A STUDY ON THE LEARNING ENGAGEMENT STATUS AND INFLUENCING FACTORS OF UNIVERSITY STUDENTS IN A SMART CLASSROOM ENVIRONMENT: A CASE STUDY OF A SMART CLASSROOM AT BAISE UNIVERSITY

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A Study on the Learning Engagement Status and Influencing Factors of University Students in a Smart Classroom Environment: A Case Study of a Smart Classroom at Baise University (208 pp.)

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ABSTRACT

The rapid development of new technologies such as Big Data, Internet of Things, Cloud Computing, Virtual Reality and Artificial Intelligence has promoted the transformation of traditional learning environments into intelligent learning environments. The quality of teaching and learning in higher education has long been a concern, and the engagement of university students in the classroom is a core element in measuring the quality of education. The study focuses on the factors that influence students' engagement in learning in the smart classroom environment. The research methodologies and research results, as well as the practical research experiences of related scholars, were then used to reflect on this study and gain inspiration. The model is based on Astin's I-E-O model, Kuh's (2009) Learning Engagement Theory and Bandura's Ternary Interaction Decision Theory, and refers to the path diagram and conceptual model of learning engagement factors. The study was based on students in a smart classroom at Baise University. The study adopted a mixed research method combining qualitative and quantitative research to understand students' learning engagement and influencing factors in the smart classroom environment.

The main findings of this study are as follows: 1. Regarding the current state of learning engagement: the overall level of college students' learning engagement is high in the smart classroom environment, with most college students' learning engagement at a medium to high level; college students' behavioral engagement, cognitive engagement, and emotional engagement levels are all high. There is no

significant difference between gender and learning engagement, and both male and female students have higher levels of learning engagement. The gender sample showed significant differences in behavioural engagement, i.e. girls were significantly more engaged than boys. 2) When students' learning status (behavioural engagement, cognitive engagement and affective engagement) is better, students' learning engagement increases significantly. 3) Factors influencing learning engagement: self-efficacy, technology acceptance, motivation, teacher factors, interactive behaviour and environmental factors are all factors influencing learning engagement. All of these factors had a positive effect on learning engagement. The author then analyses and discusses the findings and makes recommendations on each of the six factors in the hope of improving learning engagement in the smart classroom environment and promoting the use of smart classrooms in universities.

Keywords: Smart Classroom, University Students, Learning Engagement, Influencing Factors

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Jiaming Nong

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CHAPTER 1
INTRODUCTION

1.1 Research Background

The information age has placed new demands on educational concepts, teaching methods and teaching models. Traditional classrooms cannot provide teachers with rich and varied technical support for their teaching. Smart classrooms provide teachers with a smart teaching environment that can innovate teaching models and promote classroom teaching reform Research shows that the main external factors for low learning engagement in university students' classrooms are teaching methods and learning environments. The traditional classroom teaching model is relatively boring, with less interaction between teachers and students. With the rapid development of the application of network technology and wireless network technology, smart Classrooms Based on mobile terminals and network communication technology have emerged at the right time, providing new ideas and standards for independent innovation in classroom teaching reform. Compared with traditional classrooms, colorful technical support provides a natural environment for smart classrooms. Compared with traditional classroom teaching, rich and colorful technical support provides a natural environment for intelligent classroom teaching. Teachers can choose various teaching strategies such as team cooperation teaching methods, research learning task driven methods, flexibly use the special tools of network resources to create cooperative learning contacts, conduct diversified assessments, take students as the main body of learning behavior, and fully cultivate students' learning initiative and participation.

1.1.1 The smart classroom is the new trend in the information age

In recent years, with the rapid development of a new generation of information technology, universities have been paying more and more attention to information technology and their investment in human and financial resources has increased

significantly. Ambient intelligence (AMI) is a measurement industry, which is committed to having a technically rich and colorful indoor space that is reasonably applicable to everyone's daily life (Cook, Augusto, & Jakkula, 2009). Based on the significant progress of universality, autonomy and pervasive computing, AMI allows different mobile phone software and hardware configuration modules in the natural environment to interact, so as to achieve the overall goal of the world. Achieve the overall goals of the world. (Aguilar, Valdiviezo, Cordero, & Sánchez, 2015) define AI in teaching as all indoor spaces where ubiquitous new technologies assist the learning process in an unobtrusive way. Smart classroom is a test for AMI industry. The intelligent classroom has completely changed the classroom by integrating the controller, communication technology and artificial intelligence into the classroom. The idea is to use artificial intelligence to improve the learning process, while taking full account of various fields of the education industry (such as learning style) and the development of modern information technology (Guilar, Buendia, Pinto, & Gutierrez, 2019). The intelligent classroom can be understood as the artificial intelligence that specifically guides the learning process, taking into full account the special aspects of its special aspects (for example, students' classes, course contents taught by experts, etc.). In this work (Aguilar et al., 2015), a distributed database based on multi-agent system software (MAS) was developed and designed for the self-discipline of intelligent classrooms, which is called SACI (SAL ó n de clase intelligent, abbreviated in Spanish). "Intelligent classroom" is a new field in Colleges and universities. It ensures the category and limited design concept of intelligent classroom, and takes the promotion of intelligent colleges and universities as the environment. Smart universities advocate. First, the definition of intelligence is introduced in detail. First, it introduces in detail the definition of "intelligent" technology in big cities, campuses and offices (Kwet & Prinsloo, 2020). In just a few decades, electronic computers have developed from medium-sized computers to home, my mobile terminals, today's small and medium-sized mobile terminals, and the current small and medium-sized

goals of Internet of things technology.

With the promotion of Internet technology, objects such as toaster, soft bristled toothbrush and even diapers have become "intelligent" devices (Greengard, 2015). The technicality of education is changing from the original learning tool and the way of acquiring knowledge to the big data monitoring of "humanized" education based on the data collected from the students' own equipment collect data information from students' own devices. The technicality of artificial intelligence technology has increasingly endangered knowledge and scientific research, the foundation of education. Research is the foundation of Education (Kwet & Prinsloo, 2020). We were told that "smart city" will use "sensors, actuators, dashboards, transmitters, surveillance cameras and measuring devices" and the combination of "crowdsourcing platform, accurate positioning and social media" to understand and manage urban life (Kitchin, 2014; Goldsmith & Crawford, 2014). The new project of data and information collection in the physics area and more generally for students has become a part of the "complex network information grid" (Solove, 2004). Here, data and information are shared, sold and combined, and new data and information organizations and data and information archives occur (Jones, 2019). The new smart city extends the logic of RTCC to the universal urban life. Although some independent innovations are promising to improve waste management methods, lighting fixtures, energy consumption levels and traffic flow (Goldsmith & Crawford, 2014), critics blame the deployment of sensors, Internet of things technology and digital TV surveillance cameras for centralizing the energy of technocratic management methods and corporate profits (Hollands, 2008; Kitchin, 2014). The new smart city promoted by high and new technology has promoted supervision, privatized urban governance and destroyed democratization.

Multimedia teaching in smart classrooms has gradually been accepted and widely used by university teachers. The former has certain advantages over traditional teaching methods. The traditional classroom teaching method mainly consists of writing on the blackboard, listening to lectures and practicing. In other

words, the teacher is responsible for teaching and the students are responsible for learning. Teaching is a one-way process of knowledge transfer. For students, focusing on static text, data and images for a long time can easily lead to fatigue and distraction, which will greatly reduce learning efficiency and effectiveness. There are many aspects of multimedia teaching in smart classroom teaching that cannot be achieved by traditional teaching, for example, abstract things will become more intuitive and easier to learn and understand. Multimedia technology can be combined with other technologies to show not only simple digital information such as words and phrases, but also output video, animation, sound and images, which can easily be illustrated in sound to enhance the authenticity and expressiveness of the information, dynamic courseware to show multi-dimensional three-dimensional teaching information to attract students' attention, making the teaching process more in line with students' cognition, understanding and memory rules, turning The teaching process is more in line with students' cognition, comprehension and memory. This improves the efficiency and quality of teaching and learning.

The occurrence and progress of the application of new technologies have promoted the application of technology in the education industry, resulting in great changes in Teachers' teaching strategies, the structure of classroom teaching actions and teaching models. The information age has clearly put forward new regulations for classroom teaching. The ten year construction plan for education informatization (2011-2020) (Ministry of Education of the People’s Republic of China, 2012) also clearly puts forward relevant provisions. Build an intelligent system teaching environment, provide high-quality data teaching resources and tool software, and explore the creation of a new teaching mode under the natural information environment. The overall plan for the 13th five year plan for ICT in Education (Ministry of Education of the People’s Republic of China, 2012) also mentioned that "it is necessary to create an ICT based teaching environment with the help of information technology, promote the reform and innovation of educational ideas, teaching models and teaching materials, and encourage teachers to make use of ICT based teaching models".

Relevant studies show that the current teaching methods and classroom interaction forms in college classrooms are relatively fixed and single, and that

"teaching reform in colleges and universities is imminent" (Jiang, Mao, Wan, & Shen, 2018). In the traditional teaching environment, due to the limitations of teaching conditions, teachers are limited in the teaching methods they can adopt in the classroom, the form of teacher-student interaction is monotonous, and it is difficult to present the learning content to students in a concrete and concise manner as it is abstract and difficult to understand, and students with weaker learning ability have poor learning efficiency and effectiveness, which affects their learning quality. Therefore, advanced information technology tools, teaching ideas and teaching methods are particularly important in the information age." Smart classroom + classroom reform" is also "a fundamental way to achieve the ambitious goal of information technology in education" (He, 2015).

1.1.2 Learners' learning engagement is a key factor in measuring the quality of education

Interpersonal interaction, learning design and supportive natural environment can endanger learners' participation in learning activities (from the perspective of culture and education). With the help of mobile computing machines and ICT, information content, network resources and learning activities are carried out at any time (Qiu, 2019 as cited in Liu & Correia, 2021). At the level of curriculum content and learning design, giving real learning activities (Buelow, Barry, & Rich, 2018; Martin & Bolliger, 2018), integrating autonomous learning (Guenther & Miller, 2011; Hew, 2016) and giving reasonable teaching resources (Hew, 2016) are generally recognized strategies to promote learner participation. Recognized strategies to promote learner participation. Among other things, teaching resources should meet the requirements of different learners by giving clear personal goals and coaching.

Teachers can create interesting and sufficient teaching experience for college students according to the creation of high academic research norms and the assignment and evaluation of daily tasks. According to creating high academic research norms and assigning assessment daily tasks, teachers can create interesting and sufficient teaching experience for learners to enhance their participation in learning and training (Zepke & Leach, 2010). Infrastructure construction and technical services are given according to the conditions of providing a hot and

diversified learning environment and various applicable service items, and creating conditions that provide various applicable service items and allow learners to browse information services and machinery and equipment (Guenther & Miller, 2011; Tarantino, McDonough, & Hua, 2013; Zepke & Leach, 2010).

