaluate the validity of the questionnaire. 5 experts scored all items in the questionnaire according to the scoring range of -1 to 1. According to this evaluation standard, they gave 1 point (conform to the measurement), -1 point (do not conform to the measurement) and 0 point (problematic). This study draws on the views of Turner, Ronna C., Carlson.et al (2003). The specific calculation formula for item-objective consistency (IOC) is:

$$[IOC = \frac{\sum_{i=1}^{n} r_i - n \cdot p}{\sqrt{n \cdot (1 - p^2)}}]Among them:$$

 (r_i) is the score of the (i)th expert on an item. (n) is the number of experts. (p) is the average of the average ratings of all experts for all items. The evaluation results of all items in the questionnaire are greater than 0.6, indicating that all items in the questionnaire are valid and consistent with the objectives. The specific evaluation table used in this study is shown in Table 3.3

Table 3.3 Judgement of the degree of Consensus by Item-Objective Consistency

Degree of Consensus	Item-Objective Consistency (IOC)
Low	<i>IOC</i> <0.6
High	<i>IOC</i> ≥0.6

In this study, according to the average scores of the experts, the average scores of each strategy reached 0.6 points or above, proving that these strategies are recognized by IOC experts. Therefore, the second round of questionnaires will be designed based on this, and then opinions and suggestions will be solicited from 21 experts.

In this study, 21 experts scored the strategies for improving the digital learner traits of students in Guangxi higher vocational colleges on a scale of 5-1, with 5 points indicating strong agreement, 4 points indicating agreement, 3 points indicating uncertainty, 2 points indicating disagreement, and 1 point indicating strong disagreement. The number of experts who scored 4 and 5 points for each strategy accounted for more than 0.75 of the total number of experts who scored. This indicates a high degree of consensus, which is represented by High. Otherwise, this indicates a low degree of consensus, which is represented by Low.

Phase 2:

Employ the group discussion to achieve objective 3.

The Population

The researchers used the target sample to screen out 9 qualified experts, whose qualifications are as follows:

Expert Conditions:

1. Those who have been engaged in digital teaching research in the Institute of Digital Education for more than 10 years and have a doctorate or associate professor title or above;

2. Personnel who have been engaged in digital teaching in higher vocational colleges or higher education schools for more than 10 years and have a doctorate and professorial title.

Get Mothods:

In order to ensure the authenticity and validity of the answers to this research question by the nine experts in the focus group, the experts will obtain them through the following methods if they meet the conditions:

1. By sending a commission invitation letter to relevant higher vocational colleges, the relevant schools will be entrusted to recommend qualified experts to complete the research;

2. Send research-related questions to relevant schools through QQ groups and WeChat groups established in China Vocational Education, and ask relevant schools to cooperate in inviting qualified experts to complete the research;

3. Through the personnel department of the unit, ask the personnel department to send invitations to relevant schools and recommend experts who meet the conditions to cooperate in completing the research.

Research Instruments

The group discussion method is used as the research tool. Based on this method, the process design of the group discussion, the discussion process, and the comprehensive evaluation of the discussion results were completed. The discussion guide mainly focuses on research strategies, which is a structured set of open-ended questions aimed at guiding the discussions of focus group experts. The guide questions should cover all aspects of the digital learner characteristics for Higher Vocational College students in Guangxi.

Data Collection

In this phase, according to the group discussion experimental method adopted, data were collected during the experiment in the following ways:

1. The researcher presides over an active interview meeting and fully discusses the research issues with experts.

2. Record the discussion process: In order to better record the interaction, opinions and insights of the experts participating in the discussion, use audio or video to record the discussion process.

3. During the discussion, keep a record of the discussion points, opinions expressed and related dialogue processes.

Step 1: Determine the goals and issues of the focus group evaluation study on the digital learner characteristic model for Higher Vocational College students in Guangxi. Step 2: Design the meeting process and hold a focus group meeting, guide the discussion according to the agenda and record the meeting content, member opinions, views and suggestions.

Step 3: Guide focus group experts to discuss the proposed student digital learner characteristics model, soliciting expert opinions, feasibility views, and potential pros and cons of the model.

Step 4: Keep minutes of the focus group meeting through written notes, audio recordings or videos.

Data Analysis

Data collected from group discussion were analyzed using qualitative methods to gain meaningful perspectives for the study:

1. Meeting content recording and organization: conduct text transcription and written organization of audio or video recordings and written notes to ensure accurate expression of the content discussed in the meeting.

2. Analysis and determination of discussion topics: Analyze the collated meeting content to identify recurring themes, patterns and key points in the discussions.

3. Coding and categorization: Code key statements or excerpts related to the identified themes to achieve better organization and categorization of the data.

4. Content analysis: Comprehensive analysis of the discussion content through word frequency statistics, coding and classification, etc., to find out the overall trends, common views and differences among experts.

5. Explanation of quotations: Select representative quotations to explain the views expressed in the discussion.

6. Report writing: Write a summary report, comprehensively describing the project overview, the main findings of the focus group, main conclusions and suggestions, result analysis and related suggestions.

By sorting out the opinions of experts on each strategy in the meeting, a comprehensive conclusion of each strategy was obtained. The conclusions are divided into four types: approval, modification, deletion, and addition. Pass is used to indicate approval, Modify is used to indicate modification, delete is used to indicate deletion, and ADD is used to indicate addition. For the convenience of expression, each expression is simplified to the corresponding simple symbol. The specific expressions are shown in Table 3.4

Result	Symbols
Pass	P
Modify	Μ
Delete	D
Add	А

Table 3.4 Conclusions of focus group experts on each strategy

Summary

The research method section determines the Delphi method and group discussion method as research methods based on the research questions and objectives. A combination of quantitative and qualitative methods was used in the specific research. The specific research process included three parts: preparing a research plan, research procedures and writing a research report. Among them, the research process is carried out in two stages according to the research objectives and time sequence:

1. Use the running Delphi method to study the current situation of the digital learner characteristics for Higher Vocational College students in Guangxi, and provide a model of the digital learner characteristics for Higher Vocational College students in Guangxi.

2. Use group discussion method to evaluate the digital learner characteristic model for Higher Vocational College students in Guangxi.

Chapter 4 Data Analysis Results

Development of a digital learner characteristics model for higher vocational colleges students in Guangxi. This research was to study: 1) To study the current situation of digital learner characteristics for Higher Vocational College Students in Guangxi; 2) To develop of digital learner characteristics model for Higher Vocational College Students in Guangxi; 3) To evaluate of digital learner characteristics model for Higher Vocational for Higher Vocational College Students in Guangxi; 3) To evaluate of digital learner characteristics model for Higher Vocational College Students in Guangxi.

The data analysis results are as follows:

1. Symbol and abbreviations

2. Presentation of data analysis

3. Results of data analysis

The details are as follows.

Symbol and Abbreviations

N refers to the Sample Md refers to the Median Mo refers to the Mode IQR refers to the Inter-Quartile Range

Presentation of Data Analysis

Part 1: The results of the personal information analysis of the respondents, classified by gender and education level. The analysis results are presented in the form of frequency and percentage in the study.

Part 2: Text statistical analysis of the interview data on the current status of digital learner characteristics of students in Guangxi vocational colleges.

Part 3: Median, mode and interquartile range analysis results of the questionnaire data on effective training strategies for digital learner characteristics of students in Guangxi vocational colleges.

Part 4: Qualitative analysis of the results of the focus group discussion analysis on the digital learner characteristics model of students in Guangxi vocational colleges.

Results of Data Analysis

The data involved in the study are analyzed in the following five parts: Part 1: Analysis of the personal information of the respondents, classified by gender and educational background. The analysis results are presented in the form of frequency and percentage.

Table 4.1 Basic information of the 21 experts interviewed using the Delphi method

					(n=21)
No	Experts	Experience	Professional Title	Work Unit	School Type
1	Hong Dong	15	Associate	Guangxi Vocational And	State
			Professor	Technical College Of	schools
				Communications	
2	Xu liyu	25	Associate	Liuzhou City Vocational	State
			Professor	College	schools
3	Fu Baolong	26	Professor	liuzhou vocational &	State
				technical college	schools
4	Zhang yang	22	Associate	Guangxi Vocational&Technical	State
			Professor	Institute of Industry	schools
5	Li Xiaohua	21	Associate	Guangxi Electrical Polytechnic	State
			Professor	Institute	schools
6	Zhang	14	Associate	GUANGXI VOCATIONAL &	State
	Xiaohua		Professor	TECHNICAL COLLEGE	schools
7	Xiang Kunyu	8	Lecturer	Guangxi Vocational&Technical	State
				Institute of Industry	schools
8	SuShenglin	8	Lecturer	Guangxi Vocational University	State
				Of Agriculture	schools
9	ZouCaishen	7	Lecturer	Guangxi Talentinter National	Private
				College	schools
10	Tang Meixia	22	Professor	Nanning College for	State
				Vocational Technology	schools
11	Jiang	27	Professor	liuzhou vocational &	State
	Wensheng			technical college	schools

Table 4.1 (Continue)

					(n=21)
No	Experts	Experience	Professional Title	Work Unit	School Type
12	Lin Feng	21	Professor	Guangxi Technological	State
				College of Machinery and	schools
				Electricity	
13	Wei Liang	14	Lecturer	Guangxi Financial Vocational	State
				College	schools
14	Zhang	26	Lecturer	GUANGXI VOCATIONAL &	State
	Wenyuan			TECHNICAL COLLEGE	schools
15	Tang	24	Associate	Wuzhou Vocational College	State
	Yongping		Professor		schools
16	Hu Ling	25	Professor	Liuzhou Railway Vocational	State
				Technical College	schools
17	Zhu	21	Associate	Liuzhou City Vocational	State
	Mengwei		Professor	College	schools
18	Zhong Wenji	18	Associate	Guangxi College of Water	State
			Professor	Resources and Electric Power	schools
19	Li Yanni	13	Associate	Guangxi Vocational And	State
			Professor	Technical College Of	schools
				Communications	
20	Gao Weifeng	22	Professor	Nanning College for	State
				Vocational Technology	schools
21	Chen Xinrui	14	Professor	Beihai Vocational College	State
					schools

According to table 4.1, all experts are from Guangxi vocational colleges, covering State schools and private schools, national high-level schools, Guangxi high-level schools and general schools, which are quite representative. The experts' academic qualifications and professional titles meet the requirements of this study. At the same time, they are not only very clear about the characteristics of digital learners in Guangxi vocational colleges, but also have rich teaching experience in digital learning.

			(==)
Statistical Categories	Personal Information	Frequency	Percentage
Canalar	Male	15	71.43%
Gender	Female	6	28.57%
	35-39years	5	23.81%
Age	40-49years	12	57.14%
	50-59years	4	19.05%
	5-9years	3	14.29%
Experience	10-15years	5	23.81%
	15years and above	13	61.9%
	lecturer	5	23.81%
Professional Title	Associate Professor	9	42.86%
	Professor	7	33.33%
Felventional	Bachelor's degree	3	14.29%
Educational	Master's degree	17	80.95%
background	Doctor's degree	1	4.76%

 Table 4.2 Personal information of the survey respondents

According to table 4.2, the survey found that all the interviewed experts were engaged in digital teaching and research from Guangxi vocational colleges. Their units included national high-level vocational colleges, Guangxi high-level vocational colleges, general schools and private schools, which were quite representative. There were 15 male experts, accounting for 71.43%, and 6 female experts, accounting for 28.57%. The interviewed experts were classified into three age groups, including 5 people in the 35-39 age group, accounting for 23.81%; 12 people in the 40-49 age group, accounting for 57.14%; and 4 people in the 50-59 age group, accounting for 19.05%. In terms of the working years of the interviewed experts, there were 3 people who had worked for 5-9 years, accounting for 14.29%. There were 5 people who had worked for 10-15 years, accounting for 23.81%; and there were 13 people who had worked for 15 years or more, accounting for 61.9%. According to the classification of the interviewed experts' titles, 5 people hold the title of lecturer, accounting for 23.81%; 9 people hold the title of associate professor, accounting for 42.86%; 7 people hold the title of professor, accounting for 33.33%. The educational background of the interviewed experts is: 3 people hold a bachelor's degree, accounting for 14.29%; 17 people hold a master's degree, accounting for 80.95%; 1 person holds a doctoral degree, accounting for 4.76%.

(n=21)

Part 2: Analyze the data obtained from open-ended interviews based on text statistical analysis to analyze the current status, problems and strategies of digital learners characteristics for higher vocational colleges students in Guangxi.

Round 1: Result

				((n=21)
Items	High	Medium	Low	Unspecified	Total
Digital literacy and skills	7	9	5	0	01
Digital literacy and skills	(33.33)	(42.85)	(23.82)	(0.00)	21
Interactive collaboration	3	6	9	3	21
capabilities	(14.29)	(28.57)	(42.85)	(14.29)	21
Independent learning ability	0	7	11	3	21
	(0.00)	(33.33)	(52.39)	(14.28)	21
Digital learning capabilities	4	10	6	1	21
	(19.04)	(47.62)	(28.57)	(4.77)	21
	0	6	12	3	21
FIODIEITI SOLVILIY SKILLS	(0.00)	(28.57)	(57.14)	(14.29)	21

 Table 4.3 Results for Round 1: Current situation problems

According to Table 4.3, Table 4.3 reflects the answers of 21 experts to Question 1 in the open interview: What do you think is the current status of the digital learner characteristics for higher vocational colleges students in Guangxi, and what problems exist? This is a comprehensive survey on the current status of the digital learner characteristics for higher Guangxi vocational colleges students in Guangxi, including not only the overall level of students' digital learner characteristics, but also the specific factors that affect students' digital learner characteristics, such as students' digital literacy and technical level, students' interactive and collaborative learning ability, students' autonomous learning ability, students' digital learning ability, students' problem-solving ability, etc. Each survey indicator is evaluated according to four levels: high, medium, low, and uncertain. According to the statistical results of the experts' answers, 33.33% of students have high digital literacy and skills, and 23.82% have low digital literacy. 14.29% of students have high interactive and collaborative abilities, and most of them are at a low level, accounting for 42.85%. The overall level of students' autonomous learning ability evaluation is low, with 0% having high and 52.39% having low. The evaluation results of students' digital learning ability show that 19.04% have high evaluations, 47.62% have medium evaluations, and 28.57% have low evaluations. The overall evaluation level of students' problemsolving ability is low, with 0% evaluating higher and 57.14% evaluating lower.

Effective strategies for improving	students' digital literacy and skills
1. The school provides support such as	2. Teachers make full use of digital
digital learning equipment, scenarios,	platforms to carry out interactive
resources, and online courses	teaching
3. The school provides students with	4. The school establishes a digital
innovative practical projects such as	literacy and skills evaluation system
data retrieval, programming, data	and conducts regular assessments
analysis, digital art, etc.	
5. The school provides network	6. Offer unified digital literacy and skills
conditions and learning places for digital	improvement courses such as
learning	"Information Technology"
7. Provide students with regular lectures	8. Regularly hold digital literacy and
and training on digital literacy and skills	skills competitions and other practical
	activities
9. Guiding students to use digital	10. Establish a resource library for
technology in a correct way	students' digital literacy and skills
	learning and training, so that students
	can learn and train digital skills at any
	time
11. Carry out assessment and	12. Arrange students to practice digital
certification of students' digital literacy	literacy and skills in enterprises
and skills, and require students to	
complete	
13. Strengthen students' network ethics	14. Establish student clubs or
and network security education	associations for digital literacy and skills
	training, and organize digital literacy and
	skills training activities through the clubs
	or associations

Table 4.4 Results for Round 1: Digital literacy and skills

Table 4.4 (Continue)

Effective strategies for improving s	students' digital literacy and skills
15. The school and the enterprise jointly	16. Establish a unified digital literacy
build a digital literacy and skills	and skills training guarantee system
classification teaching resource library,	mechanism, unified training standards
and require students to study on time	and assessment standards for the
every day	whole school
17. Schools should establish	18. Make full use of the National Digital
corresponding supporting incentive	Literacy Training Base
policies for students to improve their	
digital literacy and skills	

According to table 4.4, it reflects the answers of 21 open-ended interview experts to question 2: What do you think are the effective strategies for improving students' digital literacy and skills for higher vocational colleges in Guangxi ? Through text data statistics, a total of 18 effective strategies for improving students' digital literacy and skills were sorted out. Table 4.5 Results for Round 1: Interactive collaboration capabilities

Effective strategies to improve students	' interactive and collaborative abilities
19. Set up special courses related to	20. Organize interactive and
team interaction and collaboration	collaborative projects such as skill
	competitions and professional
	qualification certification
21. Carry out teaching with students as	22. Make full use of online teaching
the main body, create collective	platforms and resources to carry out
discussions and collaborative practice	team-based project teaching
23. Organize team collaboration and	24. Conduct comprehensive and
development activities	individual evaluations of teamwork
25 .Organize students to practice real	26. Implementing interactive and
enterprise projects	collaborative learning in groups
27. Teach cooperation skills such as	28. Cultivate interactive collaborative
expression, listening, and negotiation	thinking and cooperation awareness
29. Digital learning tools or platform	30. Regularly organize learning
support for interactive and collaborative	summary and analysis meetings in
learning	groups
31. Set up interactive collaborative	32. Organize course interest groups for
learning assessment	interactive and collaborative learning
33. Make full use of the online teaching	34. Implement interactive and
platform and arrange to complete a	collaborative learning role-playing
project or course design from time to	
time	

According to table 4.5, it reflects the answers of 21 open-ended interview experts to question 3: What do you think are the effective strategies to enhance the interactive and collaborative abilities for higher vocational colleges students in Guangxi in the context of the digital learning era? Through text data statistics, the above 16 effective strategies for improving students' interactive and collaborative abilities are sorted and classified.
Table 4.6 Results for Round 1: Independent learning ability

Effective strategies to improve stude	ents' independent learning ability
35. Guide students to establish study	36. Encourage students to develop
plans	good time management habits
37. Providing an environment for students	38. Provide students with a
to conduct independent learning	personalized learning space
39. Stimulate students' interest in learning	40. Encourage students to make good
	learning decisions
41. Organize student group activities to	42. Encourage students to help and
promote independent thinking in the	support each other in their learning
team	process
43. Cultivate students' teamwork spirit	44. Offering courses where students
and enhance their independent learning	can complete their own studies
ability	
45. Stimulate students' learning initiative	46. Provide personalized learning
and practical ability through practical	resources
learning activities	
47. Implementing autonomous learning	48. Make full use of online teaching
incentives	platforms to set up independent
	learning projects
49. Implement teaching that encourages	
and guides students to independently	
discover and solve problems	

According to table 4.6, it reflects the answers of 21 open-ended interview experts to question 4: What do you think are the effective strategies to enhance the independent learning ability for higher vocational colleges students in Guangxi in the context of the digital learning era? Through text data statistics, the above 15 effective strategies for improving students' independent learning ability are sorted and classified.