How to improve the learning engagement of university students has become a research hotspot and development trend in the field of education. Relevant research shows that the training fund investment of college students is harmed by two levels: the teaching method of teachers and the learning environment. The traditional teaching has a single type of classroom theme activities, less interaction between teachers and students, simple course content and low classroom teaching atmosphere, which cannot arouse learners' interest in learning. Participating in peer-to-peer interactive communication can promote students' real ideas and improve their test scores. (Aghaee & Keller, 2016) The teaching environment does not provide strong service support for teaching links. Students' classroom participation is low, and the learning effect is low. The occurrence and progress of cloud computing technologies such as cloud computing technology, Internet of things technology, artificial intelligence technology and so on have brought basic technology to the production of intelligent classroom teaching in intelligent teaching classes. Teachers can use electronic device interactive white board, intelligent information interaction system software There are various teaching strategies for technical design schemes such as wireless screens. Let learners become the main body of teaching behavior, fully cultivate the training initiative of students, actively carry out the whole process of teaching class, and apply intelligent technology in the natural environment of classroom teaching to effectively apply various interactive teaching links, arouse students' interest in learning, improve students' class, and enhance the quality and effectiveness of effective teaching.

1.1.3 Analysis of the smart classroom environment at Baise University

Based on the basic hardware facilities, the wisdom classroom of Baise College relies on the cloud classroom platform and integrates information and communication technology to create a wisdom classroom with strong interactivity and deep experience, it can improve the presentation of teaching content, facilitate access to learning resources, promote the development trend of interactive

communication in classroom teaching, and implement the role of situational concept and environmental management. It can improve students' training quality and efficiency, arouse students' learning interest and consciousness, and promote innovation and independent innovation in the teaching process.The hardware of the school smart classroom mainly includes built-in electronic whiteboard touch wall-mounted LCD screen projector wireless voting screen interactive recording and broadcasting system and network infrastructure, etc. , which greatly enriches the form of classroom teaching. The software has a built-in cloud classroom learning management system, intelligent learning behaviour data collection and analysis system, etc., which supports online accommodation and classroom learning and learning activity data collection and analysis, facilitating teachers to teach accurately and develop personalised learning plans. The desks and chairs in classroom teaching can be freely combined and separated according to the needs of teaching activities, so as to improve the optional time and space for teachers and students to communicate and discuss. It is suitable for various collaborative working group learning activities.

1.2 Research Questions

How can we study learner engagement and related influences in a smart classroom environment at Baise University?

1.2.1 Exploring the state of student learning engagement in the smart classroom environment at Baise College.

1.2.2 What factors affect college students' classroom learning engagement in smart classroom environments.

1.3 Research Objectives

In the intelligent classroom environment, the classroom teaching methods become more diversified, and the information transmission and communication between teachers and students become diversified and systematic. According to this, this scientific research plans to select the intelligent classroom environment for classroom teaching. It also analyses the extent of the environment in which university students learn in the classroom, analyses and researches the current

literature and learning practices about wisdom in the classroom, summaries relevant theories and research experiences, and initially establishes and improves the model of this study with the support of the theoretical foundation. The aims and significance of the study are as follows. 1) Based on the generalization and analysis of the current relevant data, the intelligent classroom of Baise College was investigated and analyzed, and a questionnaire was prepared to analyze the data so as to grasp the current situation of college students' learning engagement in the intelligent classroom environment. 2) The elements affecting college students' learning engagement in the intelligent classroom environment were explored, and an entity model environment of the elements affecting college students' learning engagement in the intelligent classroom was generated.

1.4 Significance of the Study

As the key guarantee of learning effectiveness, how to improve students' classroom learning input has become a puzzle for cultural educators and front-line teachers for many years. This scientific research has summarized the relevant references, referred to the relevant theoretical models of learning input, compiled the survey and evaluation scale, and built an entity model of the influencing factors of College Students' learning input in the intelligent classroom environment. And put forward opinions according to the analysis conclusion. This paper has learned about the learning input of college students in the intelligent classroom environment, built an entity model of influencing factors, enriched the application research of intelligent classroom in school classroom teaching, and provided a reference and theoretical source for improving students' learning participation in the intelligent classroom environment.

CHAPTER 2
LITERATURE REVIEW

On the basis of defining the key concepts of this study in the first chapter, the editor further searched and studied the relevant references of intelligent classroom and learning and training investment, understood the current research situation of intelligent classroom and the influencing factors of the measuring instruments of learning and training investment in the world, provided reference and inspiration for practical research, and provided theoretical sources for building the entity model of the influencing factors of contemporary college students' investment in the natural environment of intelligent classroom.

2.1 Review of the Theoretical Literature

2.1.1 Theoretical research on smart classrooms

According to smart classroom theory, the classroom of the future is a technological and electronic environment where learning and teaching processes take place in a classroom setting and where students are able to focus on innovative teaching and learning through systematic technological means in the classroom. Mobility, openness, interactivity, flexibility and the use of freshly designed technology to generate smart spaces are five essential qualities that clearly identify the smart classroom and enable the smart classroom field to develop. As a result, it is believed that smart classrooms should have the ability to update and record learner data in real time, provide rapid feedback on teaching and learning assessments, retrieve materials quickly, automate device control and other related services. Early research on smart classrooms focused on the use and design of the required equipment and technology. Later, in 2012, the focus of the research shifted to educational intelligence and teaching. To enable the operation of smart classrooms, as well as the automatic analysis and real-time recording of data on classroom processes, intelligent

control systems use artificial intelligence and cloud computing technologies. As a result, teachers can keep track of their students' learning by modifying important data and learning strategies in real time. Although the definition of "classroom teaching" starts from the traditional natural teaching environment, it is also used as a distributed system learning environment, whether it is online learning, mixed learning training or distance learning. This educational model usually differs not only in terms of student population data, costs, return to school and dropout rates, but also in terms of teaching methods, admission criteria and flexibility (e.g. Shachar & Neumann 2010 as cited in Kwet & Prinsloo, 2020; Subotzky & Prinsloo, 2011 as cited in Kwet & Prinsloo, 2020). Cultural Education (in any way) applies a variety of data (such as physical geography and personal behavior data) from beginning to end to carry out overall planning, operation and classroom teaching. Intelligent technology provides new opportunities for expanding the scope of "data staring". Therefore, the smart classroom not only provides data in new ways, but also provides more types, granularity distribution and higher speed data, which can be used to provide information for classroom teaching (Kwet & Prinsloo, 2020) Established the main factors of the smart classroom, such as voice recognition technology, machine vision, remote control student mobile phone software, interactive news media board, voice recognition technology, machine vision, real-time monitoring and popularization calculation. Radio frequency identification (RFID) technology is widely used in access control system, employee management, transportation, digital wallet and other industries. In the paper reference, the creator developed and designed smart classroom system software based on near-field communication (NFC), which is a combination of RFID. The system software is used to complete the role of student attendance system and carry out interaction. The results show that interaction has an active harm to students' learning attitude. Interactive whiteboard technicality (IWBT) is a key feature of smart classroom. In the reference (Al-Qirim, 2011), research related to the effectiveness and user response to the use of IWBT is reviewed. The results suggest

that the interactive whiteboard is a suitable teaching tool under certain conditions. Reference (Al-Qirim, 2011) also describes the advantages and disadvantages of the IWBT, with technical problems and hardware misconfigurations likely to be the main causes of user dissatisfaction. In reference (Tissenbaum, Lui, & Slotta, 2012)

In, the authors note that large projection displays have a good impact on the internal interaction and cooperation of student groups and help teachers to observe the state of the whole class. The learning effects of technology-rich classrooms and multimedia classrooms are analyzed. The results are that wireless displays and shared screens for students in the classroom are essential for sharing learning and facilitating interaction. SaCI is a smart classroom proposed in (Aguilar, Valdiviezo, Cordero, Riofrio, & Encalada, 2016), where its deployment environment (middleware), called AmICL, is presented in (Sánchez, Aguilar, Cordero, & Valdiviezo, 2015). SaCI has put forward a student-centered intelligent classroom, which is applicable to the learning process, and promotes its own learning and training according to cooperative machinery, equipment and application software. Therefore, the intelligent classroom has different kinds of components: hardware configuration (such as intelligent board, surveillance camera, etc.) and mobile phone software (such as intelligent teaching management system (ITS), VLEs, learning and training target library, teaching resource recommendation algorithm, etc.), which are adjusted and integrated into the discipline according to the needs of students. Because of SACI's self-adjusting and reflective characteristics, such adaptability of different components is very possible. They proposed the SACI entity model), which uses the paradigm of multi-agent systems (MAS) (Aguilar et al., 2016) to characterise an intelligent classroom based on a community of agents.

The theoretical model and definition characteristics are the main overall objectives of the basic theoretical research of intelligent classroom in China. The definition of intelligent classroom is based on the application of human-computer interaction intelligent space technology in the classroom, and the professional

knowledge is improving all over the world. Thus, in a smart classroom, learners and teachers interact through the use of various learning methods for teaching and learning activities, such as electronic interactive classroom whiteboards, projector facilities, student terminals, and device control operations. Scholars have examined the first barriers encountered in the typical multimedia classroom. The concept of classroom intelligence was devised, arguing that the intelligence of a smart classroom can be summarized in sequential dimensions, as shown in Figure 1 below.

Figure 2.1: The five Dimensions of a Smart Classroom

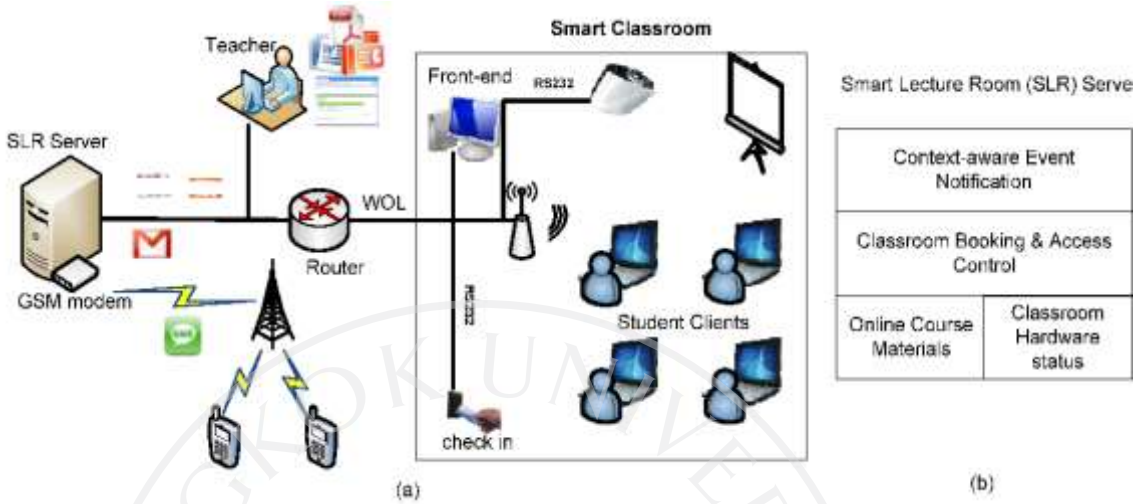
The stages of a smart classroom are depicted in the diagram above; they are a sequence that includes the processes of presentation, environment management, resource acquisition, Timely interaction, and Testing (Scenario perception). There are several types of content involved, including educational curricula, classroom teaching and in-depth engagement with technology. (Jawa et al., 2010) investigated how mobile interactivity can be used in smart classrooms. Scholars such as Nie, Zhong, & Song (2013) constructed a smart classroom based on the SMART conceptual model, as shown in Figure 2 below.

Figure 2.2: Smart Classroom Based on the SMART Concept

The SMART concept expands the five classroom dimensions shown in Figure 1 into six SMART systems, as shown in Figure 2.2 Infrastructure, network awareness, visual management, augmented reality, real-time recording and ubiquitous technology are all part of these i-SMART systems.

Professor (Yang, 2014) argues that the New Media Horizons report (2013 edition) describes the characteristics of international education development through big data, cloud computing, mobile internet, and ubiquitous learning technologies. It is argued that the smart classroom includes electronic courseware, electronic desk cloud classroom, and can comprehend the evolution of teaching resources from analogue media and digital media to cloud media (Cheng, 2015) analysed the gap between the traditional learning space and the development of the information age through his study of the smart classroom, arguing that the emergence of the smart classroom is an inevitable trend in the development of education informatization to a certain stage, and proposed a model of the smart classroom system, with the design of the smart classroom space on the left and the technical support of the smart classroom on the right. Technical support, teacher guidance, learning environment design the current situation of the smart classroom was examined at the conceptual level, and a smart research innovation room was proposed.

Figure 2.3: The overall structure of the Smart Classroom



Source: Hu, D. H. (2009). *Smart classroom 2.0: Context-aware educational system*. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=C6CB9B3D8374AEB1323C1FF5E86B95C3?doi=10.1.1.179.491&rep=rep1&type=pdf.

2.1.2 Research on the application of smart classrooms in teaching and learning

In terms of pedagogical applications, this study reviewed a large amount of domestic and international literature, mainly focusing on teaching interactions and models. The author combs through the relevant literature and divides the literature on smart classrooms in education and teaching into research on smart classrooms and teaching interactions, research on smart classrooms and teaching models, and research related to smart classrooms and investment in learning.

1) Smart Classroom + Interactive Teaching

Compared to traditional classrooms, (Tiburcio & Finch, 2015) found through classroom observations, questionnaires and interviews that smart classrooms

facilitate curiosity and excitement among students. The flexibility of the classroom facilitated collaborative inquiry or independent learning activities, as well as classroom engagement.(Lim, 2004) Using the idea of quasi experimental research, this paper analyzes the natural environment of the intelligent classroom and the traditional classroom for the fifth grade students, but applies the Flemish interactive communication analysis to structurally analyze the different natural environment between teachers and students in the classroom, and finds that the intelligent classroom is more harmful to classroom teaching than the traditional classroom. The intelligent interactive communication in the classroom briefly describes the intelligent classroom using human-computer interaction technology (Diaz León, Hincapié Montoya, Guirales Arredondo, & Moreno López, 2016) analysed the design of the smart classroom detail the design and development of a smart classroom interaction system that uses various interaction technologies (gesture-based, interactive interfaces and gestural touch) to engage with the content of the smart classroom. Al-Qirim (2011), discuss the use of interactive whiteboard technology (IWBT) for classroom teaching and learning in the smart classroom. They argue that the technological tools in smart classrooms provide a variety of support for teachers' teaching, facilitate interactive classroom behaviors, guide students to learn to think and explore independently, and allow teachers to give timely feedback to students.

The results found that student classroom interactions were richer, students were more active, and learning engagement was higher in the smart classroom environment. Zhang et al. (2017) used a quasi-experimental approach to compare traditional multimedia classroom teaching behaviours with those of the smart classroom by combining the features of the Flanders Interaction Analysis System for improving the smart classroom environment. Based on the literature review, Wang, Huang and Wang (2016) developed the Smart Classroom Observation Classroom Interaction Tool (CI0SM) to record and analyse smart classroom teaching interaction behaviours, using primary and secondary school students as research subjects for the

survey. The study found that while the smart environment could improve the frequency and quality of teaching interactions, the interactive whiteboard did not achieve the expected results the personal behavior and the whole process of teaching in the natural environment of intelligent classroom. Assuming that the subjects of interactive communication in intelligent classroom are teachers and learners, he studied the relationship between deep interactive communication and deep learning training from several perspectives, and built an entity model of deep interactive communication in teaching according to the characteristics of intelligent classroom. Zhang et al. (2017) studied the interaction technology tools in the smart classroom environment, as well as the forms of teaching interaction. They divided classroom interaction tools into three levels: software, hardware and teaching platforms, and introduced the application, teaching and learning methods of the three interaction tools. Weidong, Xindong and Jiping (2001) explored the role of smart classroom teachers and students in classroom interaction and analysed the effects, using classroom observations and questionnaires, as well as qualitative and quantitative research. The results show that teacher-student interaction in English classrooms in the smart classroom environment is effective and can solve some of the problems in traditional classroom teaching interaction.

2) Smart Classroom and Teaching Model

The smart classroom can be described as an advanced form of the traditional multimedia classroom in terms of technical equipment, providing more powerful and richer technical support. According to relevant research, the traditional multimedia classroom teaching model has become increasingly unable to adapt to the current stage of smart classroom teaching needs, so more and more researchers have begun to focus on the teaching model in the smart classroom environment. Based on the original teaching model, some scholars have carried out reforms and innovations to establish a new teaching model that is adapted to the quality of teaching and students' needs in the smart classroom environment. Language learners prefer digital

devices such as computers, smartphones, tablets and PCs to textbooks and lectures. Therefore, there is a need to find an alternative teaching tool that can meet the needs of learners (Unggyoung, 2019).

Tissenbaum and Slotta (2019), an expatriate scholar at the University of Toronto, conducted experiments with smart and traditional classrooms and proposed a knowledge community model of teaching and learning. (Tissenbaum & Slotta., 2019) argue that they propose a collaborative learning-based teaching model where teachers facilitate the occurrence of interactions between students by conducting teaching activities to achieve learning goals through collaboration. Researchers at Durham University, UK, proposed an integrated interactive smart desk system based on problem solving, active sharing and classroom creativity. Scott (2009) argues that the technological features of smart classrooms can assist teachers in managing the classroom, assessing student learning and providing timely feedback. Collaborative learning environments can be built on this foundation. Collaborative learning is the integration of announced learning training and informal learning training on this basis. SACI can have a good understanding of students according to the information formed by their service platform. In order to make better use of this information, SACI must apply the learning and training analysis (LA) method to identify the students' different self-study abilities, so as to provide them with necessary specific guidance to enhance their working abilities.

Foreign experts and scholars have also carried out a lot of scientific research on intelligent classroom teaching mode, which reflects the subjectivity, cooperation, adaptability and interaction of teaching activities in the natural environment of intelligent classroom teaching. Hu (2009) and others put forward a variety of classroom teaching application methods suitable for intelligent classroom teaching based on the actual scientific research and characteristics of intelligent classroom teaching in various countries around the world and combined with actual classroom teaching cases, and encouraged learners to explore, share and other teaching methods

based on communication, interactive communication and other teaching methods. The purpose of applying La in SACI is to form professional knowledge about learners and learning environment. Their learning environment to master and improve the learning process and teaching environment proposed by SACI. La applies the data information of SACI to deeply understand its internal structure theme activity. Conclusion the index value is the same as the feedback to improve the teaching method proposed by SACI. In particular, the use of SACI allows assessment of learning processes and educational practices. Weidong et al. (2001) has established a very typical design style for future classroom application from seven aspects: theoretical basis, model definition, overall objective and structure of entity model, correctly guiding teachers to master teaching strategy design scheme in the natural environment of intelligent classroom teaching, so as to promote. Remote control comprehensive learning training and the development trend of learners. (Kuo, Tseng, & Yang, 2019) scientifically studied the application of cloud computing technology in classroom teaching, put forward a proposal to improve the traditional teaching method, and put forward a basic construction method in the intelligent classroom based on cloud computing technology and Internet of things technology. Based on the previous study, Kuo et al. (2019) created and proposed four learning models: creative learning, group collaboration, portal learning, and independent self-help. Liu (2018) analysed the specific connotations and core features of the smart classroom in the new era using information technology such as cloud computing and big data, and combined the Internet thinking model to propose a teaching model that includes three stages and ten steps before, during and after class. Zhang et al. (2017) proposed an assessment-based APT teaching model and found that the APT teaching model could improve the smart classroom environment metacognitive level and research ability of university students under the smart classroom environment.

3) Smart Classroom + Learning Engagement

There is relatively little research on student learning engagement in smart classrooms in both the U.S. and internationally. Kim (2019) proposed using infrared thermography to portray a student engagement measurement model to measure student engagement using an algorithm for student engagement in smart classrooms. Through video analysis, learning investment was categorised into positive and negative learning investment, and the specifics of positive and negative learning investment of primary school students in the smart classroom environment were explored in scale presentations and interviews according to Liu (2018) conducted a comparative study using a quasi-experimental research method through a field survey of smart classroom teaching, combined with the design theory of smart classroom environment, and concluded that students' learning and self-efficacy were more significant and learning investment and self-efficacy were more significant when cooperative learning was taught in a smart classroom. Zhang et al. (2019) used a single-group pre- and post-test of the smart classroom to study the influence mechanism of college students' investment in smart learning from three perspectives: students themselves, teachers and peers, and the smart learning environment, and then used multiple regression methods to analyze the influence of each influencing factor on each dimension of learning investment.

2.1.3 Summary of the review of the Smart Classroom study

By classifying and summarising the literature on smart classrooms at home and abroad, we can find that research on smart classrooms has received widespread attention both at home and abroad. While foreign research has focused on the overall design, software and hardware configuration of smart classrooms, domestic research has focused more on the research and practical use of smart classrooms. Smart classrooms provide students with a wide and diverse range of teaching tools, as well as a flexible and enjoyable learning environment, changing traditional teaching outcomes and offering the possibility of reform. According to the literature, most

studies have focused on the design and configuration of the smart classroom environment or analysed the teaching behaviour of smart classroom teachers at the teacher level, while paying less attention to the subjects of the learning process and less attention to the learners themselves. This study adds to the research on smart classrooms by taking university students in smart classrooms as the research object.