Effective strategies to improve students' digital learning abilities						
50. Strengthen students' understanding	51. Strengthen students' knowledge and					
and mastery of digital technology	skills in digital technologies					
52. Implementing diversified digital	53. Build a campus network and					
teaching	management monitoring center to					
	support, analyze and manage students'					
	digital learning					
54. Build diverse digital learning	55. Set up digital learning and seminar					
platforms and resources	credit assessment					
56. Improve teachers' digital teaching	57. Guiding students in digital learning					
and guidance capabilities						
58. Use online teaching platforms to	59. Use digital learning environments					
assign learning tasks and open-ended	and resources to cultivate students'					
assignments	independent discovery and exploration					
	learning abilities					
60. Conducting digital learning	61. Establish a school-wide digital					
evaluation and feedback	teaching policy system					
62. Conduct digital learning skills	63. Real-time display of students' digital					
competition for students	learning progress and related learning					
	activities					
64. Strengthen the assessment of digital						
learning ability						

According to table 4.7, it reflects the answers of 21 open-ended interview experts to question 5: What do you think are the effective strategies to enhance the digital learning ability of students in Guangxi higher vocational colleges in the context of the digital learning era? Through text data statistics, the above 15 effective strategies for improving students' digital learning ability are sorted and classified. Table 4.8 Results for Round 1: Problem solving skills

Effective strategies to improve stu	Effective strategies to improve students' problem-solving abilities						
65. Encourage students to proactively	66. Cultivate students' dialectical and						
solve problems	critical thinking abilities						
67. Enriching students' access to	68. Stimulate students' interest and						
knowledge and skills	motivation in solving problems						
69. Provide timely feedback and	70. Cultivate students' innovative						
guidance to students in solving problems	thinking and creativity						
71. Implement training that combines	72. Develop teamwork and						
theoretical knowledge with practical	communication skills						
application							
73. Implement teaching to cultivate	74. Implement the credit system and						
students' habit of solving problems	offer more elective courses to broaden						
independently	students' knowledge						
75. Organize practical activities to	76. Use heuristic teaching methods to						
improve problem-solving skills	carry out daily teaching						
77. Establish an assessment mechanism	78. Carry out on-the-job practical						
for students' problem-solving abilities	training						
79. Make full use of online teaching and							
learning platforms to carry out							
breakthrough teaching							

According to table 4.8, it reflects the answers of 21 open-ended interview experts to question 6: What do you think are the effective strategies to enhance the problem-solving ability of students in Guangxi vocational colleges in the context of the digital learning era? Through text data statistics, the above 15 effective strategies for improving students' problem-solving ability are sorted and classified.

Part 3: The analysis results of the questionnaire data about the digital learner characteristics model for higher vocational college students in Guangxi by Median, Mode and Inter-Quartile Range.

Based on the information collected from the first round of open-ended interview questionnaires, we classified and sorted out effective strategic suggestions in five aspects, including students' digital literacy and skills, students' interactive collaboration ability, students' independent learning ability, students' digital learning ability and students' problem-solving ability. We then prepared and distributed IOC questionnaires, collected confirmation feedback from IOC experts, sorted and improved them, formed the second round of questionnaires, and distributed them to 21 experts. We continued to collect and analyze the opinions and suggestions of experts through the questionnaires.

Results for Round 2:

					(n=21)
ltems	Digital literacy and skills	Md	Мо	IQR	Consensus
1	The school provides support such as	5	5	0	High
	digital learning equipment, scenarios,				
	resources, and online courses				
2	Teachers make full use of digital	3	3	0.5	Low
	platforms to carry out interactive				
	teaching				
3	The school provides students with	4	4	0.5	Low
	innovative practical projects such as				
	data retrieval, programming, data				
	analysis, digital art, etc.				
4	The school establishes a digital	4	5	0.5	High
	literacy and skills evaluation system				
	and conducts regular assessments				
5	The school provides network	5	5	0	High
	conditions and learning places for				
	digital learning				
6	Offer unified digital literacy and skills	5	5	0	High
	improvement courses such as				
	"Information Technology"				
7	Provide students with regular lectures	4	4	0.5	Low
	and training on digital literacy and				
	skills				
8	Regularly hold digital literacy and	4	4	0.5	Low
	skills competitions and other practical				
	activities				

Table 4.9 Results for Round 2: Digital literacy and skills

Table 4.9 (Continue)

					(n=21)
Items	Digital literacy and skills	Md	Мо	IQR	Consensus
9	Guiding students to use digital	4	5	1	Low
	technology in a correct way				
10	Establish a resource library for	3	4	1	Low
	students' digital literacy and skills				
	learning and training, so that students				
	can learn and train digital skills at any				
	time				
11	Carry out assessment and certification	4	4	0.5	High
	of students' digital literacy and skills,				
	and require students to complete				
12	Arrange students to practice digital	4	4	0.5	Low
	literacy and skills in enterprises				
13	Strengthen students' network ethics	5	5	0.5	High
	and network security education				
14	Establish student clubs or associations	4	4	0.5	Low
	for digital literacy and skills training,				
	and organize digital literacy and skills				
	training activities through the clubs or				
	associations				
15	Build a digital literacy and skills	4	5	1	Low
	classification teaching resource library				
	that can be learned every day				
16	Establish a unified digital literacy and	5	5	0.5	High
	skills training guarantee system				
	mechanism, unified training standards				
	and assessment standards for the				
	whole school				
17	Schools should establish	4	4	0.5	Low
	corresponding supporting incentive				
	policies for students to improve their				
	digital literacy and skills				
18	Make full use of the National Digital	4	5	1	Low
	Literacy Training Base				

According to table 4.9, it is found that among the 18 effective strategies for improving digital literacy and skills of Higher Vocational College Students in the second round, 7 were recognized by 75% or more of the 21 experts. They are item 1 "The school provides support such as digital learning equipment, scenarios, resources, and online courses" (Md=5, Mo=5, IQR=0), item 4 "The school establishes a digital literacy and skills evaluation system and conducts regular assessments" (Md=4, Mo=5, IQR =0.5), item 5 "The school provides network conditions and learning places for digital learning" (Md=5, Mo=5, IQR=0), item 6 "Offer unified digital literacy and skills improvement courses such as 'Information Technology" (Md=5, Mo=5, IQR=0), item 11 "Carry out assessment and certification of students' digital literacy and skills, and require students to complete" (Md =4, Mo=4, IQR =0.5), item 13 "Strengthen students' network ethics and network security education" (Md =5, Mo=5, IQR=0.5), item 16 "Establish a unified digital literacy and skills training guarantee system" mechanism, unified training standards and assessment standards for the whole school" (Md=5, Mo=5, IQR=0.5).

					(n=21)
Items	Interactive collaboration capabilities	Md	Мо	IQR	Consensus
1	Set up special courses related to team	3	3	0.5	Low
	interaction and collaboration				
2	Organize interactive and collaborative	5	5	0.5	High
	projects such as skill competitions and				
	professional qualification certification				
3	Carry out teaching with students as	4	5	1	Low
	the main body, create collective				
	discussions and collaborative practice				
4	Make full use of online teaching	5	5	0.5	High
	platforms and resources to carry out				
	team-based project teaching				
5	Organize team collaboration and	4	5	1	Low
	development activities				
6	Conduct comprehensive and	4	5	1	Low
	individual evaluations of teamwork				
7	Organize students to practice real	5	5	0	High
	enterprise projects				

 Table 4.10 Results for Round 2: Interactive collaboration capabilities

Table 4.10 (Continue)

					(n=21)
ltems	Interactive collaboration capabilities	Md	Мо	IQR	Consensus
8	Implementing interactive and	4	5	0.5	High
	collaborative learning in groups				
9	Teach cooperation skills such as	4	4	0.5	High
	expression, listening, and negotiation				
10	Cultivate interactive collaborative	5	5	0.5	High
	thinking and cooperation awareness				
11	Digital learning tools or platform	4	3	0.5	Low
	support for interactive and				
	collaborative learning				
12	Regularly organize learning summary	4	4	1	Low
	and analysis meetings in groups				
13	Set up interactive collaborative	4	5	1	Low
	learning assessment				
14	Organize course interest groups for	4	5	0.5	High
	interactive and collaborative learning				
15	Make full use of the online teaching	5	5	0.5	High
	platform and arrange to complete a				
	project or course design from time to				
	time				
16	Implement interactive and	5	5	0.5	High
	collaborative learning role-playing				

According to table 4.10, it was found that among the 16 effective strategies for improving the interactive and collaborative abilities of Higher Vocational College Students in the second round, 9 were recognized by 75% or more of the 21 experts. They are the 2nd item "Organize interactive and collaborative projects such as skill competitions and professional qualification certification" (Md=5, Mo=5, IQR=0.5), the 4th item "Make full use of online teaching platforms and resources to carry out teambased project teaching" (Md=5, Mo=5, IQR =0.5), the 7th item "Organize students to practice real enterprise projects" (Md=5, Mo=5, IQR=0), and the 8th item "Implementing interactive and collaborative learning in groups" (Md=4, Mo=5, IQR=0.5), item 9 "Teach cooperation skills such as expression, listening, and negotiation" (Md =4, Mo=4, IQR =0.5), item 10 "Cultivate interactive collaborative thinking and cooperation awareness" (Md=5, Mo=5, IQR=0.5), item 14 "Organize course interest groups for interactive and collaborative learning" (Md=4, Mo=5, IQR=0.5), item 15 "Make full use of the online teaching platform and arrange to complete a project or course design from time to time" (Md=5, Mo=5, IQR=0.5), item 16 "Implement interactive and collaborative learning role-playing" (Md=5, Mo=5, IQR=0.5).

Items	Independent learning ability	Md	Мо	IQR	Consensus
1	Guide students to establish study plans	5	5	0	High
2	Encourage students to develop good	5	5	0.5	High
	time management habits				-
3	Providing an environment for students to	3	3	0.5	Low
	conduct independent learning				
4	Provide students with a personalized	4	5	1	Low
	learning space				
5	Stimulate students' interest in learning	4	4	1	Low
6	Encourage students to make good	4	5	0.5	High
	learning decisions				
7	Organize student group activities to	4	4	0.5	Low
	promote independent thinking in the				
	team				
8	Encourage students to help and support	4	5	1	Low
	each other in their learning process				
9	Cultivate students' teamwork spirit and	4	4	1	Low
	enhance their independent learning				
	ability				
10	Offering courses where students can	4	3	1	Low
	complete their own studies				
11	Stimulate students' learning initiative and	5	5	0.5	High
	practical ability through practical learning				
	activities				
12	Provide personalized learning resources	4	4	0.5	Low

 Table 4.11 Results for round 2: Independent learning ability

(n=21)

Table 4.11 (Continue)

					(n=21)
Items	Independent learning ability	Md	Мо	IQR	Consensus
13	Implementing autonomous learning	4	4	0.5	Low
	incentives				
14	Make full use of online teaching platforms	4	3	1	Low
	to set up independent learning projects				
15	Implement teaching that encourages and	4	4	0.5	High
	guides students to independently discover				
	and solve problems				

According to table 4.11, it is found that among the 15 effective strategies for improving the independent learning ability of Higher Vocational College Students in the second round, 5 were recognized by 75% or more of the 21 experts. They are Item 1 "Guide students to establish study plans" (Md=5, Mo=5, IQR=0), Item 2 "Encourage students to develop good time management habits" (Md=5, Mo=5, IQR =0.5), Item 6 "Encourage students to make good learning decisions" (Md=4, Mo=5, IQR=0.5), Item 11 "Stimulate students' learning initiative and practical ability through practical learning activities" (Md=5, Mo=5, IQR=0.5), and Item 15 "Implement teaching that encourages and guides students to independently discover and solve problems" (Md=4, Mo=4, IQR=0.5).

					(==)
ltems	Digital learning capabilities	Md	Мо	IQR	Consensus
1	Strengthen students' understanding	4	4	4	
	and mastery of digital technology	4	4	T	LOW
2	Strengthen students' knowledge and	4	4	0 5	
	skills in digital technologies	4	4	0.5	LOW
3	Implementing diversified digital	-	_	0 5	
	teaching	5	5	0.5	High
4	Build a campus network and				
	management monitoring center to	-	_	•	
	support, analyze and manage	5	5	0	High
	students' digital learning				

 Table 4.12 Results for Round 2: Digital learning capabilities

(n=21)

Table 4.12 (Continue)

					(n=21)
Items	Digital learning capabilities	Md	Мо	IQR	Consensus
5	Build diverse digital learning platforms and resources	5	5	0	High
6	Set up digital learning and seminar credit assessment	4	5	0.5	High
7	Improve teachers' digital teaching and guidance capabilities	4	4	1	Low
8	Guiding students in digital learning	4	4	1	Low
9	Use online teaching platforms to assign learning tasks and open-ended assignments	5	5	0	High
10	Use digital learning environments and resources to cultivate students' independent discovery and exploration learning abilities	4	3	1	Low
11	Conducting digital learning evaluation and feedback	4	4	1	Low
12	Establish a school-wide digital teaching policy system	4	4	0.5	Low
13	Conduct digital learning skills competition for students	4	5	0.5	High
14	Real-time display of students' digital learning progress and related learning activities	3	3	0.5	Low
15	Strengthen the assessment of digital learning ability	4	5	0.5	High

According to table 4.12, it is found that among the 15 effective strategies for improving the digital learning ability of Higher Vocational College Students in the second round, 7 were recognized by 75% or more of the 21 experts. They are the 3rd item "Implementing diversified digital teaching" (Md=5, Mo=5, IQR=0.5), the 4th item "Build a campus network and management monitoring center to support, analyze and manage students' digital learning" (Md=5, Mo=5, IQR=0), the 5th item "Build diverse digital learning platforms and resources" (Md=5, Mo=5, IQR=0), and the 6th

item "Set up digital learning and seminar credit assessment" (Md=5, Mo=5, IQR=0). d=4, Mo=5, IQR=0.5), item 9 "Use online teaching platforms to assign learning tasks and open-ended assignments" (Md=5, Mo=5, IQR=0), item 13 "Conduct digital learning skills competition for students" (Md=4, Mo=5, IQR=0.5), item 15 "Strengthen the assessment of digital learning ability" (Md=4, Mo=5, IQR=0.5).

					(n=21)
ltems	Problem solving skills	Md	Мо	IQR	Consensus
1	Encourage students to proactively solve problems	5	5	0.5	High
2	Cultivate students' dialectical and critical thinking abilities	5	5	0	High
3	Enriching students' access to knowledge and skills	4	4	0.5	Low
4	Stimulate students' interest and motivation in solving problems	5	5	0	High
5	Provide timely feedback and guidance to students in solving problems	4	3	1	Low
6	Cultivate students' innovative thinking and creativity	4	4	0.5	Low
7	Implement training that combines theoretical knowledge with practical application	4	5	0.5	High
8	Develop teamwork and communication skills	4	3	0.5	Low
9	Implement teaching to cultivate students' habit of solving problems independently	4	5	0.5	High
10	Implement the credit system and offer more elective courses to broaden students' knowledge	5	5	0.5	High
11	Organize practical activities to improve problem-solving skills	4	4	1	Low
12	Use heuristic teaching methods to carry out daily teaching	4	4	1	Low

Table 4.13 Results for Round 2: Problem solving skills

Table 4.13 (Continue)

					(11=21)
Items	Problem solving skills	Md	Мо	IQR	Consensus
13	Establish an assessment mechanism	2	2	<u>م </u>	1
	for students' problem-solving abilities	2	2	0.5	LOW
14	Carry out on-the-job practical training	5	5	0.5	High
15	Make full use of online teaching and				
	learning platforms to carry out	4	3	0.5	Low
	breakthrough teaching				

According to table 4.13, among the 15 effective strategies in round 2, 7 strategies were unanimously recognized by 75% or more of the 21 experts. They are the 1st item "Encourage students to proactively solve problems" (Md=5, Mo=5, IQR=0.5), the 2nd item "Cultivate students' dialectical and critical thinking abilities" (Md=5, Mo=5, IQR=0), the 4th item "Stimulate students' interest and motivation in solving problems" (Md=5, Mo=5, IQR=0), and the 7th item "Implement training that combines theoretical knowledge with practical application" (Md=4, Mo=5, IQR=0.5), item 9 "Implement teaching to cultivate students' habit of solving problems independently" (Md=4, Mo=5, IQR=0.5), item 10 "Implement the credit system and offer more elective courses to broaden students' knowledge" (Md=5, Mo=5, IQR=0.5), item 14 "Carry out on-the-job practical training" (Md=5, Mo=5, IQR=0.5).