2.2 Research on Learning Engagement

Domestic research on investment in learning is more recent than outside research and has been imported from abroad. With the development of theories of educational quality evaluation at home and abroad, and the popularity of surveys of college students' investment in learning, measurement tools and influencing factors have received increasing attention. With educators looking for ways to enhance learner participation, some people expect that blended learning - the thoughtful integration of zero distance and online teaching can enable college students to participate in learning more comprehensively (Aspden & Helm, 2004; Graham & Robinson, 2007). Blended learning does not have a single architecture (discussed below), but it has some functions and features. They are likely to include harmony and personalization improved according to the diversity of learning styles (Horn & Stack, 2015); Expand communication opportunities (zero distance and online, synchronous and asynchronous; means, Toyama, Alison and Bucky, 2013); Technical advantages (timely feedback, online tracking of data information, etc.), but also technical difficulties at the level of variability (Azevedo & Bernard, 1995; Picciano, 2014; Shute, 2008); Maintain human nature and spontaneity in the zero distance teaching class; Improved learning duration and teaching resources (Means, Toyama, Murphy, & Baki, 2013). Blended learning can improve thinking ability according to thinking and critical thinking sentences (Garrison & Kanuka, 2004; Nytrand & Gamoran, 1991); According to the learning method of marketing promotion, the organization participates (Reeve & Tseng, 2011); And their emotional participation in

blended learning based on zero distance communication, although this concept needs further research. Nelson, Laird and Kuh (2005) found that according to the survey conducted by students all over the country (NSSE), there is a strong positive correlation between the use of information technology for the purpose of culture and art education and the participation index.

2.2.1 Research on Theory

Overseas research on learning engagement started earlier according to Newmann (1992), learning engagement refers to the effort made in the learning process, including learning knowledge and acquiring skills according to Astin (1999), learning engagement is an important indicator of the quality and effectiveness of learning. He proposed a student engagement theory, which considers learning engagement as an active participation, mainly in various campus activities, learning objectives and teacher-student relationships. Schaufeli, Salanova, Gonzalez-Roma, & Bakker. (2002) extended the definition of learning engagement from work, where learning engagement is a positive, active and continuous state. Fredricks, Blumenfeld and Paris (2004) defined learning engagement in terms of three emotional, cognitive and behavioural dimensions to define learning engagement as a multidimensional concept. Behavioural engagement refers to students' behavioural involvement in learning-related activities. Cognitive ability participation refers to the cognitive strategies adopted by students in the teaching process. Emotional capital investment refers to students' active emotional expression of learning and training themselves and learning tasks. Later, Kuh (2009) further added to the concept of learning engagement by incorporating school support into the concept of learning engagement, arguing that student behaviour and the school environment are mutually influential. Research on learning engagement in China is more recent than abroad. At present, China's research on the definition of learning engagement is mainly transplanted and developed on the basis of the introduction of foreign learning engagement. Kong (2003) collected data on students' participation in classroom learning through questionnaires and classroom

observation records. Based on Baggers' 3P model, he studied the impact of students' classroom engagement on learning outcomes and found that comprehensive behavioural, affective and cognitive engagement was needed to promote learners' overall development. Su, Zhang and Zhu (2007) define learning engagement in terms of three aspects: financial commitment, time commitment and mental commitment. Learning engagement is an important indicator of the positive aspects of learners' learning psychology (creativity, optimism, sense of meaning, etc.), learning engagement is an emotional state of learners in the learning process that is active and continuous. There are some obstacles to scientific research participation in the mixed natural environment, including the dynamics and evolution of the definition of mixed learning, the lack of specificity of the definition of learner participation, and the confusion between the promoters and the values of participation indicators. The first obstacle is the nature of blended learning itself. At the most important level, blended learning includes zero distance classroom teaching and classroom teaching mediated by the application of new technologies (Graham, 2014). However, blended learning is a high-end professional term, which is usually defined by its surface characteristics (online and zero distance) rather than classroom teaching characteristics (Henrie, Halverson, & Graham, 2015). Some founders Laumakis, Graham, and Dziuban, 2009 and Norberg, Dziuban, and Moskal (2011) refer to this term as the overall goal of the boundary, which is sufficiently malleable to be included in local regulations and the limits of the selection party, but can also maintain the same identity (Star & Griesemer, 1989). For a long time, student participation has been regarded as a mysterious and all-round meta structure (Appleton, Christenson, & Furlong, 2008). It is the basic theory of participation of Astin (1999) and the pioneering work of Kahu (2013) and Kahu and Nelson (2018), such as the social and cultural integration of participation, this affects ongoing conversations about participatory characteristics and discussions (e.g., Boekaerts, 2016; Eccles, 2016). Participation is often confused with motivation. Motivation is regarded as the heat of antecedents and the method of support (Lim,

2004; Reschly & Christenson, 2012). The concept of participation is. The time, energy and effort level of students in their learning community can be observed according to the behavior, thinking ability or mentality index of all the total output in the continuum. It has suffered a series of structural and internal structural damages, including the complex interaction of relevance, learning theme activities and learning ecological environment. The higher the participation value, in the learning and training community of many people, and authorized students are more likely to correctly guide this kind of kinetic energy to learning again, and then come up with a series of short-term and long-term conclusions, so as to further promote participation (Bond, Buntins, Bedenlier, Zawacki-Richter, & Kerres, 2019) for educators and scientific researchers, the definition of student participation has become a mystery. They once again explore its type and diversity, and accuse the height, depth and breadth of modern theory and practical operation in empirical analysis (for example, Kahn, 2014; Zepke, 2018). The effectiveness of electronic information technology in harming students' participation is a particularly popular industry, because it has become a core feature of students' cultural and educational feelings (Henderson, Selwyn, & Aston, 2017; Selwyn, 2016). People have a deeper understanding of the requirements of data information infiltration and ICT professional skills (Organisation for Economic Cooperation and Development, 2015; Redecker, 2017). There is also evidence that technology can improve self-efficacy, self-discipline and participate in more general educational communities (Alioon & Delialioğlu, 2019; Junco, 2012)

However, there is a lack of innovative theory in the field of culture, art and educational technology (Antonenko, 2015; Karabulut-Ilgu, Jaramillo Cherrez, & Jahren, 2018), and the practical operation and understanding of students' participation is a unique problem (Henrie et al., 2015). Some people feel depressed about the lack of picture quality, while others see the operational flexibility of practical operation, allowing artists to adjust their own definitions to maximize their own development prospects, while responding to a new generation of students (Moskal, Dziuban, &

Hartman, 2013). Therefore, participation and effective composition can involve the teaching classroom composition of more than 100 possible human and technical intermediaries, which is neither unilateral design nor unilateral implementation. Traditionally, student participation refers to the meaning of students' participation in institutional committees and their active participation in classroom teaching. Teaching activities can be considered by the type of learning outcomes (Kuh & Hu, 2001; Coates, 2006).

2.2.2 A study of the factors that influence learning inputs

Thanks to the efforts of scholars over the years, research related to investment in learning has become increasingly rich and enriched. Relevant studies at home and abroad have become increasingly mature, and scholars have studied the influencing factors from multiple levels and perspectives. The author has combed through a large amount of relevant literature and found that foreign research on the factors affecting investment in learning can be divided into two categories: internal influences and external influences. External factors include the school environment (institutional development, learning environment, interpersonal relationships, teachers' teaching ability, classroom atmosphere, teacher-student relationships, etc.) and social support. Internal factors include students' personal background (gender, age, family background, etc.) and personality traits (self-efficacy, motivation, interest in learning, attitude towards learning, learning pressure, values, etc.). (education funds, awards, grants, etc.).

1) Intrinsic factors

In terms of internal factors, foreign scholars Lee and Smith (1995) used more than 10,000 high school students to investigate the effects of structural adjustment on students' academic investment and achievement and social distribution. The results showed that students with high learning investment had relatively high economic status and family background. Murtaugh, Burns and Schuster. (2019) found that high school students' academic achievement and investment would have a

favorable impact on their level of learning investment that teachers' teaching level, topics, learning tasks and teaching assessments, all have an impact on learners' learning investment levels. In China, the factors that influence learning investment are being studied the career engagement and burnout of over 300 university students using the Learning Engagement Scale and the Burnout Scale. Burnout had an impact on students' learning engagement, with the former having a better impact and the latter having the opposite impact.

2) External factors

Chickering and Gamson (2006) highlighted seven principles for improving undergraduate education, urging teachers to use positive teaching techniques for teacher-student interaction, to foster collaboration and communication among students, and to provide timely feedback to students in order to improve the quality of teaching and learning and the level of student investment in learning. The relationship between teacher behaviour and student investment in learning relationship and found that by using collaborative learning, independent inquiry, and positive interaction with students at the learning level, teachers' performance in the classroom can influence students' classroom engagement. Investigated the influential elements of learning investment in China and found that whether students are interested in the learning materials, whether they enjoy their major and non-learning activities affect their learning investment. Gill (2020) argued that teacher characteristics (teachers' teaching skills, choice and implementation of teaching methods, teaching attitudes, etc.) may influence students' investment in classroom learning. Students' readiness for school, professional recognition, and attitudes towards learning may have an impact on their investment in learning.

2.2.3 Classification studies of learning engagement

Schaufeli et al. (2002) developed the Learning Engagement Scale (UWES) on the basis of the Work Engagement Scale (UWES). Combining relevant interview data, they concluded that learning engagement includes three characteristics:

dedication, energy and concentration Based on previous research, NSS developed the Learning Engagement Scale for secondary school students in three dimensions: emotional engagement, cognitive engagement and behavioural engagement Valeski & Stipek (2001) combined classroom observation of student reports and teacher scoring methods to A detailed study was conducted. Good scientific research has been made in the classroom teaching and organizational aspects of the classroom environment.

Good scientific research has been carried out at the institutional level of classroom teaching and classroom natural environment, including teachers' ability to stimulate high-end thinking (Zohar & Dori, 2003). Connect and integrate the prior knowledge in learning and training (Vermette et al., 2001), and set the basic parameters of behavior in the classroom (Emmer & Stough, 2001). Third, a key aspect of group cooperative learning is the third. A major aspect of group cooperative learning involves teachers' ability to create a classroom atmosphere of emotional integration (Battistich, Schaps, & Wilson, 2004; Solomon, Battistich, Watson, Schaps, & Lewis, 2000). The eco-friendly digital model of children's music education believes that the interaction quality between children and the elements in the near natural environment of children will endanger the development trend of children's music education. (Bronfenbrenner, 1977; Bronfenbrenner & Morris, 1998) classroom is an important micro natural environment for group cooperative learning. The quality of social and economic development and emotional communication and communication in the classroom the quality of social and economic development and emotional communication and communication in the classroom - the interaction and communication between students and teachers (such as the consciousness of teachers, partners and their college students) - create an emotional atmosphere in the classroom (Daniels & Shumow, 2003; Ryan & Patrick, 2001). The results of scientific research show that the reliability and validity of the learning and training investment scale in China are excellent, and others think that the survey and Evaluation Scale (NSSE) for students' class capital investment across the country plays an important role in China's

current higher education evaluation system and is a locally appropriate NSS-China scale revised on the basis of the development of a questionnaire that includes five indicators. Level of active and collaborative learning, level of rig our, level of educational experience, level of teacher-student interaction and support from the campus environment. A survey of 1200 questionnaires was sent to six universities. The results indicated that the Chinese-language NSSE-China instrument has good reliability and validity for use in survey research Li and Huang (2010) also revised Schaufeli's Learning Engagement Scale (UWES-S) and conducted a study with a random sample of university students. The study showed that the higher the score on the scale, the better the learners' academic performance. Based on the NSSE-China 2009, survey data, reconstructed the scale structure, constructed the five-dimensional structure into a three-dimensional structure according to cognitive and affective behaviour, analysed the influence of influencing factors on learning engagement, and found that college students' learning engagement could be divided into three cognitive and affective dimensions, and the three dimensions influenced each other. Cognitive, emotional, and behavioral participation are three broad levels of learner participation (Fredricks et al., 2004; Fredricks, Filsecker, & Lawson, 2016). Cognitive involvement is related to deep-seated neural networks, self-regulation and understanding.

Cognitive capital investment is related to deep neural network, self-regulation and understanding; Emotional typing is related to the students' active response to the exercise. Employee engagement is related to strong support for the learning environment, partners and teachers. Emotional capital investment is related to the active response to the learning environment, partners and teachers, as well as their trust and interests.

2.2.4 Summary of the review of research inputs

As evidenced by a large body of literature, scholars at home and abroad have deepened their understanding of learning investment through years of research, including both theoretical constructs and analysis of relevant concepts in qualitative

studies, as well as the development of learning investment measurement tools, status surveys, analysis of influencing factors, and quantitative studies. The research is fruitful because we have understood the theoretical underpinnings of learning investment and developed a measurement tool for learning investment. The study draws on previous research findings, summarises practical experience in conjunction with the tutor's recommendations, and analyses and validates internal (self-efficacy, technology acceptance, motivation to learn) and external (teacher factors, interactive behaviour, environmental factors) influences.

2.3 Constructing a Theoretical Model

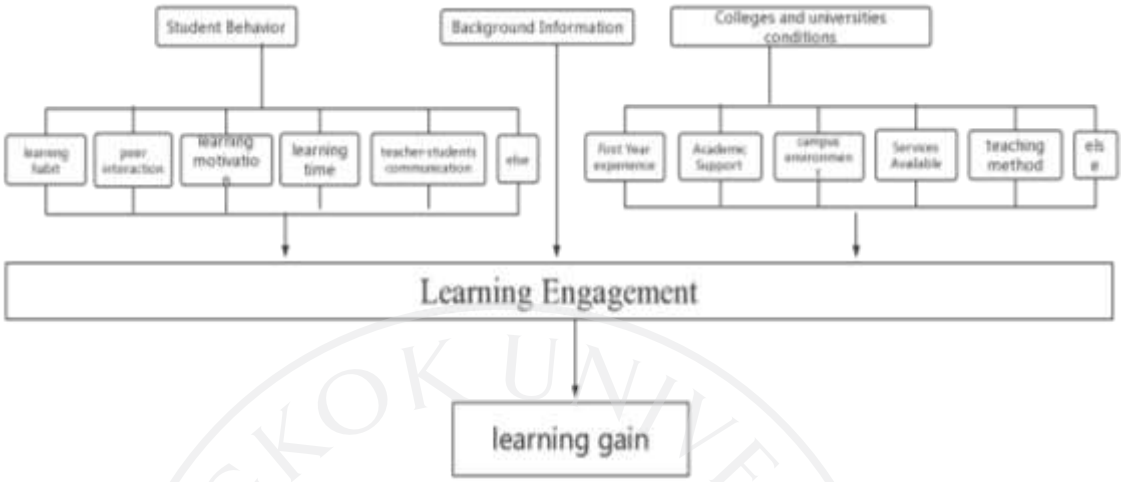
The theoretical model of influencing factors in the smart classroom environment is based on a literature review and related theories. Using learning investment theory and triadic interaction determinism, the influence of learning investment and self-efficacy, technology acceptance, learning motivation, teacher factors, interaction behaviour and environmental factors are constructed.

2.3.1 Theoretical concepts

1) George D. Kuh 's theory of learning Engagement

Measuring investment in learning should include two aspects: student investment in teaching and learning activities and school support, where teaching and learning activities include both classroom and extra-curricular school activities. Kuh (2009) argues that the more time and CV students spend in the classroom and outside the classroom, the greater their investment, knowledge and scope for development; the more resources, activities and students, the greater the learning outcomes; and the more resources, activities and students, the greater the learning outcomes. The theory provides NSEE with the teacher's teaching process, school support and school environment, teacher-student interaction, learning process and student-student interaction. The structure of the theory is shown in Figure 2.4.

Figure 2.4: Illustration of George D. Kuh's Learning Engagement Theory



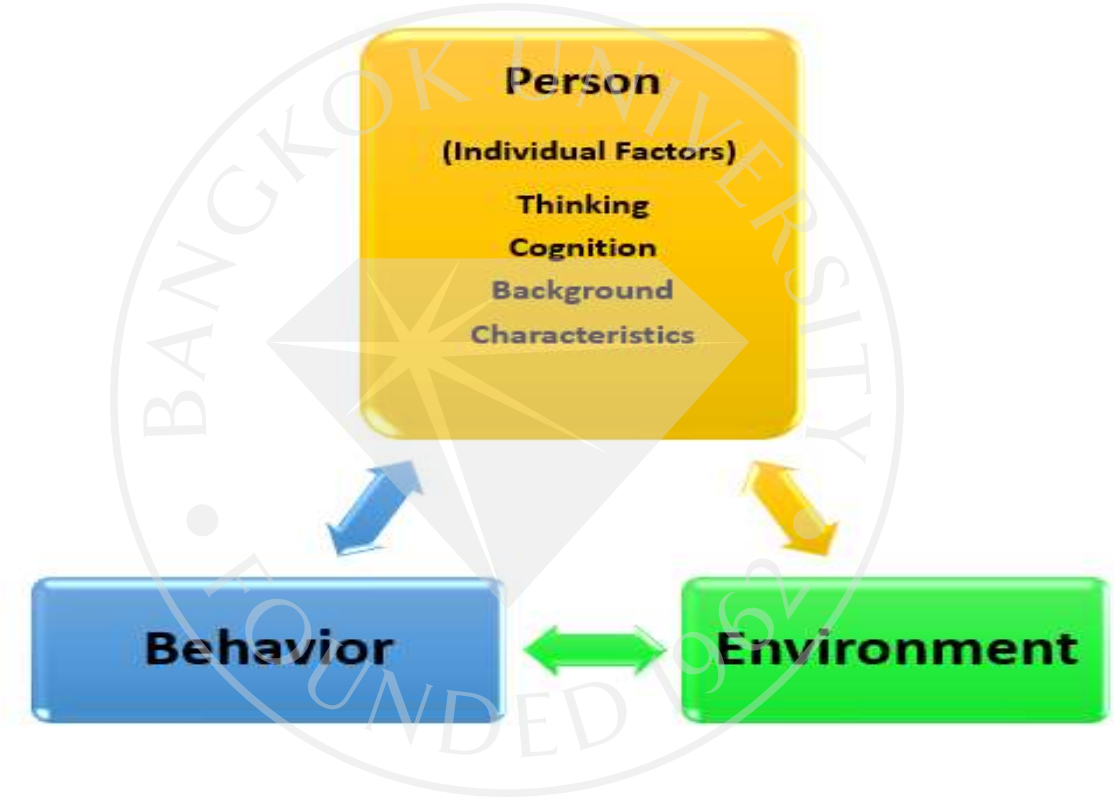
Source: Kuh, G. D. (2009). What student affairs professionals need to know about student engagement. *Journal of College Student Development, 50*(6), 683–704.

2) The theory of triadic interaction decision making

In the 1960s, Bandura wrote Social Learning Theory, which included a triadic theory of interactive decision making. He argued that there are three factors that determine the process of behavioural acquisition: the individual (person), the behaviour (behaviour) and the percentage of the environment (setting). Individual factors include mainly internal characteristics such as the individual's background, characteristics, thinking and cognition; behaviour refers to the individual's observable reflections of actions, external manifestations, specific activities, etc.; and environment refers to the external environment that influences the individual's behaviour through individual factors. Individual factors affect individual behaviour, and behaviour in turn affects individuals, and the necessary environment is in this process, the three are closely related and mutually causal. According to Bandura, the triadic interaction theory is the result of the interaction and influence of internal

(individual factors), behaviour and environment, individual factors affect individual behaviour, and behaviour in turn affects individuals, and the necessary environment is in this process, the three are closely related to each other as cause and effect. See Figure 2.5.

Figure 2.5: Bandura's Trinity Model of Interactive Determinism



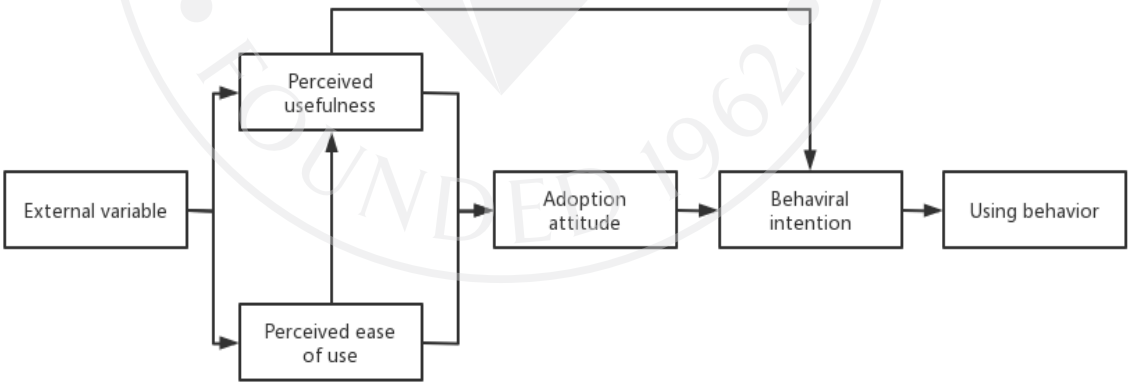
2.3.2 The impact of various influences on learning participation

Self-efficacy, technical acceptability, learning motivation, teachers' independent variables, interactive communication personal behavior and environmental factors are the six influencing factors of this analysis. This part combs and tests the data on the influencing factors of relevant learning and training investment, in order to provide theoretical significance and reference for the formulation of the entity model of influencing factors.

1) Self-efficacy

When faced with obstacles and aversions, Bandura argues that self-efficacy expectations determine whether to initiate a response, how much effort is required, and how long it will last. According to the review of the study, the results for self-efficacy and learning engagement were almost identical. Researchers have concluded that self-efficacy has a good influence on learning engagement. Foreign researchers have concluded that there is a considerable positive correlation between organisational self-efficacy and learning engagement self-efficacy can motivate individuals to engage in positive behaviours, such as learning engagement percentage domestic findings. Liao and Huang (2009) found through his study that academic self-efficacy had a beneficial effect on learning investment: the more confident learners were in completing assignments, the higher their level of learning investment.

Figure 2.6: Technology Acceptance Model



Source: Davis, F. (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340.