Results for Round 3:

					(n=21)
Items	Digital literacy and skills	Md	Мо	IQR	Consensus
1	The school provides support such as	5	5	0.5	High
	digital learning equipment, scenarios,				
	resources, and online courses				
2	Teachers make full use of digital platforms	4	3	0.5	Low
	to carry out interactive teaching				
3	The school provides students with	4	4	0.5	Low
	innovative practical projects such as data				
	retrieval, programming, data analysis,				
	digital art, etc.				

Table 4.14 Results for Round 3: Digital literacy and skills

(n - 21)

Table 4.14 (Continue)

					(n=21)
ltems	Digital literacy and skills	Md	Мо	IQR	Consensus
4	The school establishes a digital literacy	5	5	0.5	High
	and skills evaluation system and conducts				
	regular assessments				
5	The school provides network conditions	5	5	0.5	High
	and learning places for digital learning				
6	Offer unified digital literacy and skills	5	5	0.5	High
	improvement courses such as "Information				
	Technology"				
7	Provide students with regular lectures and	4	4	0.5	Low
	training on digital literacy and skills				
8	Regularly hold digital literacy and skills	4	5	0.5	High
	competitions and other practical activities				
9	Guiding students to use digital technology	4	5	1	Low
	in a correct way				
10	Establish a resource library for students'	3	3	1	Low
	digital literacy and skills learning and				
	training, so that students can learn and				
	train digital skills at any time				
11	Carry out assessment and certification of	4	5	0.5	High
	students' digital literacy and skills, and				
	require students to complete				
12	Arrange students to practice digital literacy	4	5	1	Low
	and skills in enterprises				
13	Strengthen students' network ethics and	5	5	0.5	High
	network security education				
14	Establish student clubs or associations for	4	4	0.5	High
	digital literacy and skills training, and				
	organize digital literacy and skills training				
	activities through the clubs or associations				
15	The school and the enterprise jointly build	5	5	0.5	High
	a digital literacy and skills classification				
	teaching resource library, and require				
	students to study on time every day				

Table 4.14 (Continue)

					(n=21)
Items	Digital literacy and skills	Md	Мо	IQR	Consensus
16	Establish a unified digital literacy and skills	5	5	0	High
	training guarantee system mechanism,				
	unified training standards and assessment				
	standards for the whole school				
17	Schools should establish corresponding	3	3	0.5	Low
	supporting incentive policies for students				
	to improve their digital literacy and skills				
18	Make full use of the National Digital	4	5	1	Low
	Literacy Training Base				

According to table 4.14, among the 18 effective strategies for students' digital literacy and skills in Round 3, 10 strategies were unanimously recognized by 75% or more of the 21 experts. However, the following strategies did not reach a consensus of 75%, namely, item 2 "Teachers make full use of digital platforms to carry out interactive teaching" (Md=4, Mo=3, IQR=0.5), item 3 "The school provides students with innovative practical projects such as data retrieval, programming, data analysis, digital art, etc." (Md=4, Mo=4, IQR=0.5), item 7 "Provide students with regular lectures and training on digital literacy and skills" (Md=4, Mo=4, IQR=0.5), item 9 "Guiding students to use digital technology in a correct way" (Md=4, Mo=5, IQR=1), item 10 "Establish a resource library for students' digital literacy and skills learning and training, so that students can learn and train digital skills at any time" (Md=3, Mo=3, IQR=1), item 12 "Arrange students to practice digital literacy and skills in enterprises" (Md=4, Mo=5, IQR=1), item 17 "Schools should establish corresponding supporting incentive policies for students to improve their digital literacy and skills" (Md=3, Mo=3, IQR=0.5), item 18 "Make full use of the National Digital Literacy Training Base" (Md=4, Mo=5, IQR=1).

					(n=21)
ltems	Interactive collaboration capabilities	Md	Мо	IQR	Consensus
1	Set up special courses related to team	3	3	0.5	Low
	interaction and collaboration				
2	Organize interactive and collaborative	5	5	0	High
	projects such as skill competitions and				
	professional qualification certification				
3	Carry out teaching with students as the	4	5	0.5	High
	main body, create collective discussions				
	and collaborative practice				
4	Make full use of online teaching	5	5	0.5	High
	platforms and resources to carry out				
	team-based project teaching				
5	Organize team collaboration and	4	5	1	Low
	development activities				
6	Conduct comprehensive and individual	4	5	1	Low
	evaluations of teamwork				
7	Organize students to practice real	5	5	0	High
	enterprise projects				
8	Implementing interactive and	5	5	0.5	High
	collaborative learning in groups				
9	Teach cooperation skills such as	4	4	1	Low
	expression, listening, and negotiation				
10	Cultivate interactive collaborative	5	5	0	High
	thinking and cooperation awareness				
11	Digital learning tools or platform	4	4	0	High
	support for interactive and collaborative				
	learning				
12	Regularly organize learning summary	4	4	1	Low
	and analysis meetings in groups				
13	Set up interactive collaborative learning	4	5	1	Low
	assessment				
14	Organize course interest groups for	5	5	0.5	High
	interactive and collaborative learning				

 Table 4.15 Results for Round 3: Interactive collaboration capabilities

Table 4.15 (Continue)

					(n=21)
ltems	Interactive collaboration capabilities	Md	Мо	IQR	Consensus
15	Make full use of the online teaching	5	5	0.5	High
	platform and arrange to complete a				
	project or course design from time to				
	time				
16	Implement interactive and collaborative	4	5	0.5	High
	learning role-playing				

According to table 4.15, among the 16 effective strategies for students' mutual assistance and collaboration ability in round 3, a total of 10 strategies were unanimously recognized by 75% or more of the 21 experts. However, there are still the following strategies that have not reached a consensus of 75%, namely, item 1 "Set up special courses related to team interaction and collaboration" (Md=3, Mo=3, IQR=0.5), item 5 "Organize team collaboration and development activities" (Md=4, Mo=5, IQR=1), item 6 "Conduct comprehensive and individual evaluations of teamwork" (Md=4, Mo=5, IQR=1), item 9 "Teach cooperation skills such as expression, listening, and negotiation" (Md=4, Mo=4, IQR=1), item 12 "Regularly organize learning summary and analysis meetings in groups" (Md=4, Mo=5, IQR=1).

					(n=21)
ltems	Independent learning ability	Md	Мо	IQR	Consensus
1	Independent learning ability	5	5	0	High
2	Guide students to establish study plans	5	5	0.5	High
3	Encourage students to develop good	3	3	0.5	Low
	time management habits				
4	Providing an environment for students to	3	3	0.5	Low
	conduct independent learning				
5	Provide students with a personalized	4	4	1	Low
	learning space				
6	Stimulate students' interest in learning	5	5	0.5	High
7	Encourage students to make good	4	5	1	Low
	learning decisions				

Table 4.16 Results for Round 3: Independent learning ability

Table 4.16 (Continue)

					(n=21)
ltems	Independent learning ability	Md	Мо	IQR	Consensus
8	Organize student group activities to	4	3	1	Low
	promote independent thinking in the				
	team				
9	Encourage students to help and support	5	5	0.5	High
	each other in their learning process				
10	Cultivate students' teamwork spirit and	4	3	1	Low
	enhance their independent learning				
	ability				
11	Offering courses where students can	5	5	0.5	High
	complete their own studies				
12	Stimulate students' learning initiative and	4	5	0.5	High
	practical ability through practical learning				
	activities				
13	Provide personalized learning resources	5	5	0.5	High
14	Implementing autonomous learning	5	5	0	High
	incentives				
15	Make full use of online teaching	5	5	0.5	High
	platforms to set up independent learning				
	projects				

According to table 4.16, among the 15 effective strategies for students' independent learning ability in round 3, 9 strategies were unanimously recognized by 75% or more of the 21 experts. However, the following strategies still did not reach 75% consensus, namely, item 3 "Encourage students to develop good time management habits" (Md=3, Mo=3, IQR=0.5), item 4 "Providing an environment for students to conduct independent learning" (Md=3, Mo=3, IQR=0.5), item 5 "Provide students with a personalized learning space" (Md=4, Mo=4, IQR=1), item 7 "Encourage student group activities to promote independent thinking in the team" (Md=4, Mo=3, IQR=1), and item 10 "Cultivate students' teamwork spirit and enhance their independent learning ability" (Md=4, Mo=3, IQR=1).

Table 4.17 Results for round	3: Digital learning capabilities
------------------------------	----------------------------------

					(n=21)
ltems	Digital learning capabilities	Md	Мо	IQR	Consensus
1	Strengthen students' understanding and	4	4	1	Low
	mastery of digital technology				
2	Strengthen students' knowledge and	4	4	1	Low
	skills in digital technologies				
3	Implementing diversified digital teaching	5	5	0	High
4	Build a campus network and	5	5	0	High
	management monitoring center to				
	support, analyze and manage students'				
	digital learning				
5	Build diverse digital learning platforms	5	5	0	High
	and resources				
6	Set up digital learning and seminar	5	5	0.5	High
	credit assessment				
7	Improve teachers' digital teaching and	4	5	1	Low
	guidance capabilities				
8	Guiding students in digital learning	4	5	0.5	High
9	Use online teaching platforms to assign	5	5	0	High
	learning tasks and open-ended				
	assignments				
10	Use digital learning environments and	4	4	1	Low
	resources to cultivate students'				
	independent discovery and exploration				
	learning abilities				
11	Conducting digital learning evaluation	4	5	1	Low
	and feedback				
12	Establish a school-wide digital teaching	5	5	0.5	High
	policy system				
13	Conduct digital learning skills	5	5	0.5	High
	competition for students				

Table 4.17 (Continue)

					(n=21)
Items	Digital learning capabilities	Md	Мо	IQR	Consensus
14	Real-time display of students' digital	3	3	0.5	Low
	learning progress and related learning				
	activities				
15	Strengthen the assessment of digital	5	5	0.5	High
	learning ability				

According to table 4.17, among the 15 effective strategies for students' digital learning ability in round 3, 9 strategies were unanimously recognized by 75% or more of the 21 experts. However, the following strategies still did not reach a consensus of 75%, namely, item 1 "Strengthen students' understanding and mastery of digital technology" (Md=4, Mo=4, IQR=1), item 2 "Strengthen students' knowledge and skills in digital technologies" (Md=4, Mo=4, IQR=1), item 7 "Improve teachers' digital teaching and guidance capabilities" (Md=4, Mo=5, IQR=1), item 10 "Use digital learning environments and resources to cultivate students' independent discovery and exploration learning abilities" (Md=4, Mo=5, IQR=1), item 11 "Conducting digital learning evaluation and feedback" (Md=4, Mo=5, IQR=1), and item 14 "Real-time display of students' digital learning progress and related learning activities" (Md=3, Mo=3, IQR=0.5).

					(n=21)
ltems	Problem solving skills	Md	Мо	IQR	Consensus
1	Encourage students to proactively	4	5	1	Low
	solve problems				
2	Cultivate students' dialectical and	5	5	0	High
	critical thinking abilities				
3	Enriching students' access to	4	5	1	Low
	knowledge and skills				
4	Stimulate students' interest and	5	5	1	Low
	motivation in solving problems				
5	Provide timely feedback and guidance	4	5	1	Low
	to students in solving problems				

Table 4.18 Results for round 3: Problem solving skills

Table 4.18 (Continue)

					(n=21)
Items	Problem solving skills	Md	Мо	IQR	Consensus
6	Cultivate students' innovative thinking	4	4	1	Low
	and creativity				
7	Implement training that combines	5	5	0	High
	theoretical knowledge with practical				
	application				
8	Develop teamwork and	5	5	0.5	High
	communication skills				
9	Implement teaching to cultivate	5	5	0	High
	students' habit of solving problems				
	independently				
10	Implement the credit system and offer	5	5	1	Low
	more elective courses to broaden				
	students' knowledge				
11	Organize practical activities to improve	5	5	0.5	High
	problem-solving skills				
12	Use heuristic teaching methods to	5	5	0	High
	carry out daily teaching				
13	Establish an assessment mechanism	3	3	0.5	Low
	for students' problem-solving abilities				
14	Carry out on-the-job practical training	5	5	0	High
15	Make full use of online teaching and	5	5	0.5	High
	learning platforms to carry out				
	breakthrough teaching				

According to table 4.18, among the 15 effective strategies for students' problem-solving ability in round 3, 8 strategies were unanimously recognized by 75% or more of the 21 experts. However, the following strategies still did not reach a consensus of 75%, namely, item 1 "Encourage students to proactively solve problems" (Md=4, Mo=5, IQR=1), item 3 "Enriching students' access to knowledge and skills" (Md=4, Mo=5, IQR=1), item 4 "Stimulate students' interest and motivation in solving problems" (Md=5, Mo=5, IQR=1), item 5 "Provide timely feedback and guidance to students in solving problems" (Md=4, Mo=5, IQR=1), item 5 "Cultivate students' innovative thinking and creativity" (Md=4, Mo=4, IQR=1), item 10 "Implement

the credit system and offer more elective courses to broaden students' knowledge" (Md=5, Mo=5, IQR=1), and item 13 "Establish an assessment mechanism for students' problem-solving abilities" (Md=3, Mo=3, IQR=0.5).

Focusing on the research on the digital learners characteristics for higher vocational colleges students in Guangxi, through three rounds of expert surveys, combined with the consensus strategy of experts and research analysis findings, a systematic the digital learners characteristics model for higher vocational colleges students in Guangxi (version 1) was constructed, as shown in Figure 4.1.





Interactive collaboration capabilities

- 1. Build interactive and collaborative teaching platform
- 2. Implement student-centered interactive and collaborative teaching
- 3. Implement interactive and collaborative project learning and practice

Digital learning capabilities

- 1. Enrich digital platforms and resources
- 2. Implement digital teaching
- 3. Carry out digital learning skills practice
- 4. Implement digital learning assessment and evaluation

2. Implement teaching to cultivate students' problem-solving ability

3. Enrich activities and practices to cultivate problem-solving ability

Figure 4.1 The digital learner characteristics model for vocational colleges students in Guangxi (version 1)

In Figure 4.1, The digital learner characteristic model for higher vocational colleges students in Guangxi (version 1). The model includes five dimensions of Guangxi vocational college students' digital learner characteristics, namely, digital literacy and skills, interactive collaboration capabilities, independent learning ability, digital learning capabilities, and problem solving skills. These five dimensions comprehensively constitute the students' digital learner characteristics. The following is an explanation of the five dimensions of the model. For the convenience of expression, the researchers summarized and refined the characteristic models of each field into short phrases, called "themes", followed by the specific digital learner characteristic models of students. The researchers proposed 10 digital literacy and skill models, 10 interactive collaboration ability models, 9 autonomous learning ability models, 9 digital learning ability models, and 8 problem-solving ability models, a total of 47 models. The details are as follows:

The digital literacy and skills include five major themes: systems and mechanisms, digital learning hardware and software conditions, cybersecurity education, course offerings and digital skills activities, and a sound evaluation system; systems and mechanisms include: establishing unified standards for the development of digital literacy and skills, and establishing unified assessment standards; digital learning hardware and software conditions include: building a sound basic network, building digital learning places, purchasing digital learning equipment, and building digital learning platforms and resources; course offerings and skill activities include: offering information technology courses with unified standards, regularly holding digital literacy and skills, organizing lectures or training related to digital literacy and skills, building a digital literacy and skills project library and setting learning content every day; a sound evaluation system; cybersecurity education includes: cybersecurity awareness education and the safe use of social media.

Interactive collaboration capabilities include three major themes: building interactive collaborative teaching platform resources, implementing student-centered interactive collaborative teaching, and implementing interactive collaborative project learning and practice. Building interactive collaborative teaching platform resources includes two modes: building online teaching platforms and resources, and building digital learning tools for interactive collaborative learning; implementing student-centered interactive collaborative teaching includes four modes: building attention teaching includes four modes: implementing student-centered interactive collaborative teaching includes four modes: implementing student-centered collective discussion and collaborative practice teaching, making

full use of online platforms to implement interactive collaborative teaching, demonstrating and guiding interactive collaborative teaching, and making full use of online platforms for project-based interactive collaborative teaching; implementing interactive collaborative project learning and practice includes five modes: conducting interactive collaborative skills competitions, conducting interactive collaborative project practices, conducting interactive collaborative enterprise practices, conducting group interactive collaborative learning, forming interactive collaborative learning groups, and implementing interactive collaborative collaborative role-playing.

Independent learning capabilities include three major themes: personalized learning support, cultivating independent learning capabilities, and providing platform resources for independent learning. Personalized learning support includes three modes: guiding the formulation of personalized learning goal plans, guiding the establishment of self-management awareness, and guiding the formulation of independent learning goal plans; the cultivation of independent learning ability includes four modes: cultivating students' teamwork spirit to enhance independent learning ability, organizing independent learning project inspections and practices, implementing student-centered independent learning teaching methods, and implementing homework-driven course teaching methods; providing independent learning platform resources and providing rich independent learning network resources.

Digital learning ability includes four major themes: enriching digital platforms and resources, implementing digital teaching, carrying out digital learning skills practice, and implementing digital learning assessment. Enriching digital platforms and resources includes five modes: building digital teaching platforms, building digital teaching resources, building digital learning environments, building digital learning platforms, and building digital learning resources; implementing digital teaching includes three modes: setting up digital learning and discussion credits to encourage students to conduct digital learning, making full use of online teaching platforms to implement teaching and guidance, guiding students to conduct digital learning, teachers conducting online answering interactions, and guiding students to conduct digital learning digital learning assessment includes two modes: setting up digital learning and discussion credits to reform course learning evaluation and strengthen the assessment of students' digital learning ability.