2) Acceptance of new technologies

Davis (1989) proposed the TAM (Technology Acceptance Model). It

allows for the assessment of the acceptability of information technology. The model is frequently utilized in the field of education and has a high degree of reliability. Perceived usefulness refers to learners' subjective perceptions of the performance of technology in an intelligent classroom environment to improve their learning efficiency and effectiveness, while perceived ease of use refers to learners' subjective perceptions of their efforts to use the intelligent classroom environment. Using structural equation modeling, investigated the relationship between learner technology and learning efficiency and approach and found that learning efficiency influenced perceived ease of use. Using structural equation modeling, investigated the relationship between students' learning technology goals, learning efficiency and learning methods, and found that learning efficiency would endanger the usability and usefulness of technology. Potential problems can be mitigated according to the adopted technology (Shepherd & Hannafin, 2011) or the existence of a continuously excellent team for technology application (Levin, Whitsett, & Wood, 2013). Sufficient and clear indication of how the technology will be used. Describe how to use technology (Lim, 2004; Peck, 2012; Salaber, 2014), including ICT that cares about students' autonomous learning (Sumuer, 2018), and why ICT should be used in unique courses. Courses (Cakir, 2013; Northey, Bucic, Chylinski, & Govind, 2015) also help ensure the participation of students. It should be considered that students should be asked to choose which technology to adopt (Martin & Bolliger, 2018), because understanding can eliminate the problem of insufficient self-confidence in technology (Northey, Govind, Bucic, Chylinski, Dolan, & Van Esch, 2018).

3) Academic motivation

Learning engagement is related to internal structural reasons such as motivation and self-efficacy, both of which can have a positive impact on learning engagement. According to the survey of 519 students, (Wang et al., 2016), it is found that the learning motivation of college students has a significant impact on learning engagement. Weidong et al. (2014) developed and designed a theoretical model based

on the intermediary company elements of IP0 and learning input. He found that the learning motivation of college students has an impact on their learning project investment and profits, the effect of internal structure learning motivation is more obvious, and the impact of external learning motivation is less. The structural equation model analysis was carried out by using the national questionnaire on graduate learning and work experience. It is found that learning motivation has a negative impact on learners' learning supply at the same time. Learning motivation will affect students' learning attitude and satisfaction rate. Then, in the questionnaire for international students, that learners' motivation immediately affects students' personal behavior participation, thus affecting students' learning supply; Environmental elements are divided into teaching environment, learning natural environment and natural environment related to social development. Environmental impact can immediately affect learners' learning, digestion and absorption, and can also indirectly affect learners' learning, digestion and absorption according to their learning intention. The concept of "motivation" is based on the definition of "motivation". The concept of "learning and learning training motivation" is based on the definition of learning motivation. One of the basic principles of rational teaching is to shape students' motivation (Bransford, Brown, & Cocking, 2000). Many studies have shown that the level of motivation of students is directly proportional to the level of academic performance (Uguroglu & Walberg, 1979; Walberg, 1984). In the traditional teaching method, teachers can choose a variety of strategies and training methods to shape and maintain students' learning and practice motivation based on zero distance interaction. However, there is time difference between students and teachers when using the online platform. In many cases, students are unlikely to receive appropriate supervision and incentives. Under such circumstances, it is crucial to find new strategies to motivate students.

4) Teacher influence

In the smart classroom, the teacher element is mainly related to the ability of the instructor to apply information technology and the level of teaching. According to classroom teaching is the main channel through which students invest in academic activities, and teachers should actively assist students to invest in learning through teaching activities and other means (Perry, Turner, & Meyer, 2006). The way teachers structure learning activities has an impact on learning engagement, including the way students perform tasks, the content of tasks, and the authenticity of tasks. The participation of students will also lead to a more valued and collaborative method: students master teachers' workload, enthusiasm and work.

Students' views on Teachers' workload, enthusiasm and professional skills. On the other hand, teachers realize that students are advocates of stronger cultural education feelings and effects made scientific research on the investment in classroom teaching, learning and training of college students, which revealed that teachers' teaching level, teaching methods, and teaching attitudes affect learners' classroom learning engagement. According to teachers' teaching activities and teaching behaviours are key factors in determining learning investment.

5) Interaction behavior

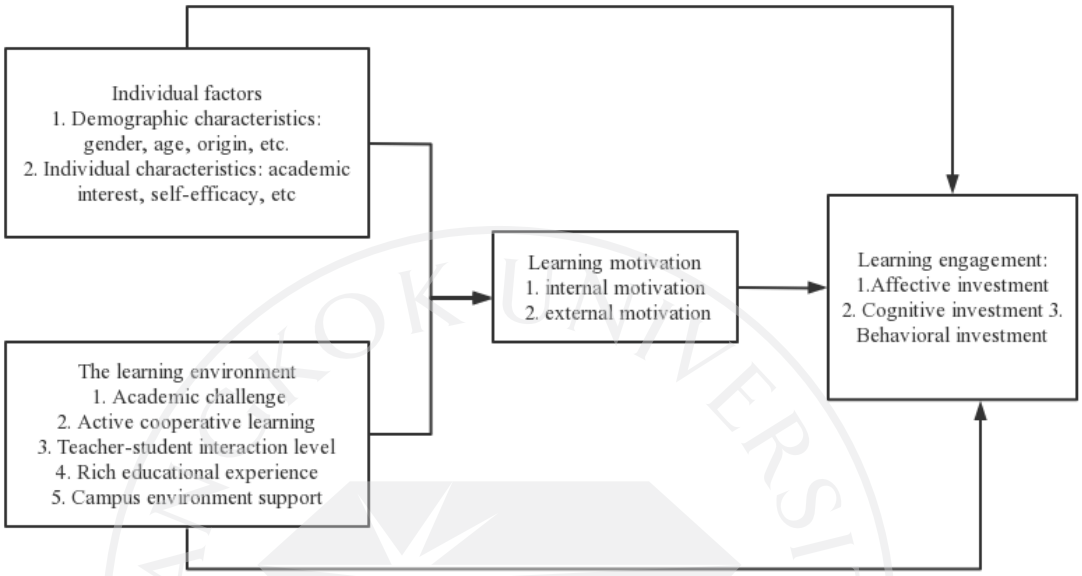
Cooperative learning and students' interactive communication are the expression forms of intelligent classroom teaching interactive communication. Participating in course management helps to understand the (basic theory) environment and course structure. This inspires adequate learning and training, gives insight into the organizational structure, and helps to develop self and professional skills that tend to be common, such as teamwork. This will stimulate sufficient understanding and learning training, in-depth understanding of the organizational structure, help create common self and professional skills, such as teamwork, leadership and critical thinking, and help create interpersonal networks (Anderson, 2006; Lizzio & Wilson 2009; Carey, 2013). Student-faculty interaction had a

significant impact on learning engagement and that positive student-faculty interaction could beneficially increase learning engagement. Using Astin's (1999) input theory, Pace's quality of effort, and Kuhn's learning engagement as a theoretical basis, classroom interaction had an impact on learning engagement using the NSSE survey method.

6) Environmental factors

The hardware and software environments in smart classrooms are referred to as environmental elements. The relevant learning investment literature and developed a conceptual model of the influencing elements, which was then validated and refined. Finally, The results of scientific research show that the natural learning environment has a great impact on learning project investment and personal behavior and emotional investment. It is found that both family atmosphere and school environment will affect learning investment, among which school environment has a greater impact. The NSSE-china questionnaire survey was used to define the definition of learning input and verify the three-dimensional structure of learning input. See Figure 2.7.

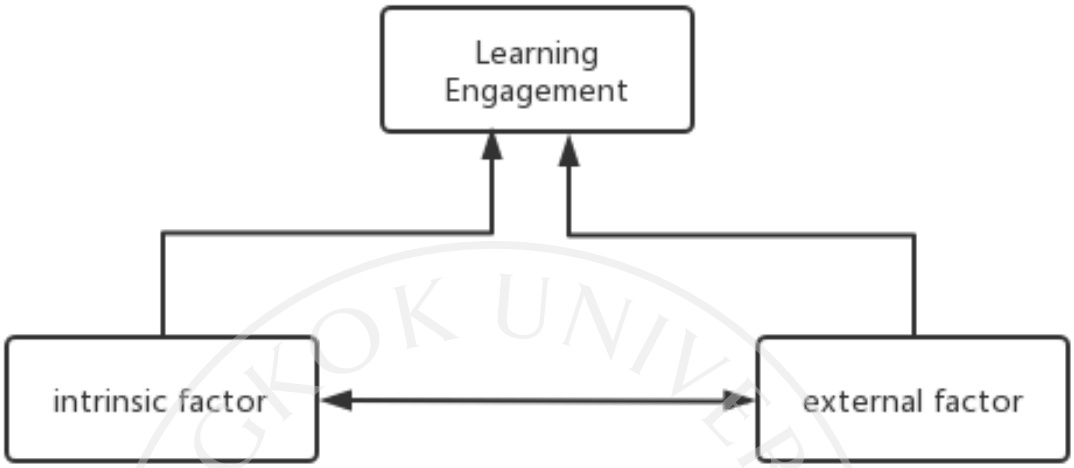
Figure 2.7: Conceptual Model of the Relationship between Various Factors and Motivation and Engagement in Learning



2.4 Model Construction of Factors Influencing Learning Engagement

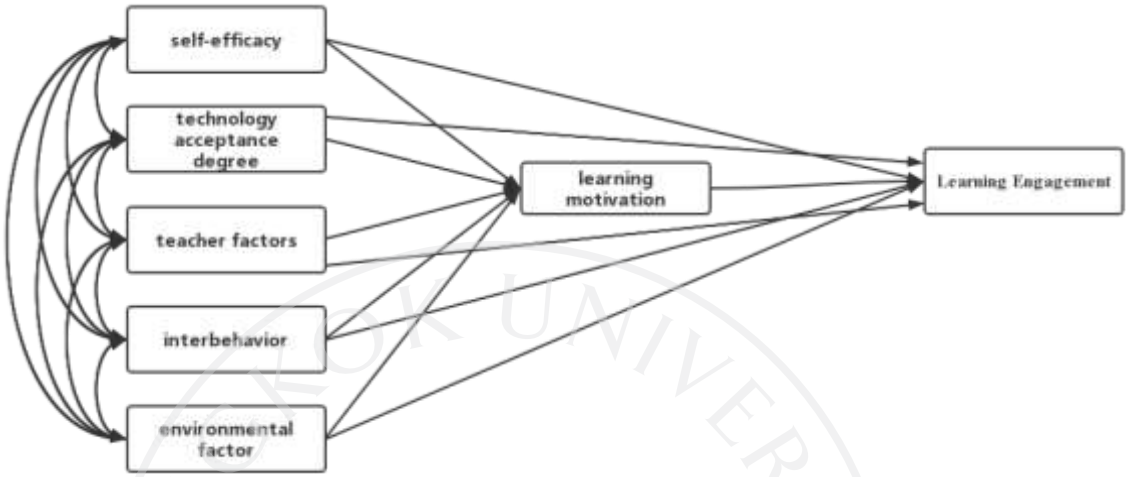
This study takes the learning participation behaviour of university students as the research object, and explores the main factors that influence the specific situation of university students' learning participation in the smart classroom and their interactions The triadic mutual determinism, the intelligent input factors that influence the classroom environment of university students can be roughly divided into the intrinsic individual variables and the external environment. Combined with the analysis of the six factors mentioned above, the intrinsic individual variables include self-efficacy technology acceptance and learning motivation, and the external environment variables include teacher factor interaction and the environment based on the above theory, a model of the influence of internal and external factors on learning engagement can be obtained, as shown in Figure 2.8.