Problem-solving ability includes three major themes: digital platform support, implementation of teaching to cultivate students' problem-solving ability, enrichment of activities and practices to cultivate problem-solving ability, and strengthening process guidance. Digital platform support includes two modes: using online teaching platforms and resources to implement student-centered teaching to cultivate students' independent problem-solving ability, and using online teaching platforms and learning platforms to implement level-breaking task learning to improve problem-solving ability; the implementation of teaching to cultivate students' problem-solving ability includes three modes: implementing teaching methods to guide students to use speculative and critical thinking to cultivate students' critical thinking ability and problem-solving ability, implementing training that combines theoretical knowledge with practical application, allowing students to consolidate and apply the knowledge they have learned in the process of solving practical problems and improve their problem-solving ability, and implementing heuristic teaching to improve students' problem-solving ability through heuristic guidance; enrichment of activities and practices to cultivate problem-solving ability includes three modes: organizing group cooperation to solve problems together to improve teamwork and communication skills, organizing practical activities such as skill competitions to improve problem-solving ability, and setting up corporate job practices to improve problem-solving ability through practice.

Part 4: Qualitative analysis of the results of the focus group discussion on the digital learner characteristics model for Higher vocational colleges students in Guangxi

		(n=9)
ltems	Digital literacy and skills	Result
1	The school provides support such as digital learning equipment,	Р
	scenarios, resources, and online courses	
2	The school establishes a digital literacy and skills evaluation	Ρ
	system and conducts regular assessments	
3	The school provides network conditions and learning places for	Ρ
	digital learning	
4	Offer unified digital literacy and skills improvement courses such	Ρ
	as "Information Technology"	
5	Regularly hold digital literacy and skills competitions and other	Ρ
	practical activities	
6	Carry out assessment and certification of students' digital literacy	Ρ
	and skills, and require students to complete	

Table 4.19 Result for discussion: Digital literacy and skills

Table 4.19 (Continue)

		(n=9)
ltems	Digital literacy and skills	Result
7	Establish student clubs or associations for digital literacy and	Р
	skills training, and organize digital literacy and skills training	
	activities through the clubs or associations	
8	Develop learning resources and teaching project libraries in	Μ
	various fields related to digital literacy and skills, implement	
	them into daily teaching and keep the resources continuously	
	updated	
9	Establish a unified digital literacy and skills training guarantee	Р
	system mechanism, unified training standards and assessment	
	standards for the whole school	
10	Strengthen students' network ethics and network security skills	Μ
	education	
11	Provide teacher guidance for students to improve their digital	А
	literacy and skills	

According to table 4.19, 9 experts were consulted to evaluate the feasibility of 10 models for improving students' digital literacy and skills. Items 1, 2, 3, 4, 5, 6, 7, and 9 were unanimously approved. Item 8 "Establish a resource library for students' digital literacy and skills learning and training, so that students can learn and train digital skills at any time" was revised to "Develop learning resources and teaching project libraries in various fields related to digital literacy and skills, implement them into daily teaching and keep the resources continuously updated", Item 10 "Strengthen students' network ethics and network security education" was revised to "Strengthen students' network ethics and network security skills education", and Item 11 "Provide teacher guidance for students to improve their digital literacy and skills" was added.

Table 4.20 Result for discussion: Interactive collaboration capabilitie	es
---	----

		(n=9)
ltems	Interactive collaboration capabilities	Result
1	Organize interactive and collaborative projects such as skill	D
	competitions and professional qualification certification	
2	Carry out teaching with students as the main body, create	Р
	collective discussions and collaborative practice	
3	Make full use of online teaching platforms and resources to	Р
	carry out team-based project teaching	
4	Organize students to practice real enterprise projects	Р
5	Implementing interactive and collaborative learning in groups	Р
6	Cultivate interactive collaborative thinking and cooperation	Р
	awareness	
7	Digital learning tools or platform support for interactive and	Р
	collaborative learning	
8	Conduct interactive and collaborative learning in small groups	Р
9	Make full use of the online teaching platform and arrange to	Р
	complete a project or course design from time to time	
10	Implement interactive and collaborative learning role-playing	Р
11	Implement interactive collaboration skills assessment	А

According to table 4.20, 9 experts were consulted to evaluate the feasibility of 10 models for improving students' interactive and collaborative abilities. Items 2, 3, 4, 5, 6, 7, 8, 9, and 10 were unanimously approved. It was suggested to delete item 1 because the research was about the interactive and collaborative ability characteristics of students' digital learners. Therefore, item 2 already included the content of item 1, and add item 11 "Set up interactive and collaborative ability assessment".

		(n=9)
Items	Independent learning ability	Result
1	Strengthening students' independent learning ability	Μ
2	Guide students to develop study plans	Р
3	Provide personalized learning resources	Р
4	Encourage students to help and support each other in the	Р
	learning process	
5	Self-study courses	Р
6	Stimulate students' learning initiative and practical ability	Р
	through practical learning activities	
7	Stimulate students' interest in learning	Р
8	Implementing autonomous learning incentives	Р
9	Make full use of online teaching platforms and set up	Р
	independent learning projects	
10	Provide teacher guidance and support	А
11	Implementation evaluation feedback	А
12	Guided self-reflection and evaluation	А

Table 4.21 Result for discussion: Independent learning ability

According to table 4.21, 9 experts were consulted to evaluate the feasibility of 9 models for improving students' independent learning ability, and unanimously approved items 2, 3, 4, 5, 6, 7, 8, and 9. Item 1 "independent learning ability" was strengthened, item 10 "providing teacher guidance and support" was added, item 11 "implementing evaluation feedback" was added, and item 12 "guiding self-reflection and evaluation" was added.

Table 4.22 Result for discussion: Digital learning capabilities

		(n=9)
ltems	Digital learning capabilities	Result
1	Implementing diversified digital teaching	Ρ
2	Build a campus network and management monitoring center to	Ρ
	support, analyze and manage students' digital learning	
3	Build diverse digital learning platforms and resources	Ρ
4	Set up digital learning and seminar credit assessment	Ρ
5	Guiding students in digital learning	Ρ
6	Use online teaching platforms to assign learning tasks and open-	Ρ
	ended assignments	
7	Establish a school-wide digital teaching policy system	Ρ
8	Conduct digital learning skills competition for students	Ρ
9	Strengthen the assessment of digital learning ability	Ρ
10	Improving teachers' digital teaching capabilities	А
11	Provide digitalization situation analysis and learning evaluation	А
	services for teachers	
12	Improve the organizational management and guarantee service	А
	mechanism for the entire process of digital teaching	
13	Provide students with digital academic warnings and academic	А
	assistance	

According to table 4.22, 9 experts were consulted to evaluate the feasibility of 9 models for improving students' independent learning ability, and Items 1, 2, 3, 4, 5, 6, 7, 8, and 9 were unanimously approved. At the same time, Item 10 "Improving teachers' digital teaching capabilities", Item 11 "Provide digitalization situation analysis and learning evaluation services for teachers", Item 12 "Improve the organizational management and guarantee service mechanism for the entire process of digital teaching", and Item 13 "Provide students with digital academic warnings and academic assistance" were added.

 Table 4.23 Result for discussion: Problem solving skills

		(n=9)
Items	Problem solving skills	Result
1	Cultivate students' dialectical and critical thinking abilities	Ρ
2	Implement training that combines theoretical knowledge with	Р
	practical application	
3	Develop teamwork and communication skills	Р
4	Implement teaching to cultivate students' habit of solving	Р
	problems independently	
5	Organize practical activities to improve problem-solving skills	Р
6	Use heuristic teaching methods to carry out daily teaching	Р
7	Implementing real enterprise project practice to cultivate	М
	students' innovative consciousness and practical ability	
8	Make full use of online teaching and learning platforms to carry	Р
	out breakthrough teaching	
9	Strengthening training on problem-solving steps	А
10	Guide students to reflect and summarize their own problem-	А
	solving process	
11	Provide feedback and guidance	А

According to table 4.23, 9 experts were consulted to evaluate the feasibility of 8 models for improving students' problem-solving ability, and items 1, 2, 3, 4, 5, 6 and 8 were unanimously approved. Item 7 "Carry out on-the-job practical training" was changed to "Implementing real enterprise project practice to cultivate students' innovative consciousness and practical ability", and item 9 "Strengthening training on problem-solving steps" was added, item 10 "Guide students to reflect and summarize their own problem-solving process" was added, and item 11 "Provide feedback and guidance" was added.



Figure 4.2 The digital learner characteristics model for vocational colleges students in Guangxi (version 2)

According to Figure 4.2, focus group experts conducted a comprehensive and in-depth discussion and evaluation on the 5 dimensions and 47 strategies of the digital learner characteristic model (version 1) for students in Guangxi higher vocational colleges, and finally formed a more scientific and complete Guangxi higher vocational colleges Characteristic model of digital learners in colleges and universities (version 2). In the new version, strategies in each dimension have been adjusted and improved: digital literacy and skills have been improved to 11 items (8 unanimously approved, 2 revised, and 1 new); interactive collaboration capabilities have been improved to 10 items (9 items unanimously passed, 1 item added, 1 deleted); independent learning ability was improved to 12 items (8 items unanimously adopted, 1 modified, 3 new items); digital learning ability was improved to 13 items (9 items unanimously adopted, 4 items were added); problem-solving ability was improved to 11 items (7 items were unanimously approved, 1 item was revised, and 3 items were added). To sum up, the second edition covers a total of 5 dimensions and 57 strategies, which is significantly richer, optimized and improved than before.

Digital literacy and skills include three major themes: institutional guarantee, learning support, and strengthening cybersecurity laws and regulations and skills. Institutional guarantee includes three strategies: schools establish a digital literacy and skills assessment system and conduct regular assessments; conduct assessment and certification of students' digital literacy and skills, and require students to complete; establish a unified digital literacy and skills training guarantee system mechanism, and unify the training standards and assessment standards for the whole school. Learning support includes seven strategies: schools provide digital learning equipment, scenarios, resources, online courses and other support; schools provide network conditions and learning places for digital learning; offer unified "Information Technology" and other digital literacy and skills improvement courses; regularly hold practical activities such as digital literacy and skills competitions; establish student digital literacy and skills training clubs or associations, and organize digital literacy and skills training activities through clubs or associations; develop learning resources and teaching project libraries in various fields related to digital literacy and skills, implement them in daily teaching and keep resources continuously updated; provide teachers with guidance for students to improve their digital literacy and skills; strengthen cybersecurity laws and regulations and skills, including cultivating awareness of compliance with cybersecurity laws and regulations and improving cybersecurity skills.

Interactive collaboration capabilities include four major themes: teaching resource platform guarantee, teaching method model support, interactive collaboration practice training, and assessment and evaluation. Teaching resource platform guarantee includes three strategies: make full use of online teaching platforms and resources to carry out team project teaching; digital learning tools or platforms support interactive collaborative learning; make full use of online teaching platforms and arrange to complete projects or course designs from time to time. Teaching method model support includes four strategies: carry out teaching with students as the main body, create group discussions and collaborative exercises; implement group interactive collaborative learning; cultivate interactive collaborative thinking and cooperation awareness; organize course interest groups to carry out interactive collaborative learning includes two strategies: organize students to practice real enterprise projects; implement interactive learning role-playing. Assessment and evaluation refers to the implementation of interactive collaboration skills assessment.

Independent learning ability includes four major themes: learning strategy and goal guidance, creating an autonomous learning environment, cultivating autonomous learning habits, and self-assessment and evaluation feedback. Learning strategy and goal guidance includes 3 strategies: guiding students to develop learning plans; encouraging students to help and support each other in the learning process; and stimulating students' interest in learning. Creating an autonomous learning environment includes 3 strategies: providing personalized learning resources; selfstudy courses; making full use of online teaching platforms and setting up autonomous learning projects. Cultivating autonomous learning habits includes 4 strategies: strengthening students' autonomous learning ability; stimulating students' learning initiative and practical ability through practical learning activities; implementing autonomous learning incentives; and providing teacher guidance and support. Self-assessment and evaluation feedback includes 2 strategies: implementing evaluation feedback; and guiding self-reflection and evaluation.

Digital learning ability includes four major themes: digital learning environment support, improvement of teachers' digital teaching ability, cultivation of students' digital learning ability, and sound digital organization guarantee and evaluation system. Digital learning environment support includes three strategies: building a campus network and management monitoring center to support, analyze and manage students' digital learning; building diversified digital learning platforms and resources; and using online teaching platforms to arrange learning tasks and open-ended assignments. Improving teachers' digital teaching ability refers to improving teachers' digital teaching ability. Cultivating students' digital learning ability includes four strategies: implementing diversified digital teaching; setting up digital learning and seminar credit assessments; guiding students' digital learning; and conducting digital learning skills competitions for students. Sound digital organization guarantee and evaluation system includes four strategies: strengthening digital learning ability assessments; providing teachers with digital status analysis and learning evaluation services; improving the organizational management and guarantee service mechanism for the entire digital teaching process; and providing students with digital academic warnings and academic assistance.

Problem-solving skills include three major themes: teaching method reform, practical training of problem-solving skills, and guided reflection and evaluation feedback. Teaching method reform includes three strategies: implementing student-centered teaching to cultivate students' habit of solving problems independently; adopting heuristic teaching methods to carry out daily teaching; and making full use of online teaching platforms to carry out challenge-style teaching. Problem-solving skills practical training includes six strategies: cultivating students' dialect ical and critical thinking abilities; implementing training that combines theoretical knowledge with practical applications; cultivating teamwork and communication skills; organizing project practices to cultivate students' innovative consciousness and practical ability; and strengthening problem-solving step training. Guiding reflection and evaluation feedback includes two strategies: guiding students to reflect on and summarize their own problem-solving process; and providing feedback and guidance.

Chapter 5 Conclusion Discussion and Recommendations

Research on the development of digital learner characteristics model for higher vocational colleges students in Guangxi. The purpose of this study is: 1) to study the current status of digital learner characteristics of students in higher vocational colleges in Guangxi; 2) to develop a digital learner characteristics model for students in higher vocational colleges in Guangxi; 3) to implement and evaluate the digital learner characteristics model for students in higher vocational colleges in Guangxi; 3) to implement and evaluate the digital learner characteristics model for students in higher vocational colleges in Guangxi. The research content includes the following five aspects: 1) digital literacy and skills; 2) interactive and collaborative learning ability; 3) independent learning ability; 4) digital learning ability; 5) problem-solving ability. The study adopted two methods, the Delphi method and the focus group method. There were 21 experts in the open interview group and 9 experts in the focus group. The statistics for analyzing the data include median, mode, and interquartile range. The conclusions, discussions, and suggestions of this study are as follows:

Conclusion

Research on the development of learner characteristics model for higher vocational colleges students in Guangxi. The researchers summarized the research conclusions into three parts, as follows:

Part 1: To study the current situation of digital learner characteristics for Higher Vocational College Students in Guangxi.

Part 2: To develop of digital learner characteristics model for Higher Vocational College Students in Guangxi.

Part 3: To evaluate of digital learner characteristics model for Higher Vocational College Students in Guangxi.

Part 1: To study the current situation of digital learner characteristics for Higher Vocational College Students in Guangxi.

The current status of digital learner characteristics for higher vocational colleges students in Guangxi is at a medium-low level in five aspects. According to the specific results of the study, the characteristics of student digital learners are as follows: students' digital literacy and skills and digital responsibilities have the highest levels, followed by students' digital learning ability, while students' autonomous learning ability and students' problem-solving ability have the lowest levels.

Digital literacy and skills are at an upper-average level. According to the interview results, students can use operating systems, communication chat tools, office automation software, access the Internet, common exploration engines and learning platforms relatively skillfully. They have certain data query, collection and storage and digital learning capabilities, and have certain digital security awareness and network behavior norms. However, they lack the ability in computational thinking, information validity analysis, and data analysis and processing, and lack the ability to use the digital literacy and skills they have mastered to drive their own learning.

The ability of interactive and collaborative learning is at a medium-low level. According to the interview results, students have the ability to use communication chat tools to ask other students and teachers for advice during the learning process, but their interactive collaboration is limited to a small range. They lack the ability to use professional learning tool platforms and teaching platforms to consult teachers and classmates in a timely manner, join professional learning forums, and carry out interactive and collaborative learning. On the other hand, the awareness of group interactive and collaborative learning is still relatively lacking, and the atmosphere of collecting learning resources, opinions, learning suggestions, mutual discussion, encouragement, and supervision through digital learning platforms has not yet been formed.

The ability of autonomous learning is at a medium-low level. According to the interview results, students generally need to study under the guidance of teachers, and lack the ability to independently learn new knowledge and skills, so as to master new knowledge and skills. At the same time, students generally lack the awareness and ability to independently set learning goals and plans, and are generally prone to being addicted to the Internet and games, and cannot effectively plan and manage their study time. They generally lack the ability to self-discipline management, set learning goals, and make full use of learning platform resources to carry out autonomous learning.

The digital learning ability is at a medium level. According to the interview results, after students have certain digital knowledge and skills, they can skillfully use common teaching and learning platforms, such as the Chaoxing learning platform, and can watch learning videos, learning PPTs, learning documents and other materials assigned by teachers on the platform, and can also complete the homework tasks assigned by teachers, indicating that students have a certain foundation in digital learning. However, the ability to learn and use new online teaching software and new platforms independently is insufficient, the ability to obtain and use digital learning
resources is insufficient, the ability to search professionally on search engines is insufficient, the ability to process, handle, share and manage resources using various tools and software is insufficient, and the ability to use various platforms, tool software and resources to efficiently realize digital learning is insufficient.

The problem-solving ability is at a low level. According to the interview results, most students can find general problems, make preliminary judgments and implement simple processing. The problem-solving ability is at the primary level. Students generally need clear guidance materials or guidance from teachers to solve problems. The lack of ability in problem-finding ability, problem-analysis ability, exploring solutions to problems, summarizing the laws of problems, and independently exploring solutions to problems indicates that students' problem-solving ability needs to be strengthened and improved.

Part 2: The develop for the digital literacy development model for higher vocational college teachers in Guangxi.

Through two rounds of questionnaire surveys and repeated demonstrations of 21 experts using the Delphi method, the researchers successfully constructed a digital learner characteristic model for higher vocational colleges students in Guangxi (first edition), covering 46 strategies in five dimensions: digital literacy and skills, interactive and collaborative learning ability, independent learning ability, digital learning ability, and problem-solving ability.

Part 3: To evaluate of digital learner characteristics model for Higher Vocational College Students in Guangxi.

Focus group experts conducted in-depth discussions and evaluations on the 5 dimensions and 46 strategies (first edition) of the digital learner characteristics model for students in Guangxi vocational colleges, and finally formed a more scientific and complete digital learner characteristics for students in Guangxi vocational colleges. Model (2nd ed.). The new version contains a total of 5 dimensions and 58 strategies, which is significantly enriched and optimized than before.

The Digital Literacy and Skills Strategy Consists of 11 Items:

1. The school provides support such as digital learning equipment, scenarios, resources, and online courses

2. The school establishes a digital literacy and skills evaluation system and conducts regular assessments

3. The school provides network conditions and learning places for digital learning

4. Offer unified digital literacy and skills improvement courses such as "Information Technology"

5. Regularly hold digital literacy and skills competitions and other practical activities

6. Carry out assessment and certification of students' digital literacy and skills, and require students to complete

7. Establish student clubs or associations for digital literacy and skills training, and organize digital literacy and skills training activities through the clubs or associations

8. Develop learning resources and teaching project libraries in various fields related to digital literacy and skills, implement them into daily teaching and keep the resources continuously updated

9. Establish a unified digital literacy and skills training guarantee system mechanism, unified training standards and assessment standards for the whole school

10. Strengthen students' network ethics and network security skills education

11. Provide teacher guidance for students to improve their digital literacy and skills

The Interactive Collaboration Capabilities Strategy Contains 10 Items:

1. Carry out teaching with students as the main body, create collective discussions and collaborative practice

2. Make full use of online teaching platforms and resources to carry out team-based project teaching

3. Organize students to practice real enterprise projects

4. Implementing interactive and collaborative learning in groups

5. Cultivate interactive collaborative thinking and cooperation awareness

6. Digital learning tools or platform support for interactive and collaborative learning

7. Organize course interest groups for interactive and collaborative learning

8. Make full use of the online teaching platform and arrange to complete a project or course design from time to time

9. Implement interactive and collaborative learning role-playing

10. Implement interactive collaboration skills assessment

The Independent Learning Ability Strategy Contains 13 Items:

1. Strengthening students' independent learning ability

2. Guide students to develop study plans

3. Provide personalized learning resources

4. Encourage students to help and support each other in the learning process

5. Self-study courses

6. Stimulate students' learning initiative and practical ability through practical learning activities

7. Stimulate students' interest in learning

8. Implementing autonomous learning incentives

9. Make full use of online teaching platforms and set up independent learning projects

10. Provide teacher guidance and support

11. Implementation evaluation feedback

12. Guided self-reflection and evaluation

The Digital Learning Capabilities Strategy Contains 13 Items:

1. Implementing diversified digital teaching

2. Build a campus network and management monitoring center to support, analyze and manage students' digital learning

3. Build diverse digital learning platforms and resources

4. Set up digital learning and seminar credit assessment

5. Guiding students in digital learning

6. Use online teaching platforms to assign learning tasks and open-ended assignments

7. Establish a school-wide digital teaching policy system

8. Conduct digital learning skills competition for students

9. Strengthen the assessment of digital learning ability

10. Improving teachers' digital teaching capabilities

11. Provide digitalization situation analysis and learning evaluation services for teachers

12. Improve the organizational management and guarantee service mechanism for the entire process of digital teaching

13. Provide students with digital academic warnings and academic assistance The Problem Solving Skills Strategy Contains 13 Items:

1. Cultivate students' dialectical and critical thinking abilities

2. Implement training that combines theoretical knowledge with practical application

3. Develop teamwork and communication skills

4. Implement teaching to cultivate students' habit of solving problems independently

5. Organize practical activities to improve problem-solving skills

6. Use heuristic teaching methods to carry out daily teaching

7. Implementing real enterprise project practice to cultivate students' innovative consciousness and practical ability

8. Make full use of online teaching and learning platforms to carry out breakthrough teaching

9. Strengthening training on problem-solving steps

10. Guide students to reflect and summarize their own problem-solving process

11. Provide feedback and guidance

Discussion

The research in the development of digital learner characteristic model for higher vocational colleges students in Guangxi. The researchers summarized the research content into two parts, as follows:

Part 1: Current status of digital learner characteristics for higher vocational colleges students in Guangxi.

Part 2: Digital learner characteristic model for higher vocational colleges students in Guangxi.

Part 1: Current status of digital learner characteristics for higher vocational colleges students in Guangxi.

The current status of digital learner characteristics for higher vocational colleges students in Guangxi is at a medium-low level in five aspects. According to the results of this study, the digital learning characteristics of students are from high to low: digital literacy and skills are the highest, followed by digital learning ability and interactive collaboration ability, and independent learning ability and problem-solving ability are the lowest.

With the acceleration of the digital transformation of vocational education, students' digital learning characteristics have become the key to adapting to learning needs and growth. At present, the application of information technology in learning by students in higher vocational colleges is still lagging behind, and the level of subjective initiative in learning based on information technology is low. The collaborative learning ability based on information technology, the awareness and ability of independent inquiry learning, the ability of learning self-management and

planning, and the role of information technology in helping students to cultivate their professional abilities still need to be continuously improved (Han Xibin et al., 2022).

Digital learning ability is the basic quality to adapt to the development of the digital economy era and an important trend in future talent training, including the ability to adapt to the digital learning environment, the ability to explore digital learning resources, and the ability to use digital learning methods. Vocational college students have problems such as incomplete mastery of digital learning tools, low learning enthusiasm, and relatively weak self-control (Deng Fei, Deng Xue, Han Dandan, 2023).

In a digital environment, students have a strong desire for digital learning, but their awareness and literacy of digital learning are insufficient. Although students have certain digital literacy and skills and master the use of some digital learning platform tools, they lack reasonable time planning, are easily disturbed by the outside world, and cannot express their opinions well in the digital learning process, communicate and interact with others, and lack the awareness of active learning and the relevant skills and techniques of digital learning (Lü Xiao, Li Jiaxuan, 2024).

Digital learning ability is a necessary condition for vocational college students to adapt to digital learning and improve their learning effects. It is also a core quality that promotes students' lifelong learning and takes the initiative in future development. Although students are accustomed to digital learning, they mostly participate passively; their ability to apply digital learning tools needs to be improved; their ability to process information and share knowledge is weak; their attention is often lost; and they rarely actively reflect on and adjust the learning process (Hong Shuang, Zhou Xiangjun, 2024).

Improving students' digital literacy and capabilities is the only way for my country to build a strong education country, a strong digital country, and cultivate new people for the development of the digital economy. At present, students' abilities in cognition, collection and acquisition of digital information, data analysis, exchange, communication and evaluation, and ensuring digital security in solving digital problems are insufficient, and further training and improvement are needed to better cultivate high-quality new people in the digital age (Jiang Fuqiang, Yan Chaoyang, 2024).

At present, in the process of vocational education reform, the country has vigorously promoted the digital transformation of vocational education. However, in the implementation process, the focus is on infrastructure, teachers, resources, etc., while the cultivation of students' comprehensive digital learner characteristics is relatively neglected. Students' comprehensive digital learning quality is insufficient, which affects the overall digital transformation and the effectiveness of digital education (Feng Tingting et al., 2024).

Part 2: Digital learner characteristic model for higher vocational colleges students in Guangxi.

1. Explore digital literacy and skills development strategies

The research results show that students in Guangxi vocational colleges are at a medium level in terms of digital literacy and skills. It is necessary to implement the school to provide digital learning equipment, scenarios, resources, online courses and other support; the school to establish a digital literacy and skills assessment system and conduct regular assessments; the school to provide network conditions and learning places for digital learning; to offer unified digital literacy and skills improvement courses such as "Information Technology"; to regularly hold practical activities such as digital literacy and skills competitions; to assess and certify students' digital literacy and skills and require students to complete them; to establish a student digital literacy and skills training club or association, and to organize digital literacy and skills training activities through the club or association; to develop learning resources and teaching project libraries in various fields related to digital literacy and skills, implement them in daily teaching and keep resources continuously updated; to establish a unified digital literacy and skills training guarantee system mechanism, unify the training standards and assessment standards for the whole school; to strengthen students' network ethics and network security skills education; to provide teachers with guidance for students to improve their digital literacy and skills. This is consistent with the research results of relevant research experts, such as: coordinating resources to promote digital construction, formulating an authoritative digital literacy indicator system, building a digital literacy ability qualification certification system, integrating digital literacy into talent training goals and curriculum teaching standards, carrying out digital cultural activities, and guiding students to apply digital literacy to professional ability development (Li Wenjun, Xin Lei, Zhang Yawen, 2024); it is necessary to create a digital campus cultural environment, build a digital literacy course teaching system, hold digital second classroom activities, and build a digital responsibility training system for college students (Liu Yi, 2023); reconstruct the curriculum system, improve practical training facilities, improve the digital training environment, innovate the digital literacy evaluation system, and encourage industry enterprises and other forces to actively participate in digital literacy cultivation (Zhou Yanyan. 2023); strengthen the

construction of resources to support digital literacy education, and promote colleges and universities to offer digital literacy courses and various educational activities (A Xing, Feng Lei, 2021); build a digital literacy evaluation system, enrich digital literacy teaching content, and carry out rich digital literacy teaching and practice activities (Chen Yanfang, 2022).

2. Explore Interactive collaboration capabilities development strategies

The research results show that the interactive and collaborative ability of students in Guangxi vocational colleges is at a medium-low level. It is necessary to carry out teaching with students as the main body, create collective discussions and collaborative exercises; make full use of online teaching platforms and resources to carry out team project teaching; organize students to practice real enterprise projects; carry out interactive and collaborative learning in groups; cultivate interactive and collaborative thinking and cooperation awareness; support interactive and collaborative learning with digital learning tools or platforms; organize course interest groups to carry out interactive and collaborative learning; make full use of online teaching platforms, arrange to complete a project or course design from time to time; carry out interactive and collaborative learning role-playing; and carry out interactive and collaborative skills assessment. This is consistent with the research results of some scholars. For example, there is a problem of insufficient depth in cooperative learning in higher vocational teaching practice, and the effect is not good. The development of digital technology provides an infinitely broad prospect for the deepening of students' cooperative learning. Under the guidance of digital technology, with the help of Internet thinking and methods, modern information technology is deeply integrated with the cooperative learning of Higher Vocational College Students, the status of student participation is reconstructed, the relationship power of group cooperation is enhanced, and the cooperative task of problem solving is pointed out, highlighting the comprehensive evaluation of advantage development. Promote in-depth cooperative learning among Higher Vocational College Students through platform application, virtual-real integration, resource sharing, data analysis, etc., and enhance the enthusiasm and effectiveness of Higher Vocational College Students' learning (Chen Jianrong, 2023). Build an Internet learning platform, realize the deep integration of information technology and classroom, build an intelligent and visual teaching and learning environment, create a student-centered deep autonomous learning model, provide personalized learning resources, set questions in the classroom, and let students discuss in groups (Lu Qin, 2022). Integrate smart classroom resources to stimulate students' learning motivation; enrich classroom

interaction forms and improve cooperative learning models; collect classroom information feedback, build multi-dimensional teaching evaluation and other optimization strategies, in order to achieve the goal of building a smart campus, cultivating new people with cooperative awareness, and promoting the reform and development of higher education (Liu Jingjing, Xu Minghua, 2024). Establish a sense of cooperation, cultivate students' cooperative motivation and ability, rely on intelligent technology, create a diversified and interconnected cooperative environment, optimize content design, build a flexible and open curriculum system, promote concept recognition, and build an efficient and flexible cooperative group (Zhao Pengyu, 2022). Improve their own awareness of autonomy and cooperation, provide a good autonomous and cooperative learning environment, and carry out learning activities related to autonomous and cooperative learning models (YANG Yuhua, Tongren University. 2020).

3. Explore independent learning ability development strategies

The research results show that the independent learning ability of students in Guangxi vocational colleges is at a medium-low level. It is necessary to strengthen students' autonomous learning ability; guide students to develop learning plans; provide personalized learning resources; encourage students to help and support each other in the learning process; self-study courses; through practical learning activities; stimulate students' learning initiative and practical ability; stimulate students' learning interest; implement autonomous learning incentives; make full use of online teaching platforms; set up autonomous learning projects; provide teacher guidance and support; implement evaluation feedback; guide self-reflection and evaluation. This is consistent with the research results of some scholars. Such as improving students' information literacy, cultivating students' learning interest and motivation (Lv Cuncun, 2024). Follow the motivation-driven mode of autonomous learning, improve learners' content discrimination, conform to learners' time rhythm, and open up learners' life space (Wang Yongchao, Qi Wanxue, 2024). Accumulate rich digital teaching resources, actively adapt to the changes in learning modes, cultivate strong autonomous learning ability, and customize courses (Ji Caiyun, Ren Jiali, 2024). By analyzing the visualization, digitization, personalization, interactivity, and collaboration of digitally empowered classroom teaching, the internal mechanism of digitally empowered classroom teaching innovation is explored from three dimensions: the development of the digital information age, the digital upgrading of industrial economy, and the needs of vocational education itself. Finally, the practical path to achieve digital empowerment classroom teaching innovation is proposed

from four aspects: teaching resource construction, teaching mode innovation, evaluation feedback mechanism, and teaching ecosystem construction (He Huituan, 2024). Strengthen the construction of learning platform resources in higher vocational colleges and create a suitable learning environment; guide students to participate in the entire teaching process and promote students to build efficient learning strategies; cultivate students' interest in professional knowledge and skills and stimulate students' motivation to learn (Zhang Chengtao, Ya Guiling, 2024). Make full use of the teaching platform to cultivate students' ability to explore new knowledge; attach importance to classroom interaction and cultivate students' autonomous learning ability; pay attention to after-class expansion and self-evaluation, and cultivate students' self-evaluation ability (MA Yanxia et al., 2024).

4. Explore Digital learning capabilities development strategies

The research results show that the digital learning ability of students in Guangxi vocational colleges is at an upper-middle level. It is necessary to implement diversified digital teaching; build a campus network and management monitoring center to support, analyze and manage students' digital learning; build diversified digital learning platforms and resources; set up digital learning and seminar credit assessment; guide students' digital learning; use online teaching platforms to arrange learning tasks and open assignments; establish a school-wide digital teaching policy system; carry out student digital learning skills competitions; strengthen digital learning ability assessment; improve teachers' digital teaching ability; provide teachers with digital situation analysis and learning evaluation services; improve the organization and management of the entire digital teaching process and guarantee service mechanisms; provide students with digital academic warnings and academic assistance. The research conclusions are consistent with the research results of relevant experts. For example, students have strong digital learning habits, but passive participation is dominant; the ability to apply digital learning tools needs to be improved; information processing and knowledge sharing abilities are weak; attention loss problems occur frequently; and there is less active reflection and adjustment during the learning process. To improve the digital learning ability of Higher Vocational College Students, we should build high-quality digital learning spaces, pay attention to cultivating students' metacognitive strategies and critical thinking, let teachers become the "navigators" of digital learning, and build a horizontally integrated and vertically connected digital learning ability training system (Hong Shuang, Zhou Xiangjun, 2024). To address the problem of insufficient digital learning ability of students, we can deepen the theory of digital education, strengthen

the emphasis on the application of digital learning platforms, scientifically use the functions of digital learning platforms, implement the combination of theoretical classroom and practice, clarify the main position of students, and improve the digital learning evaluation system (Xu Fengpan, Wei Hongmei, 2024). In view of the problems of relatively insufficient adaptability, incomplete mastery of learning tools, weak learning motivation, and relatively weak self-monitoring ability in the cultivation of digital learning ability of Higher Vocational College Students, we need to focus on improving digital literacy and skills, strengthening digital learning resource support, improving the construction of digital-related courses, improving teachers' digital teaching literacy, and building a digital learning evaluation system (Deng Fei, Deng Xue, Han Dandan, 2023). It is necessary to create a digital learning environment, improve students' ability to collect and manage digital resources, and improve students' ability to apply and innovate digital resources (Liu Yang et al., 2023). To improve students' digital learning ability, we can reform digital learning methods by creating a digital learning environment, developing a series of micro-courses to enrich digital learning resources, and building autonomous learning models, cooperative learning models, and exploratory learning models (Yang Huaijin, 2018).