Figure 2.8: Extended Model of Factors Influencing University Students' Learning Engagement in a Smart Classroom Environment



The model suggests that internal factors (self-efficacy technology acceptance and motivation to learn) and external factors (teacher factors interaction and ring) jointly influence and are put into practice in learning On the basis of the extended model, combined with influence factor six, and based on the above analysis of relevant literature, the preliminary influence of college students' learning engagement in the smart classroom environment constructed in this study factor model is as follows.

Figure 2.9: Theoretical Model of Factors Influencing University Students' Learning Engagement in a Smart Classroom Environment



The model shows that six factors - self-efficacy, technology acceptance, motivation, teacher factors, interactive behaviour and environmental factors - can directly influence learning engagement, while five factors - self-efficacy, technology acceptance, teacher factors, interactive behaviour and environmental factors - can indirectly influence learning engagement by affecting motivation, and that these five factors interact with each other.

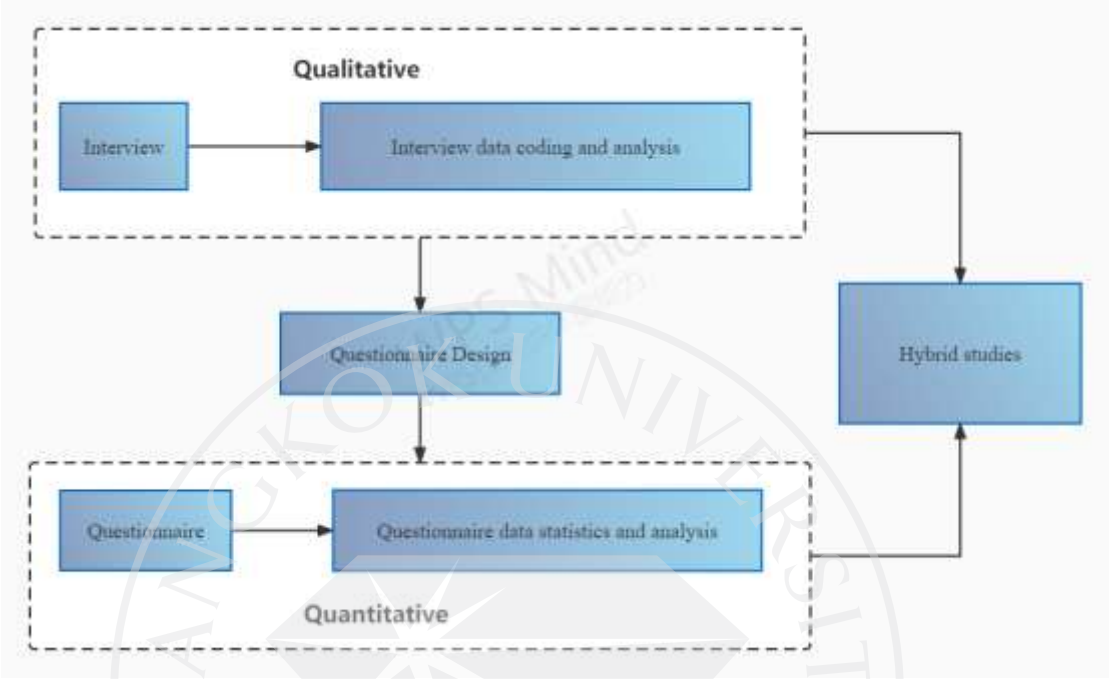
CHAPTER 3
SCIENTIFIC METHODOLOGY

This chapter describes the ideas of descriptive analysis. The second part describes the whole process of exploratory mixed design. The third part describes the overall situation of the respondents from both quantitative and qualitative aspects. The specific contents of the table of contents in the following chapters describe the development design, design scheme and quality of common tools.

3.1 Study Design

This paper discusses the use of literature, case analysis, and the combination of qualitative and quantitative research. Figure 3.1 describes the research process of the exploratory hybrid approach. First of all, master the training fund investment and influencing factors of college students in the natural environment of intelligent classroom teaching according to qualitative scientific research, then analyze the situation in qualitative discussion according to quantitative research, and finally draw a conclusion by integrating the data information of qualitative and qualitative analysis.

Figure 3.1: Research Process of the Explorative Mixed-method



1) Search for relevant literature through keywords. Search the Internet or academic journal networks for relevant literature using keywords related to the research topic, such as student engagement in the smart classroom, factors influencing student engagement, overall student learning engagement, and factors influencing student learning research literature.

2) Read the references collected in the article, and master the learning capital investment and influencing factors of college students in the natural environment of intelligent classroom.

3) Design interview questions. According to the conclusion of literature research, an interview questionnaire consisting of open-ended questions is designed.

4) Conduct interviews and collate data information. Take the students and teachers participating in the course content in the smart classroom as the sample version, and carry out zero distance interviews, recording and recording for these people.

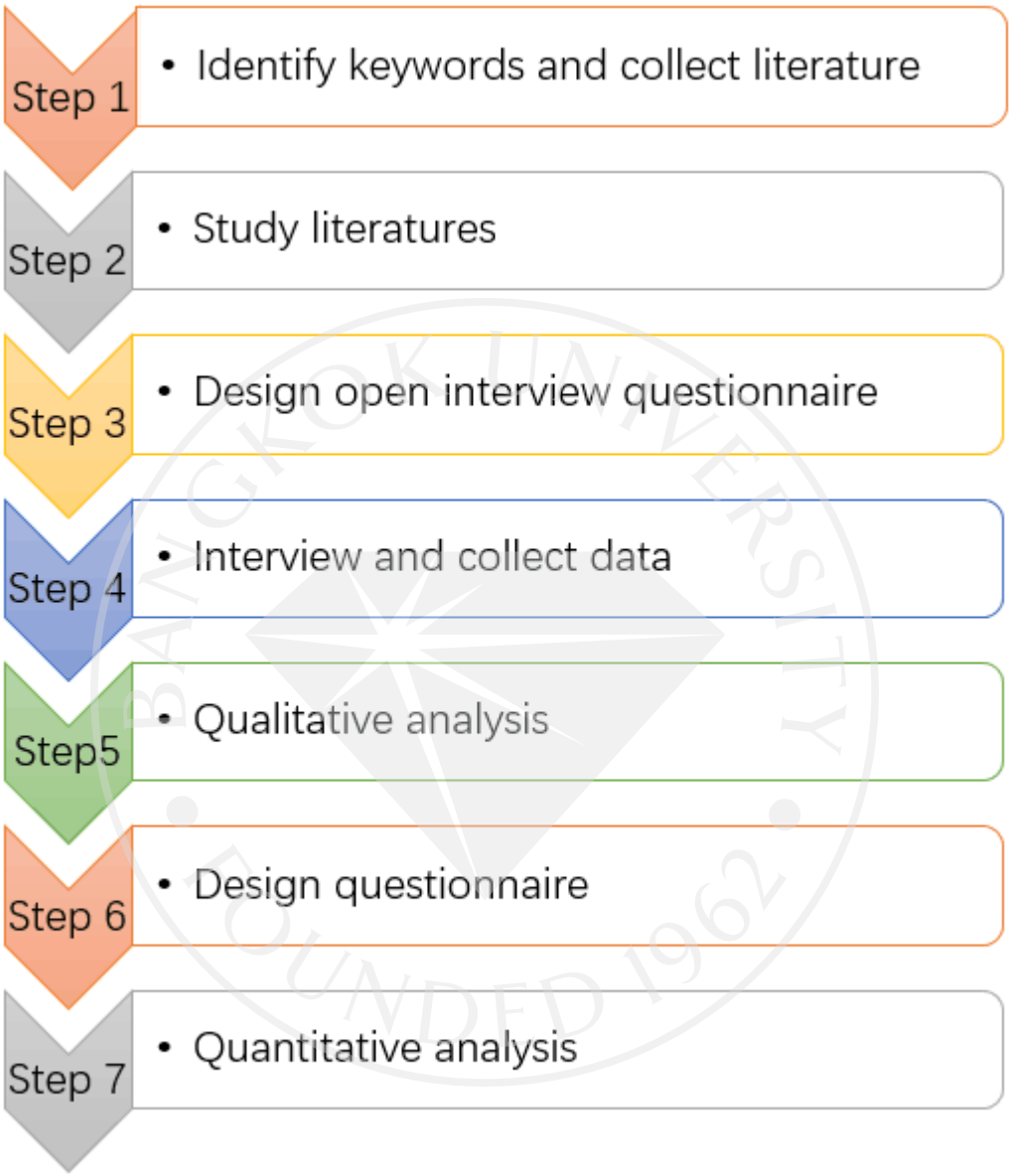
5) Qualitative research. Code and analyze the interview text to summarize and classify the respondents' opinions and suggestions on the overall participation of students in Baise University, and the elements that harm college students' participation in learning in the natural environment of intelligent classroom.

6) Design scheme questionnaire survey. According to the basic conceptual framework obtained from quantitative research, this paper defines the relevant independent variables and influencing factors of College Students' learning capital investment in the natural environment of intelligent classroom, and points out a large number of independent variables, that is, the independent innovation learning capital investment and influencing factors of contemporary college students in the natural environment of intelligent classroom, In the natural environment of intelligent classroom, the fund investment and influencing factors of contemporary college students' independent innovation learning are designed into a questionnaire survey used in quantitative research.

Quantitative analysis.

Questionnaires were administered and data were collected using the online survey software "Questionnaire Star", and the data were analysed using SPSS tools. The researcher designed a flow chart for this study based on the above steps Figure 3.2.

Figure 3.2: Study Process



3.2 Sampling

In this study, a mixed method of qualitative and quantitative research is used. The difference between mixed mode research and qualitative and quantitative research depends on the fact that mixed mode research attempts to combine qualitative and quantitative research approaches in a practical way to maximize the overall goal of the research.

3.3 Literature Research

According to the research topic of this study, the relevant literature can be retrieved on the Internet or academic journal Internet by using the keywords related to the research topic, such as the student participation in the smart classroom, the elements that endanger the student participation, the student overall learning and training participation, and the elements that endanger the child's learning. Then, the retrieved literature was analyzed in detail, and finally tried to summarize and classify the effects of each literature, which was used as the basis for the design of this research interview questionnaire. See Table 3.1 for the research conclusions of relevant literature, and see Annex A for the interview questionnaire designed in the early stage.