5. Explore Problem solving skills development strategies

The research results show that the problem-solving ability of students in Guangxi vocational colleges is relatively weak, and is generally at a medium-low level. It is necessary to cultivate students' dialectical thinking and critical thinking ability; implement training that combines theoretical knowledge with practical application; cultivate teamwork and communication skills; implement teaching to cultivate students' habit of solving problems independently; organize practical activities to improve problem-solving ability; use heuristic teaching methods to carry out daily teaching; implement real enterprise project practice to cultivate students' innovative consciousness and practical ability; make full use of online teaching platforms to carry out breakthrough teaching; strengthen problem-solving step training; guide students to reflect and summarize their own problem-solving process; provide feedback and guidance. For example, problem-solving ability is the key ability of students' high-order thinking ability. Cultivating problem-solving ability is the only way for education to meet the social talent needs in the era of artificial intelligence. It is necessary to create high-quality problem situation links, preset and generate problem chains, problem-solving technology decision-making links, and multi-scenario migration reflection links, so as to improve the cultivation of students' problemsolving ability (Wang Huanjing, Wei Jiangming, Fei Jianxiang, 2024). "Problem guidance"

helps students understand core concepts, "task activities" promote students to develop key abilities, and "precision practice" helps students form method skills (Zheng Dazhao, 2024). It is recommended that applied technology colleges and universities adhere to the "applied technology" positioning and build a talent training system; focus on "problem-oriented" training and innovate education and teaching models; deepen the "cooperative learning" mechanism and change students' learning methods (Hu Chunxian, Zhou Zhengzhu, 2024). We should start from cultivating students' habit of actively solving problems and stimulate their desire to explore. The teaching process should be problem-oriented, cultivate students' habit of solving problems, stimulate students' desire to explore and solve problems independently, change teaching concepts, emphasize problem solving under professional needs, enrich classroom forms, and integrate professional situation problems into the classroom (Liu Jiahao, 2022). Through club activities, improve students' ability to use methods and skills, through practical teaching and social part-time jobs, improve students' personal execution, advocate project-based and research-based learning methods, and improve students' communication and learning abilities (Gu Yipeng, 2014).

Recommendations

Implications

Based on the research results, the following suggestions are made to improve the digital learner characteristics for higher vocational colleges students in Guangxi:

1. Build a more complete digital learning resource support for students

The national digital education platform provides massive learning resources to meet personalized learning needs. By using digital technologies such as micro-classes, virtual reality (VR) and augmented reality (AR), we can turn static into dynamic and abstract into intuitive, stimulate students' interest in learning, help them better understand mathematical knowledge, and cultivate their thinking flexibility and creativity. By creating multi-scenario application examples of educational resources, such as using metaverse technology to create personalized and socialized digital learning spaces, and by building dedicated teaching resource libraries and hybrid teaching case libraries, we can provide teachers with rich teaching resources, promote innovation in teaching methods, and improve teaching quality. We can design project-based digital learning resources, and publish relevant project learning resources through digital platforms around specific project scenarios, so that students can have an independent and flexible learning space after class.

As an innovative educational tool, the virtual simulation platform is gradually leading a new perspective for future education. The virtual simulation platform plays an important role in the cultivation of high-quality talents. First, it breaks the limitations of time and space, and learners can freely explore, practice and experiment in a virtual environment without being bound by time and space. Secondly, the virtual simulation platform enhances learners' participation and motivation by providing a highly interactive learning experience. Learners can interact with the virtual environment through the virtual simulation platform, provide realtime feedback and adjustments, and deepen their understanding and memory of the learning content. This interactive experience not only improves learners' learning effects, but also cultivates important abilities such as problem solving, cooperative teamwork and innovative thinking.

2. Improve teachers' digital teaching capabilities

Improving teachers' digital teaching ability is an important part of cultivating students' digital learning characteristics. This requires teachers to not only have digital awareness, but also be able to effectively apply digital technology in actual teaching. Therefore, in view of the current problem of insufficient digital teaching ability of teachers, digital awareness should be strengthened. Only when teachers have a deep understanding of the nature, function and application scope of digital technology, and realize the revolutionary impact of digital technology on education and teaching, can they embrace and use digital technology more actively. Strengthen teachers' digital application level, encourage teachers to actively explore and try new digital tools and methods, and integrate them into teaching practice to improve teaching effectiveness and students' learning experience. At the same time, teachers should participate in the development and sharing of digital teaching resources. Carry out digital training: Through winter and summer training, customize course modules, develop digital resources, meet teachers' training needs, cultivate teachers' autonomous learning ecology, and improve teachers' digital literacy.

3. Strengthen generative AI digital technology skills

Generative AI is reshaping the future of education. Generative AI plays an important role in promoting students' autonomous learning, personalized learning, exploratory learning, collaborating with students to complete homework, exam review, language learning, and improving digital literacy. Generative AI expands the educational space. Generative AI has multiple forms of expression such as text, voice, pictures, videos, and animations. The training data output by the large model can be used as a shared medium for students to learn and discuss with peers. Generative AI can further break through the spatial limitations of classrooms and promote the globalization of educational space. In the future, any place with access to the Internet can be used as a learning space. Generative AI enriches educational scenarios. For example, giving instant prompts and other guidance in the scenarios where students are doing hands-on operations can enable students' practical and theoretical learning to proceed in parallel, thereby further promoting the combination of theory and practice. Generative AI extends the educational time and efficiently enables lifelong learning. Relying on its powerful parallel processing capabilities, the generative AI large model can support multiple learners to participate in learning tasks at the same time, and provide personalized teaching content and feedback to each learner at the same time. Generative AI has the potential to be a "virtual tutor" and can promote autonomous learning for adult learners in asynchronous online environments. Therefore, it is necessary to strengthen students' digital technology skills such as generative AI and the awareness of making good use of generative AI tools.

4. Promote the integration of digital technology and education and teaching It is necessary to incorporate the integration and innovation of digital technology and education and teaching into the overall development plan of the school, actively explore new concepts of digital education and teaching, promote multi-department linkage, and form a joint force for digital education and teaching. Innovate digital teaching models and methods. Expand teaching time and space, and explore new teaching modes such as experiential, exploratory, cooperative, interactive, and hybrid in the space of virtual and real integration. Promote innovation in teaching content, teaching methods, and teaching processes supported by digital technology. Innovate the content and form of teachers' digital teaching ability training, and continuously improve teachers' digital teaching ability and level.

5. Improve the digital teaching evaluation mechanism

Build a digital teaching evaluation model. Make full use of big data, improve result evaluation, strengthen process evaluation, explore value-added evaluation, improve comprehensive evaluation, improve the scientificity, professionalism, and objectivity of teaching evaluation, and build a digital teaching and learning evaluation feedback mechanism and continuous improvement mechanism oriented to the development of students' comprehensive abilities. Innovate digital teaching evaluation methods. Deepen the accompanying collection of teaching behavior data, comprehensively analyze the data of the entire teaching and learning process, and continuously improve teaching methods. Establish a longterm, cross-field, and multi-dimensional student portrait, accurately evaluate students' cognitive structure, ability tendency, and personality characteristics, and carry out targeted and differentiated guidance. Strengthen the application of digital teaching evaluation. Give full play to the guiding, assessment, diagnosis, regulation, and improvement role of digital teaching evaluation. Use evaluation to promote learning, apply digital precision analysis to provide academic warning and academic assistance, and promote the healthy growth of students.

Future Researches

Based on the existing conclusions, the digital learner characteristic model for higher vocational colleges students in Guangxi was deeply analyzed. In order to more effectively improve the digital learning characteristics of students, the researchers focused on proposing the following effective strategies, as follows:

1. Research on the teaching model of digital learner characteristics of students in vocational colleges.

2. Research on the quality assurance system of digital learner characteristics of students in vocational colleges.

3. Research on the evaluation system of digital learner characteristics of students in vocational colleges.

References

- Cen,S.,Wu,S.,Jia,S.,Luo,H.,Zhang,Y.,Cheng,K.,...Ye,Y. (2023). Teaching research on independent online learning to improve the learning ability of Higher Vocational College Students in analytical chemistry. **Guangdong Chemical Industry**, 50(499),188–190.
- Chen,G. (2019). Research on the impact of formative assessment on the independent learning ability of public English among Higher Vocational College Students (Master's thesis). **Minnan Normal University**.
- Chen,J. (2023). Research on the optimization of deep cooperative learning paths for Higher Vocational College Students under the background of digitalization: A case study of students majoring in preschool education at Zhanjiang Preschool Education College. **Modern Vocational Education**, (09),95-98.
- Chen,Y. (2022). The value, goals and practical path of college students' digital literacy education. **Data**, (04),72-74.
- Darren,L.P. (2009). Back to basics: e-collaboration in education. Commonwealth of Tasmania: **University of Tasmania**, Australia.
- Deirdre,B.,Dr,M.L. (2020). Proceedings of research supporting the introduction of technology in a redeveloped primary school curriculum. **Dublin City University**.
- Deng,F.,Deng,X.,Han,D. (2023). Dilemmas and countermeasures in cultivating digital learning abilities of Higher Vocational College Students. **Vocational and Technical Education**, 44(1086), 47–51.
- Eliana,E.G.,Luis,M.,Mark,B.,Jan-willem,S.(2015). Let's Talk about Digital Learners in the Digital Era. International Review of Research in Open and Distributed Learning, 16(3), 156–187.
- Fu,X., Wang,H. (2017). Review of Connectivist Learning Theory. Guangdong Vocational and Technical Education and Research, (5), 46–49.
- Georgia, J. (2013). 21st Century Learner, from wordpress.com: https://learner21stcentury.wordpress.com/.
- Gert,F.,Kathrin,K., Claudia,L., Dagmar, M. (2019). Top 10 Defining Characteristics of Digital Learning and Teaching. **Researchgate.Net**.
- Gordon, David, T. (2000). The digital classroom: How technology is changing the way we teach and learn. Harvard Education Communications, 22(08), 37-40.

- Gu,Y. (2014). Research on the ways to cultivate problem-solving ability of Higher
 Vocational College Students Taking Jiangsu University of Business as an example. Journal of Jiangsu University of Business, (03),87-89.
- Hatis,G.B.,Dilek,D.,Saadi,S. (2016). Digital Natives in Online Learning Environments: Old
 Wine in New Bottles Contemporary Online Learning Environments The design of. In Hatice Gokce Bilgic, Dilek Dogan, Sadie Seferoglu, Handbook of Research on Digital Indigenous Engagement in Higher Education Settings (192-221). Pennsylvania : IGI Global.
- He,H. (2024). Digital empowerment of teaching innovation: basic characteristics, internal mechanisms and implementation paths. **Industrial Technology and Vocational Education**, (01),31-36.
- Hu,C.,Zhou,Z. (2024). Research on the value-added development of complex problem-solving ability of students in applied technology universities: An empirical analysis based on 8 universities in the Yangtze River Delta region.
 China University Science & Technology, (07), 19-25.
- Jason, B., Jena, F., Christina, V.I. (2021). Online Learner Characteristics Angelo State University. **Angelo.Edu**.
- Ji,C.,Ren,J.. (2024). Strategy for high-quality development of vocational education under the background of digital transformation. **Western China Quality Education**, (05), 141-144.
- Jiang,F.,Yan,C. (2024). Dilemma and countermeasures of cultivating digital literacy of college students in the digital age. **China Education Informatization**, (06), 102-111.
- Jiang,J.(2015). Analysis of online learning characteristics of college students in the new media era. **Software Guide**, (2), 54-56.
- Kelly,J.,Lisa,C.,Peta,W. (2022). Defining digital technologies, from center of digital excellence for the child: https://www.digitalchild.org.au/blog /defining-digital-technology/.
- Kou,X.,Liu,S.,Xiao,F. (2022). Research on the cultivation of problem-solving ability of students in higher vocational colleges. **Industrial Technology and Vocational Education**, 20(4), 57–60.
- Li,F. (2022). Research on factors affecting the adaptability of online learning among Higher Vocational College Students during the epidemic (Master's thesis). Guangdong Technical Normal University.

- Li,Y. (2017). Research on the cultivation of independent learning ability of Higher Vocational College Students in the "Internet +" era (Master's thesis). **Hunan Normal University**.
- Lin,W. (2023). Analysis on the digital literacy and skills cultivation path and evaluation of "Information Social Responsibility". **Journal of Fujian Institute of Education**, (5), 10–13.
- Liu,J. (2022). Dilemma and countermeasures for cultivating students' problem-solving ability in higher vocational colleges. **Modern Vocational Education**, (16), 106-108.
- Liu,J.,Xu,M. (2024). Research on the teaching practice of cooperative learning model in smart classroom - taking organizational behavior course as an example. Modern Vocational Education, (21), 105-108.
- Liu,L. (2019). Investigation and research on the preparation and current situation of middle school students' sports cooperative learning ability scale (Master's thesis). **Hangzhou Normal University**.
- Liu,X. (2022). Research on optimization of high school classroom teaching model based on cooperative learning ability cultivation (Master's thesis). Jiangxi Science and Technology Normal University.
- Liu,Y., Li,S., Zhang,X.,Feng,Y. (2023). Research on the evaluation index system of digital learning ability of continuing education students. Journal of Tianjin Radio and Television University, (2), 64–69.
- Liu,Y. (2023). Research on improving digital literacy of students in higher vocational colleges - Based on an empirical survey of 1051 college students in higher vocational colleges in Hunan Province. Journal of Hunan Industrial Vocational and Technical College, (01), 53-60.
- Lü,C. (2024). Cultivation of autonomous learning ability of students in higher vocational colleges under the digital teaching material learning environment. Guangxi Education, (15), 110-113.
- Lu,F., Liu,F., Zhan,H., Zhang,N. (2018). Digital Learning. Guangzhou, China: South China University of Technology Press.
- Lu,M. (2022). Research on optimization strategies of autonomous learning for Higher Vocational College Students in the Internet+ era. **China Educational Technology and Equipment**, (18), 71-73+86.
- Ma,L. (2020). Research on cultivating college students' problem-solving abilities based on online learning space (Master's thesis). **Northeastern University**.

- Ma,X., Feng,L. (2021). The value, goals and strategies of promoting college students' digital literacy education. Jiangsu Higher Education, (11), 118-124.
- Ma,Y., Yang C., Wang,Q. (2024). Research on online and offline hybrid teaching mode based on autonomous learning and self-evaluation of Higher Vocational College Students. **North China Fisheries**, (01), 108-110.
- Mao,G., Liu,Q., Wu,L. (2016). Analysis model and application of group collaborative learning based on activity theory. **Modern Distance Education Research**, (3), 93–103.
- María, J.S., Alvaro, R. (2019). Digital learning: developing skills for the digital transformation of organizations. **Next Generation Computer Systems**, (91), 327-334.
- Martin, Mary. (2009). Encyclopedia of Information Science and Technology. Pittsburgh, USA: **Book News Company**.
- Pan,J. (2023). Research on the correlation between English learning strategies and independent learning ability of junior high school students (Master's thesis).
 Jilin International Studies University.
- Pearl,C.A. (2019). LIS Education for 21st Century Information Users.**Managing and** Adapting Library Information Services for Future Users,59–74.
- Ping,Q, Xiao,Z. (2023). Research on the impact of hybrid learning model on college students' independent learning ability under the background of "Internet +". Internet Weekly, (8), 52–55.
- Pirker, G., Martínez, R. (2020). Education and Learning. Brussels: Institut John Tonisoni.
- Qi,L. (2021). Research on the cultivation of independent learning ability of Higher Vocational College Students. Journal of Liaoning Higher Vocational College, (9), 88–91.
- ROSCORLA, T.(2019) . Five Characteristics of Digital Learners by Sbonelo Mdluli. Infogram.com.
- Ruan,S. (2020). Research on O2O Chinese as a Foreign Language Teaching Model to Improve Independent Learning Ability (Master's Thesis). **East China Normal University**.
- Song,L.,Wang,B. (2022). An overview of the current situation and countermeasures of online learning for students in higher vocational colleges during the epidemic. **Western Quality Education**, (13), 130–132.
- Sujit,K.B.,Marguerite,W.,Paul,B. (2018). E-learning, mobile learning and digital learning: Concept definition and comparative analysis. **E-learning and Digital Media**, (04), 191-216.

- Sun,J.(2015). Research on the impact of learner characteristics on college students' digital learning effectiveness (Master's thesis). **Nanjing University**.
- Sun,Q. (2020). Research on influencing factors and improvement strategies of secondary vocational students' information literacy (Master's thesis). Zhejiang University of Technology.
- Sun,Y. (2021). Research on strategies to cultivate problem-solving abilities of secondary vocational students under the blended learning model (Master's thesis). **Guangzhou University**.
- Tan,Y., Su,Y. (2023). Characteristics and adaptation: Research on online learner portraits in higher vocational colleges. Vocational and Technical Education, 44(1071), 36–40.
- Tanya,R. (2016). Iste identifies 7 characteristics of digital learners. **Government Technology**. https://www.govtech.com/education/k-12/iste-identifies-7 traits-of-digital-learners.html.
- Turner, R.C., Carlson., Laurie. (2003).Indexes of Item-Objective Congruence for Multidimensional Items.**International Journal of Testing**,3(13),163-171.
- Tony,B. (2022). Teaching in a Digital Age: Third Edition-General. Vancouver, BC: **Tony Bates Associates Ltd**.
- Wang,H., Wei,J., Fei,J. (2024). Deep problem-solving ability: conceptual characteristics, theoretical framework and cultivation path: Based on the perspective of AIGC technology empowerment. **China Educational Technology**, (05), 97-104.
- Wang,T., Wang,Y., Han,D.,Uzturk,B.,Zhong,L., Guo,H.,Wang,X. (2023). Analysis of factors influencing the online teaching model on college students' independent learning ability. **China Higher Medical Education**, (8) , 51–53.
- Wang,Y, Qi,W. (2024). The deviation and return of autonomous learning in the era of digital education. Jiangsu Higher Education,(05), 61-67.
- Wang,Z. (2011). Connectivism and New Constructivism: From Connectivity to Innovation. Journal of Distance Education, 29(5), 34–40.
- Wang,Z. (2013). Saving in small amounts and rounding up: Learning strategies in the Internet era. Journal of Distance Education, 31(3), 37–43.
- Wan,J.,Bill. (2020). What is Digital, **from Webopedia**: https://www.webopedia.com/ definitions/digital/.
- Wi,C.Wong,Y.,Marut,P. (2019). Digital Learning. Bangkok: Srinakharinwirot University Research Institute.

- Wu,Y. (2023). Analysis of the current situation and improvement paths of digital literacy of students in higher vocational colleges. Journal of Huaibei Vocational and Technical College, 22(3),64–66.
- Xu,C., Liu,X.,Han,C.,Zhang,G (2020). Investigation into the current situation and improvement strategies of students' information literacy in higher vocational colleges. **Curriculum Education Research**, (52), 33–34.
- Xu,F., Wei,H. (2024). Exploration on cultivating students' digital learning ability based on the learning platform - taking higher mathematics as an example. **Journal of Hubei Open Vocational College**, (06), 182-184.
- Xu,F. (2022). Exploration of cultivating students' online learning ability in vocational colleges. **The Road to Talent**, (22), 137–140.
- Yan,Z. (2022). Research on teaching strategies to improve secondary vocational students' information literacy from the perspective of TPACK (Master's thesis). **Guangxi Normal University**.
- Yang,B. (2016). Research on the application model of network "teaching space" to cultivate students' problem-solving ability (doctoral thesis). Northwest Normal University.
- Yang,H. (2023). Analysis on the current situation and countermeasures of digital learning ability of Higher Vocational College Students - Taking the pharmaceutical preparation technology major of Nanjing Mochou Technical School as an example. **Modern Vocational Education**, (11), 14-15.
- Yang,Y. (2020). Practical research on the "autonomous cooperation" learning model of college English online courses. Journal of Science and Education, (21),64-67.
- Ye,P. (2015). Current status and analysis of digital learning for college students in higher vocational colleges. **Education and Teaching Forum**, (4), 167-168.
- Yu,Y., Zhao,L. (2023). Research on the construction and improvement strategies of college students' independent learning ability evaluation system. **Career**, (640), 74–76.
- Yu,Z., Li,Z., Li,M., Song,Z. (2023). Research on paths and strategies to improve digital literacy of Higher Vocational College Students. Journal of Tianjin Vocational Colleges United, 25(7), 55–59.
- Zhang,A. (2022). Analysis and improvement strategies of college students' independent learning ability. Western Quality Education, 8(3), 35–37.
- Zhang,C.,Ya,G. (2024). Mechanisms and strategies for improving autonomous learning behavior of Higher Vocational College Students. **Vocational and Technical Education**, (14), 60-66.

- Zhang,M., Man,Y., Li,M. (2024). Research on strategy optimization for improving autonomous learning ability of Higher Vocational College Students in the Internet + era. **Modern Distance Education of Traditional Chinese Medicine**, (17), 166-169.
- Zhang,X. (2021). A brief discussion on the cultivation of students' independent and cooperative learning ability in junior middle school Chinese education teaching. **Teaching Discussion**, (33), 266–267.
- Zhao,M. (2023). Research on strategies to improve the quality of high school information technology teaching based on subject core competencies. **China Information Technology Education**, (23), 30–33.
- Zhao,P. (2024). Research on the influencing factors and optimization strategies of cooperative learning in the context of smart classrooms (Master's thesis). (03), 147. Hainan Normal University.
- Zheng,D. (2024). A preliminary study on effective ways to develop students' problemsolving ability. **Teaching and Examination**, (24), 4-6.

Appendix

Appendix A List of Specialists and Letters of Specialists Invitation for IOC Verification

List of Specialists and Letters of Specialists Invitation for IOC Verification

1.	Professor Dr.Huang Jin zhu	Guangxi Technological College of
		Machinery and Electricity
2.	Professor Dr.Wang ying	Chongqing Industry Polytechnic
		College
3.	Professor Dr.Tan Zhi gang	Jiangxi College of Applied Technology
4.	Associate Professor Dr.Zhu Jing feng	GuangXi Vocational Normal University
5.	Professor Dr.Li Guangrong	Nanning College for Vocational
		Technology

List of Interviews with 21 Experts

1.	Associate Professor Dr.Hong Dong	Guangxi Vocational And Technical
		College Of Communications
2.	Associate Professor Ms. Xu Liyu	Liuzhou City Vocational College
3.	Professor Dr.Fu Baolong	liuzhou vocational & technical college
4.	Associate Professor Dr.Zhang Yang	Guangxi Vocational&Technical Institute of Industry
5.	Associate Professor Ms. Li Xiaohua	Guangxi Electrical Polytechnic Institute
6.	Associate Professor Ms. Zhang Xiaohu	GUANGXI VOCATIONAL & TECHNICAL COLLEGE
7.	Mr. Xiang Kunyu	Guangxi Vocational&Technical Institute of Industry
8.	Mr. Li Shenglin	Guangxi Vocational University Of Agriculture
9.	Mr. Zou Caishen	Guangxi Talentinter National College
10.	Professor Ms. Tang Meixia	Nanning College for Vocational
		Technology
11.	Professor Dr.Jiang Wensheng	liuzhou vocational & technical college
12.	Professor Dr.Lin Feng	Guangxi Technological College of Machinery and Electricity
13.	Mr. Wei Liang	Guangxi Financial Vocational College
14.	Mr. Zhang Wenyuan	GUANGXI VOCATIONAL & TECHNICAL COLLEGE
15.	Associate Professor Dr.Tang Yongping	Wuzhou Vocational College
16.	Professor Ms. Hu Ling	Liuzhou Railway Vocational Technical College
17.	Associate Professor Dr.Zhu Mengwei	Liuzhou City Vocational College
18.	Associate Professor Dr.Zhong Wenji	Guangxi College of Water Resources and Electric Power
19.	Associate Professor Ms. Li Yanni	Guangxi Vocational And Technical College Of Communications
20.	Professor Dr.Gao Weifeng	Nanning College for Vocational Technology
21.	Professor Dr.Chen Xinrui	Beihai Vocational College

List of Focus Group with 9 Experts

1.	Professor Dr. Wuchunling	Chongqing Polytechnic University of Electronic
		Technology
2.	Professor Dr. Wu Ma Qun	Beijing Information Technology College
3.	Professor Dr. Wangyi	Nanning Normal University
4.	Professor Dr. Wu Xinzhang	GuangXi University
5.	Professor Dr. Dingyong	Guilin University Of Electronic Technology
6.	Professor Dr. Liang Yu	GUANGXI VOCATIONAL & TECHNICAL COLLEGE
7.	Professor Dr.Cai Tie	Shenzhen Institute of Information Technology
8.	Professor Dr. Chen Zhenzhen	Guangxi Vocational And Technical College Of
		Communications
9.	Professor Dr. Zhao Lin	Guangxi Electrical Polytechnic Institute



Ref.No. MHESI 0643.14/ 2 44

Bansomdejchaopraya Rajabhat University 1061 Itsaraparb Hirunrujee Thonburi Bangkok 10600

22 February 2024

RE: Invitation to validate research instrument

Dear Professor Dr. Huang Jin zhu, Guangxi Technological College of Machinery and Electricity

Mr. Luo Yunfang is a graduate student in Doctor of Philosophy Program in Digital Technology Management for Education of Bansomdejchaopraya Rajabhat University. He is undertaking research entitle "Development of Digital Learner Characteristics Model for Higher Vocational Students in Guangxi"

The thesis adversity committee has considered that you are an expert in this topic. Your recommendations would be useful for further improvement of this research instrument.

With your expertise, we would like to ask your permission to validate the attached research instrument. Would like to avail ourselves of this opportunity to express our sincere thanks and appreciation for your help.

Sincerely,

)/m.

(Assistant Professor Akaranun Asavarutpokin) Vice Dean of Graduate School



Ref.No. MHES10643.14/289

Bansomdejchaopraya Rajabhat University 1061 Itsaraparb Hirunrujee Thonburi Bangkok 10600

22 February 2024

RE: Invitation to validate research instrument

Dear Professor Dr. Wang ying, Chongqing Industry Polytechnic College

Mr. Luo Yunfang is a graduate student in Doctor of Philosophy Program in Digital Technology Management for Education of Bansomdejchaopraya Rajabhat University. He is undertaking research entitle "Development of Digital Learner Characteristics Model for Higher Vocational Students in Guangxi"

The thesis adversity committee has considered that you are an expert in this topic. Your recommendations would be useful for further improvement of this research instrument.

With your expertise, we would like to ask your permission to validate the attached research instrument. Would like to avail ourselves of this opportunity to express our sincere thanks and appreciation for your help.

Sincerely,

los

(Assistant Professor Akaranun Asavarutpokin) Vice Dean of Graduate School



Ref.No. MHESI 0643.14/ 240

Bansomdejchaopraya Rajabhat University 1061 Itsaraparb Hirunrujee Thonburi Bangkok 10600

22 February 2024

RE: Invitation to validate research instrument

Dear Professor Dr. Tan Zhi gang, Jiangxi College of Applied Technology

Mr. Luo Yunfang is a graduate student in Doctor of Philosophy Program in Digital Technology Management for Education of Bansomdejchaopraya Rajabhat University. He is undertaking research entitle "Development of Digital Learner Characteristics Model for Higher Vocational Students in Guangxi"

The thesis adversity committee has considered that you are an expert in this topic. Your recommendations would be useful for further improvement of this research instrument.

With your expertise, we would like to ask your permission to validate the attached research instrument. Would like to avail ourselves of this opportunity to express our sincere thanks and appreciation for your help.

Sincerely,

(Assistant Professor Akaranun Asavarutpokin) Vice Dean of Graduate School



Ref.No. MHESI 0643.14/291

Bansomdejchaopraya Rajabhat University 1061 Itsaraparb Hirunrujee Thonburi Bangkok 10600

22 February 2024

RE: Invitation to validate research instrument

Dear Associate Professor Dr. Zhu Jing feng, GuangXi Vocational Normal University

Mr. Luo Yunfang is a graduate student in Doctor of Philosophy Program in Digital Technology Management for Education of Bansomdejchaopraya Rajabhat University. He is undertaking research entitle "Development of Digital Learner Characteristics Model for Higher Vocational Students in Guangxi"

The thesis adversity committee has considered that you are an expert in this topic. Your recommendations would be useful for further improvement of this research instrument.

With your expertise, we would like to ask your permission to validate the attached research instrument. Would like to avail ourselves of this opportunity to express our sincere thanks and appreciation for your help.

Sincerely,

(Assistant Professor Akaranun Asavarutpokin) Vice Dean of Graduate School



Ref.No. MHESI 0643.14/ 292

Bansomdejchaopraya Rajabhat University 1061 Itsaraparb Hirunrujee Thonburi Bangkok 10600

22 February 2024

RE: Invitation to validate research instrument

Dear Professor Dr. Li Guangrong, Nanning College for Vocational Technology

Mr. Luo Yunfang is a graduate student in Doctor of Philosophy Program in Digital Technology Management for Education of Bansomdejchaopraya Rajabhat University. He is undertaking research entitle "Development of Digital Learner Characteristics Model for Higher Vocational Students in Guangxi"

The thesis adversity committee has considered that you are an expert in this topic. Your recommendations would be useful for further improvement of this research instrument.

With your expertise, we would like to ask your permission to validate the attached research instrument. Would like to avail ourselves of this opportunity to express our sincere thanks and appreciation for your help.

Sincerely,

(Assistant Professor Akaranun Asavarutpokin) Vice Dean of Graduate School

Appendix B Official Letter



มหาวิทยาลัยราชภัฏบ้านสมเด็จเจ้าพระยา BANSOMDEJCHAOPRAYA RAJABHAT UNIVERSITY

No.0643.13/471

25th August 2021

Letter of Acceptance

To Whom It May Concern

BSRU has accepted Mr. Luo Yunfang, holding a passport number EJ2053213, Chinese citizen, to be a full time student in the Doctor of Philosophy (Digital Technology Management for Education), Graduate School. The Degree is for a period of 3 years; will start from August 2021 and is expected to complete the Doctor of Philosophy in August 2024 depending on the credit transfer.

On behalf of the program, I would like to express my gratitude to Mr. Luo Yunfang for choosing Bansomdejchaopraya Rajabhat University to be a part of his professional growth.

If you need any information, please do not hesitate to contact me.



Please Notice:

1) This letter shall be effective when a student completes the whole registration process of Graduate School.

2) The enrollment fees must be transferred to "Bansomdejchaopraya Rajabhat University" bank account only.

3) In case that the number of students does not reach the minimum number of acceptance as indicated in the announcement of Graduate School, Bansomdejchaopraya Rajabhat University reserves the right to cancel this letter of acceptance without prior notice. The student could request the enrollment refund by using original receipt or transfer slip to Bansomdejchaopraya Rajabhat University only.

4) Bansomdejchaopraya Rajabhat University accepts for enrollment refund request only the case as stated in number 3).

มหาวิทยาลัยราชภัฏบ้านสมเด็จเจ้าพระยา 1061 ถนนอิสรภาพ 15 แขวงหิรัญรูจี เบตธนบุรี กรุงเทพฯ 10600 โทรสาร 0-2466-6539 BANSOMDEJCHAOPRAYA RAJABHAT UNIVERSITY 1061 Isaraphab 15 Rd Dhonburi Bangkok 10600 www.bsru.ac.th

Scanned with CamScanner

Appendix C Research Instrument

1. Open-Ended Interview

Development of digital learner characteristics model for higher vocational colleges students in Guangxi

Instructions:

Dear experts, Hello:

The purpose of this questionnaire is to understand the current status of digital learner characteristics for higher vocational colleges students in Guangxi, so as to discover the factors that affect students' digital learner characteristics and establish an effective model to improve the digital learning ability for higher vocational colleges students in Guangxi. Your opinions are very important to this study. Please answer according to the actual situation. Thank you very much!

This questionnaire consists of two parts

Part 1: Basic personal information

Part 2: Current status of digital learner characteristics for higher vocational colleges students in Guangxi

Part 1: Basic Personal Information Name: Gender: School: Experience: Educational background: Professional Title:

Part 2: Current status of digital learner characteristics for higher vocational colleges students in Guangxi

Questions	Answer
1. What do you think of the overall level of	
digital learning characteristics (abilities) of	
students in your school? (Short answer question)	
2. What do you think the school provides to	
support the development of students' digital	
learning characteristics (abilities)? (Short answer	
question)	

Questions	Answer
3. How much do you think the school values the	
cultivation of students' digital learning	
characteristics (abilities)? (Short answer question)	
4. What factors do you think affect students'	
digital learning characteristics (abilities)? (Short	
answer question)	
5. What do you think are the strategies to	
effectively improve students' digital learning	
characteristics (abilities)? (Short answer question)	
6. What other measures do you think schools	
should take to cultivate students' digital learning	
characteristics (abilities)? (Short answer question)	
7. Digital literacy and skills:	
What are the digital technology application	
capabilities and digital literacy levels of Higher	
Vocational College Students?	
What difficulties and challenges do Higher	
Vocational College Students encounter in	
improving their digital technology application	
capabilities and digital literacy?	
8. Interactive collaboration capabilities:	
How willing are Higher Vocational College	
Students to learn interactively and	
collaboratively?	
How capable are Higher Vocational College	
Students of interactive and collaborative	
learning?	
What are the main factors that affect Higher	
Vocational College Students' interactive and	
collaborative learning?	
9. Independent learning ability:	
What is the level of independent learning ability	
that students demonstrate in their studies?	
What are the main factors that affect the	
Questions	Answer
---	--------
independent learning of Higher Vocational	
College Students?	
10. Digital learning capabilities:	
What is the level of digital learning capabilities of	
Higher Vocational College Students and their	
ability to use digital technology for innovative	
learning?	
What problems and challenges do Higher	
Vocational College Students encounter in digital	
learning?	
11. Problem solving skills:	
How capable are vocational college students in	
finding solutions to problems they encounter in	
their studies?	
What are the main factors that affect vocational	
college students' problem solving skills?	

2. Questionnaire

For the questionnaire about the developed digital learner characteristic model for higher vocational colleges students in Guangxi. Please select your degree of agreement with the following descriptions based on your actual situation. The agreement range is 5-1, strongly agree, agree, neutral, disagree, and strongly disagree. Please select one according to your actual situation, and you can propose modifications, additions, deletions, and suggestions for modifying the description of the strategy.

Part 1: Respondent Status (Personal Information)

Name: Gender: School: Experience: Educational background: Professional Title:

Part 2: Questionnaire

No	ltem		\$	Score	5		Suggest
NO		5	4	3	2	1	Juggest
	Digital literacy and ski	lls	1	1	r	1	I
1	The school provides support such as digital						
	learning equipment, scenarios, resources, and						
	online courses						
2	Teachers make full use of digital platforms to						
	carry out interactive teaching						
3	The school provides students with innovative						
	practical projects such as data retrieval,						
	programming, data analysis, digital art, etc.						
4	The school establishes a digital literacy and						
	skills evaluation system and conducts regular						
	assessments						
5	The school provides network conditions and						
	learning places for digital learning						
6	Offer unified digital literacy and skills						
	improvement courses such as "Information						
	Technology"						
7	Provide students with regular lectures and						
	training on digital literacy and skills						
8	Regularly hold digital literacy and skills						
	competitions and other practical activities						
9	Guiding students to use digital technology in						
	a correct way						
10	Establish a resource library for students'						
	digital literacy and skills learning and training,						
	so that students can learn and train digital						
	skills at any time						
11	Carry out assessment and certification of						

No	ltom		S	core	è		Suggest
NO	item	5	4	3	2	1	Suggest
	students' digital literacy and skills, and						
	require students to complete						
12	Arrange students to practice digital literacy						
	and skills in enterprises						
13	Strengthen students' network ethics and						
	network security education						
14	Establish student clubs or associations for						
	digital literacy and skills training, and organize						
	digital literacy and skills training activities						
	through the clubs or associations						
15	The school and the enterprise jointly build a						
	digital literacy and skills classification teaching						
	resource library, and require students to						
	study on time every day						
16	Establish a unified digital literacy and skills						
	training guarantee system mechanism, unified						
	training standards and assessment standards						
	for the whole school						
17	Schools should establish corresponding						
	supporting incentive policies for students to						
	improve their digital literacy and skills						
18	Make full use of the National Digital Literacy						
	Training Base						
	Interactive collaboration cap	abili	ities	-	-		
19	Set up special courses related to team						
	interaction and collaboration						
20	Organize interactive and collaborative						
	projects such as skill competitions and						
	professional qualification certification						
21	Carry out teaching with students as the main						

No	ltom		S	Score	5		Suggost
NO	item	5	4	3	2	1	Suggest
	body, create collective discussions and						
	collaborative practice						
22	Make full use of online teaching platforms						
	and resources to carry out team-based						
	project teaching						
23	Organize team collaboration and						
	development activities						
24	Conduct comprehensive and individual						
	evaluations of teamwork						
25	Organize students to practice real enterprise						
	projects						
26	Implementing interactive and collaborative						
	learning in groups						
27	Teach cooperation skills such as expression,						
	listening, and negotiation						
28	Cultivate interactive collaborative thinking						
	and cooperation awareness						
29	Digital learning tools or platform support for						
	interactive and collaborative learning						
30	Regularly organize learning summary and						
	analysis meetings in groups						
31	Set up interactive collaborative learning						
	assessment						
32	Organize course interest groups for interactive						
	and collaborative learning						
33	Make full use of the online teaching platform						
	and arrange to complete a project or course						
	design from time to time						
34	Implement interactive and collaborative						

No	ltom		Score			Suggost		
INO	litem	5	4	3	2	1	Suggest	
	learning role-playing							
Independent learning ability								
35	Guide students to establish study plans							
36	Encourage students to develop good time							
	management habits							
37	Providing an environment for students to							
	conduct independent learning							
38	Provide students with a personalized learning							
	space							
39	Stimulate students' interest in learning							
40	Encourage students to make good learning							
	decisions							
41	Organize student group activities to promote							
	independent thinking in the team							
42	Encourage students to help and support each							
	other in their learning process							
43	Cultivate students' teamwork spirit and							
	enhance their independent learning ability							
44	Offering courses where students can							
	complete their own studies							
45	Stimulate students' learning initiative and							
	practical ability through practical learning							
	activities							
46	Provide personalized learning resources							
47	Implementing autonomous learning							
	incentives							
48	Make full use of online teaching platforms to							
	set up independent learning projects							
49	Implement teaching that encourages and							

No	Itom		9	Score	5		Suggost
NO	litem	5	4	3	2	1	Suggest
	guides students to independently discover						
	and solve problems						
	Digital learning capabilit	ties					
50	Strengthen students' understanding and						
	mastery of digital technology						
51	Strengthen students' knowledge and skills in						
	digital technologies						
52	Implementing diversified digital teaching						
53	Build a campus network and management						
	monitoring center to support, analyze and						
	manage students' digital learning						
54	Build diverse digital learning platforms and						
	resources						
55	Set up digital learning and seminar credit						
	assessment						
56	Improve teachers' digital teaching and						
	guidance capabilities						
57	Guiding students in digital learning						
58	Use online teaching platforms to assign						
	learning tasks and open-ended assignments						
59	Use digital learning environments and						
	resources to cultivate students' independent						
	discovery and exploration learning abilities						
60	Conducting digital learning evaluation and						
	feedback						
61	Establish a school-wide digital teaching policy						
	system						
62	Conduct digital learning skills competition for						
	students						
63	Real-time display of students' digital learning						

No	Itom	Score					Suggost
NO	item	5	4	3	2	1	Suggest
	progress and related learning activities						
64	Strengthen the assessment of digital learning						
	ability						
	Problem solving skills	s	1	1	1	1	1
65	Encourage students to proactively solve						
	problems						
66	Cultivate students' dialectical and critical						
	thinking abilities						
67	Enriching students' access to knowledge and						
	skills						
68	Stimulate students' interest and motivation in						
	solving problems						
69	Provide timely feedback and guidance to						
	students in solving problems						
70	Cultivate students' innovative thinking and						
	creativity						
71	Implement training that combines theoretical						
	knowledge with practical application						
72	Develop teamwork and communication skills						
73	Implement teaching to cultivate students'						
	habit of solving problems independently						
74	Implement the credit system and offer more						
	elective courses to broaden students'						
	knowledge						
75	Organize practical activities to improve						
	problem-solving skills						
76	Use heuristic teaching methods to carry out						
	daily teaching						
77	Establish an assessment mechanism for						

No	ltem		S	Suggest			
		5	4	3	2	1	Juggest
	students' problem-solving abilities						
78	Carry out on-the-job practical training						
79	Make full use of online teaching and learning						
	platforms to carry out breakthrough teaching						

3. Evaluate

Please comment on the strategies of each dimension and mark the appropriate box with " \checkmark " if you agree. You can also fill in suggestions. Please fill in the corresponding box to modify or supplement the indicator. (P for pass, E for edit and D for delete).

No	ltem	Р	Е	D
	Digital literacy and skills			
1	The school provides support such as digital learning			
	equipment, scenarios, resources, and online courses			
2	Teachers make full use of digital platforms to carry out			
	interactive teaching			
3	The school provides students with innovative practical			
	projects such as data retrieval, programming, data analysis,			
	digital art, etc.			
4	The school establishes a digital literacy and skills			
	evaluation system and conducts regular assessments			
5	The school provides network conditions and learning			
	places for digital learning			
6	Offer unified digital literacy and skills improvement courses			
	such as "Information Technology"			
7	Provide students with regular lectures and training on			
	digital literacy and skills			
8	Regularly hold digital literacy and skills competitions and			
	other practical activities			

No	ltem	Р	E	D					
9	Guiding students to use digital technology in a correct way								
10	Establish a resource library for students' digital literacy and								
	skills learning and training, so that students can learn and								
	train digital skills at any time								
	Suggestions:								
	Interactive collaboration capabilities	1	1	1					
11	Organize interactive and collaborative projects such as skill								
	competitions and professional qualification certification								
12	Carry out teaching with students as the main body, create								
	collective discussions and collaborative practice								
13	Make full use of online teaching platforms and resources to								
	carry out team-based project teaching								
14	Organize students to practice real enterprise projects								
15	Implementing interactive and collaborative learning in								
	groups								
16	Cultivate interactive collaborative thinking and cooperation								
	awareness								
17	Digital learning tools or platform support for interactive and								
	collaborative learning								
18	Organize course interest groups for interactive and								
	collaborative learning								
19	Make full use of the online teaching platform and arrange								
	to complete a project or course design from time to time								
20	Implement interactive and collaborative learning role-								
	playing								
	Suggestions:								
	Independent learning ability								

No	ltem	Р	Е	D
21	Independent learning ability			
22	Guide students to establish study plans			
23	Stimulate students' interest in learning			
24	Encourage students to help and support each other in their			
	learning process			
25	Offering courses where students can complete their own			
	studies			
26	Stimulate students' learning initiative and practical ability			
	through practical learning activities			
27	Provide personalized learning resources			
28	Implementing autonomous learning incentives			
29	Make full use of online teaching platforms to set up			
	independent learning projects			
	Suggestions:			
	Digital learning capabilities			
30	Implementing diversified digital teaching			
31	Build a campus network and management monitoring			
	center to support, analyze and manage students' digital			
	learning			
32	Build diverse digital learning platforms and resources			
33	Set up digital learning and seminar credit assessment			
34	Guiding students in digital learning			
35	Use online teaching platforms to assign learning tasks and			
	open-ended assignments			
36	Establish a school-wide digital teaching policy system			
37	Conduct digital learning skills competition for students			
38	Strengthen the assessment of digital learning ability			

No	Item	Р	E	D
	Suggestions:			
	Problem solving skills			
39	Cultivate students' dialectical and critical thinking abilities			
40	Implement training that combines theoretical knowledge with practical application			
41	Develop teamwork and communication skills			
42	Implement teaching to cultivate students' habit of solving problems independently			
43	Organize practical activities to improve problem-solving skills			
44	Use heuristic teaching methods to carry out daily teaching			
45	Carry out on-the-job practical training			
46	Make full use of online teaching and learning platforms to			
	carry out breakthrough teaching			
	Suggestions:			

Appendix D The Results of the Quality Analysis of Research Instruments

Na	ltem		Expe					\/_!! <u>-</u> ! !+
INO		1	2	3	4	5	IUC	validity
Digital literacy and skills								
1	The school provides support such as							
	digital learning equipment, scenarios,	1	1	1	1	1		Valid
	resources, and online courses							
2	The school establishes a digital literacy							
	and skills evaluation system and conducts	1	1	1	1	1		Valid
	regular assessments							
3	The school provides network conditions	1	1	1	. 1	1		Valid
	and learning places for digital learning	-		-				, add
4	Offer unified digital literacy and skills							
	improvement courses such as "Information	1	1	1	1	1		Valid
	Technology"							
5	Regularly hold digital literacy and skills	1	1	1	1	1		Valid
	competitions and other practical activities							
6	Carry out assessment and certification of				1	1		Valid
	students' digital literacy and skills, and	1	1	1				
	require students to complete							
7	Establish student clubs or associations for							Valid
	digital literacy and skills training, and	1	1	1	1 1	1		
	organize digital literacy and skills training							
	activities through the clubs or associations							
8	Develop learning resources and teaching				1			Valid
	project libraries in various fields related to							
	digital literacy and skills, implement them	1	1	1		1		
	into daily teaching and keep the resources							
	continuously updated							
9	Establish a unified digital literacy and skills				1 1	1 1		Valid
	training guarantee system mechanism,	1	1	1				
	unified training standards and assessment							
	standards for the whole school							
10	Strengthen students' network ethics and	1	1	1	1	. 1		Valid
	network security skills education	_						
11	Provide teacher guidance for students to	1	1	1	1	1		Valid
	improve their digital literacy and skills		-					

Na	ltem		E>	kpei	erts			الما الما	
INO		1	2	3	4	5	IUC	validity	
Interactive collaboration capabilities									
12	Carry out teaching with students as the								
	main body, create collective discussions	1	1	1	1	1		Valid	
	and collaborative practice								
13	Make full use of online teaching platforms								
	and resources to carry out team-based	1	1	1	1	1		Valid	
	project teaching								
14	¹ Organize students to practice real	1	1			4		N/ 11 1	
	enterprise projects	1	1	1	T	1		valid	
15	Implementing interactive and collaborative		1	1	1	1		Valid	
	learning in groups	1	1	1	1				
16	Cultivate interactive collaborative thinking			1	1) (- 1: -1	
	and cooperation awareness	1	1	T	1	1		valid	
17	Digital learning tools or platform support	1	1	1	1	1		Valid	
	for interactive and collaborative learning			Ţ					
	Organize course interest groups for	1	1	1	1 1	1		Valid	
18	interactive and collaborative learning	1	1	1	1	1		Valid	
19	Make full use of the online teaching								
	platform and arrange to complete a	1	1	1	1 1	1		Valid	
	project or course design from time to time		L						
20	Implement interactive and collaborative	1	1	1	1	1		Valid	
	learning role-playing		1	1	1	1			
21	Implement interactive collaboration skills	1	1	1	1	1		Valid	
	assessment			1	1				
	Independent learning ability								
22	Strengthening students' independent								
	learning ability	1		1	1	1		Valid	
23	Guide students to develop study plans	1	1	1	1	1		Valid	
24	Provide personalized learning resources	1	1	1	1	1		Valid	
25	Encourage students to help and support	4	4	4	4	4			
	each other in the learning process					1		valid	
26	Self-study courses	1	1	1	1	1		Valid	

Nie	Item	Experts) (= ; = ; t= .
0/1		1	2	3	4	5	IUC	validity
27	Stimulate students' learning initiative and practical ability through practical learning activities	1	1	1	1	1		Valid
28	Stimulate students' interest in learning	1	1	1	1	1		Valid
29	Implementing autonomous learning incentives	1	1	1	1	1		Valid
30	Make full use of online teaching platforms and set up independent learning projects	1	1	1	1	1		Valid
31	Provide teacher guidance and support	1	1	1	1	1		Valid
32	Implementation evaluation feedback	1	1	1	1	1		Valid
33	Guided self-reflection and evaluation	1	1	1	1	1		Valid
Digital learning capabilities								
34	Implementing diversified digital teaching	1	1	1	1	1		Valid
35	Build a campus network and management monitoring center to support, analyze and manage students' digital learning	1	1	1	1	1		Valid
36	Build diverse digital learning platforms and resources	1	1	1	1	1		Valid
37	Set up digital learning and seminar credit assessment	1	1	1	1	1		Valid
38	Guiding students in digital learning	1	1	1	1	1		Valid
39	Use online teaching platforms to assign learning tasks and open-ended assignments	1	1	1	1	1		Valid
40	Establish a school-wide digital teaching policy system	1	1	1	1	1		Valid
41	Conduct digital learning skills competition for students	1	1	1	1	1		Valid
42	Strengthen the assessment of digital learning ability	1	1	1	1	1		Valid
43	Improving teachers' digital teaching capabilities	1	1	1	1	1		Valid

NIE	ltem		E	kpei	ts			N7 12 1120
NO		1	2	3	4	5	IUC	Validlity
44	Provide digitalization situation analysis and learning evaluation services for teachers	1	1	1	1	1		Valid
45	Improve the organizational management and guarantee service mechanism for the entire process of digital teaching	1	1	1	1	1		Valid
46	Provide students with digital academic warnings and academic assistance	1	1	1	1	1		Valid
	Problem solving skills							
47	Cultivate students' dialectical and critical thinking abilities	1	1	1	1	1		Valid
48	Implement training that combines theoretical knowledge with practical application	1	1	1	1	1		Valid
49	Develop teamwork and communication skills	1	1	1	1	1		Valid
50	Implement teaching to cultivate students' habit of solving problems independently	1	1	1	1	1		Valid
51	Organize practical activities to improve problem-solving skills	1	1	1	1	1		Valid
52	Use heuristic teaching methods to carry out daily teaching	1	1	1	1	1		Valid
53	Implementing real enterprise project practice to cultivate students' innovative consciousness and practical ability	1	1	1	1	1		Valid
54	Make full use of online teaching and learning platforms to carry out breakthrough teaching	1	1	1	1	1		Valid
55	Strengthening training on problem-solving steps	1	1	1	1	1		Valid
56	Guide students to reflect and summarize their own problem-solving process	1	1	1	1	1		Valid
57	Provide feedback and guidance	1	1	1	1	1		Valid

Appendix E Certificate of English



Appendix F

The Document for Accept Research



วารสาร RSU JET

วิศวกรรมและเทคโนโลยี มหาวิทยาลัยรังสิต

RANGSIT UNIVERSITY JOURNAL OF ENGINEERING AND TECHNOLOGY

1 ตุลาคม 2567

- เรื่อง ตอบรับบทความเรื่อง "*Development of Digital Learner Characteristics Model for Higher Vocational Students in Guangxi*" ลงตีพิมพ์ในวารสารวิศวกรรมและเทคโนโลยี มหาวิทยาลัย รังสิต (RSU JET)
- เรียน Luo Yunfang, Assoc.Prof.Dr.Pong Horadal, Asst.Prof.Dr.Kanakorn Sawangcharoen, and Asst.Prof.Dr.Prapai Sridama

กองบรรณาธิการวารสารวิศวกรรมและเทคโนโลยี มหาวิทยาลัยรังสิต (RSU JET) ขอเรียนแจ้งให้ ท่านทราบว่า บทความเรื่อง "Development of Digital Learner Characteristics Model for Higher Vocational Students in Guangxi" ที่ท่านส่งมาเพื่อพิจารณาและตีพิมพ์กับวารสารฯ นั้น ขณะนี้ผ่านการ พิจารณาแล้ว โดยทางวารสารฯ จะนำบทความของท่านลงตีพิมพ์ในวารสารฯ เล่มปีที่ 27 ฉบับที่ 2 (กรกฎาคม-ธันวาคม 2567)

ขอแสดงความนับถือ

An

(รองศาสตราจารย์ ดร. ดวงอาทิตย์ ศรีมูล) บรรณาธิการวารสารวิศวกรรมและเทคโนโลยี มหาวิทยาลัยรังสิต

สำนักงานคณบดีวิทยาลัยวิศวกรรมศาสตร์ มหาวิทยาลัยรังสิต 52/347 หมู่บ้านเมืองเอก, ถนนพหลโยธิน, หลักหก, ปทุมธานี 12000 โทร.02-997-2222-30 ต่อ 3226

Research Profile

Name-Surname:Luo YunfangBirthday:August 24, 1981Place of Birth:HeZhou, Guangxi, China

Educational Background:

- 2012.09-2014.06, master's degree graduation, University of Electronic Science and Technology of China major in Software Engineering

- 2006.3-2009.01, Bachelor's degree, Xi'an Jiaotong University of Computer Science and Technology

Work Experience:

- 2004.08-2020.12, Teacher of Guangxi Vocational & Technical College

- 2020.12-2024.05, Vice Dean of the School of Big Data of Guangxi

Vocational & Technical College

- 2024.05-Present, Dean of the School of Big Data of Guangxi Vocational & Technical College

Office Location:

- Guangxi Vocational and Technical College

Current Contact Location:

- No.19, Mingyang Avenue, Jiangnan District, Nanning, Guangxi, China