Table 3.1: Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
Cognitive input	Marton, F (1976)	On qualitative differences in learning: I. conclusion and process.	It was found that within each study, it was possible to identify a number of categories (outcome levels) that contained fundamentally different Corresponding differences in processing levels were described as whether learners were engaged in Corresponding differences in processing levels were described as whether learners were engaged in surface-level or deep-level processing.	1. If you were asked to classify the level of student understanding during a lesson, what would you say are the categories? Give your opinion on each category (e.g. superficial rote learning, deep self-study understanding, reliance on peer and teacher understanding, etc.)

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
	Biggs (1987)	Mastering the relevance of learning (ML) in English Teaching (a case study of Guilin University, Iran)	Mastery learning promotes the surface learners to make better quantitative English conclusions, but there are also risks. One of the specific objectives of learning and training is to improve the higher-end cognitive process	
	(Kong Qi Ping 2003)	Students' participation in mathematics teaching / mathematics education research is at the forefront	The student learning engagement rating scale is divided into three dimensions: emotional engagement, personal behavior engagement and cognitive engagement	

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
Emotional engagement	Connell & Wellborn (1991)	Capability, autonomy and relevance - motivation analysis of software process of own system	Connell and wellborn's own system software driver development trend entity model (ssmmd; 1991) believes that teachers' construction, independent application and participation will harm students' cognition of ability, autonomy and relevance. Teachers influence students' cognition of ability, autonomy and relevance	2. How do you feel the students in the classroom behaved emotionally in the smart classroom environment? Be specific about how the classroom behaves (positively engaged, negatively engaged, etc.)

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
	Skinner & Belmont (1993)	Classroom motivation - the interaction between teachers' personal behavior and students' participation throughout the academic year	The importance of the teacher's response received by these students with alienated personal behavior should further weaken their motivation. Pay attention to the relationship between teachers and students, especially the importance of getting along with others in improving students' motivation.	

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
Behavioural input	Angelino & Natvig Shuanya Wang (2013) Hongcan Hong (2014)	A Conceptual Model for Engagement of the Online Learner	Personal behavior capital investment refers to the compressive strength of students' participation in learning activities, including Including students' participation in collaborative learning in the intelligent classroom, teachers Interact with students and interact with students.	3. What methods do teachers use to engage students in classroom activities in the smart classroom environment? (e.g. teacher-student interaction, student participation in cooperative learning, student-student interaction, etc.)

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
Self-efficacy	Youguo Liao (2010)	Exploring the status of university students' learning engagement and strategies to enhance it	Students' perceptions of their self-learning abilities subjective power, problem-solving skills and learning behaviour Judgment that reflects whether the student has a high level of confidence	4. In the smart classroom environment, do you think the students understand the content of the lessons? How do you think students feel when they encounter problems in class (e.g. confident that they will find a solution or that they will be able to solve most of the problems through their own efforts, etc.)?

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
	Leishan Shi (2013)	Socioeconomic status and learning and training investment: the mediating effect of middle school students' academic self-efficacy	Academic self-efficacy is expected to be positively related to engagement in learning because self-efficacy leads to a greater willingness to expend The self-efficacy of the student is expected to be positively related to engagement in learning because self-efficacy leads to a greater willingness to expend more energy and effort to complete a task or assignment, resulting in greater engagement and absorption in the task.	

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
Acceptance of new technologies	Yan Liu (2015)	The reform practice of higher vocational mathematics teaching in technical colleges based on micro-course	In the information age, online videos are prevalent, and the use of information-based teaching tools in school In the information age, online videos are prevalent, and information technology teaching tools are applied to school teaching, effectively combining online education with school education. The newest and most important of these is the use of online education. The students are arranged to study the micro-video independently and complete the micro-learning task list before the group lecture, and discuss	5. Are modern technology tools acceptable to you in a smart classroom environment? How does it affect your lessons?

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
			the micro-exercises in small groups after the group lecture. The students are arranged to study the micro-video independently and complete the micro-learning task list before the group lecture, and discuss the micro-exercises in small groups after the group lecture. This is conducive to promoting student-student interaction and teacher-student interaction, which adds vitality to classroom teaching. This helps promote student-student interaction and teacher-student interaction, and adds vitality to classroom teaching. Teacher-student	

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
	Yi Zhang (2016)	The study of college students' Study on classroom learning engagement and influencing factors	interaction behavior with technology support, teachers' IT application ability, technology acceptance and cognitive load had The study also found that the teacher-student interaction behavior with technology support, teachers' IT application ability, technology acceptance and cognitive load had significant effects on students' behavioral engagement. There are significant effects of teacher-student interaction behavior, teacher's IT skills, technology acceptance and cognitive load on students' behavioral engagement with technology support	

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
	Chuxin Fu (2019)	A Study of Cognitive Engagement in Secondary Schools in a Technology-Rich Environment	Improving students' information literacy and improving the assessment and interaction features of technology platforms positively affects students' cognitive engagement levels. Moreover, in a technology-rich environment, students with higher levels of technology use more often use active and interactive cognitive strategies	

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
Motivation for learning	Nurlaeli, N (2016)	Improving Students' Motivation to Learn in the Classroom	Learning motivation is related to students' desire or willingness to participate in learning; Therefore, students' motivation plays an important role in students' learning. Students' learning motivation is related to students' desire or willingness to study; Therefore, student motivation plays a key role in students' performance.	6. What is your motivation for learning in a smart classroom environment? What factors influence your motivation to learn?
	Purnamasari, Untung Desy (2018)	Exploratory Factor Analysis: Motivation for Learning	Learning motivation is a major aspect of the learning process, because it can promote performance goals and maintain academic performance	

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
Teacher influence	Yugai Du (2013)	The mediating role of high school students' learning self-efficacy in test anxiety and learning engagement	The experience of others is also an important factor in the formation of individual self-efficacy; verbal persuasion from significant others (e.g. teachers, elders, etc.) also plays a role in the development of individual efficacy expectations, teachers, elders, etc.) also plays a role in the development of individual efficacy expectations	7. In a smart classroom environment, what impact do you feel the teacher has on your lessons? What do you think the teacher needs to do to enable you to learn better?

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
Interaction behaviour	Skinner, E. A (1993)	Classroom motivation - the interaction between teachers' personal behavior and students' participation throughout the academic year	Teacher engagement was central to children's experiences in the classroom, and the autonomy support and optimal structure provided by teachers The reciprocal influence of student motivation on teacher behaviour was also found.	8. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)

(Continued)

Table 3.1 (Continued): Related Literature Research Results and Variables

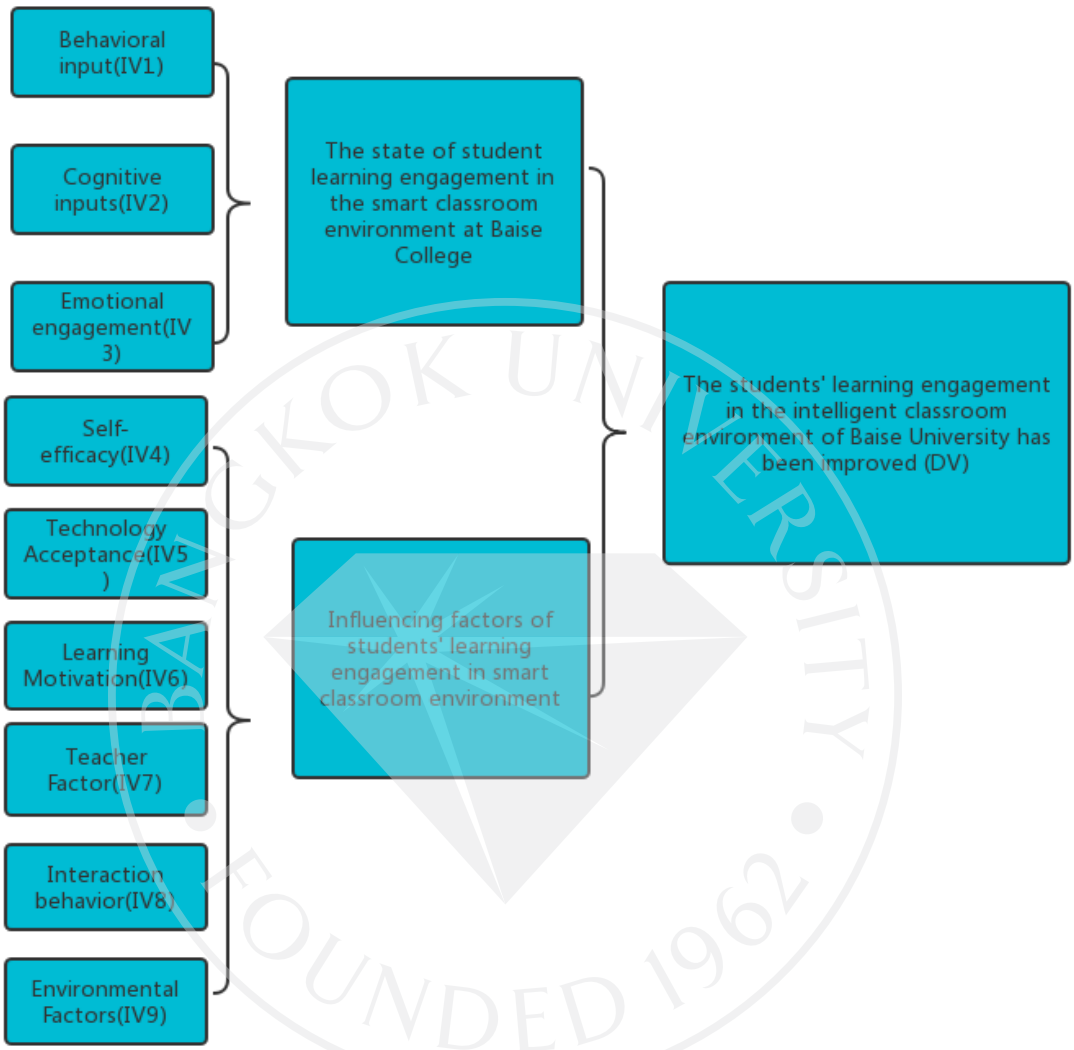
Variables in a literature review	Author & Year	Title	Literature Results	Interview Questions
Environmental factors	Xiaoling Han (2014)	A study on the structure of college students' learning input based on the NSSE-CHINA questionnaire	The school's curriculum goals and requirements, as well as the assistance and support provided by the school for student learning, are also very important aspects. The school's curriculum goals and requirements, as well as the assistance and support provided by the school for student learning, are also very important aspects.	9. In a smart classroom environment, what technology in the classroom do you find helpful for your learning?
	Suifan, 2015	Influence Human resource practices Commitment of relevant organizations: Morocco studies	Improving the learning environment of college students can be effective in promoting behavioral and emotional engagement in learning.	

3.4 Qualitative Research Sample and Data

Based on the findings of the literature study, ten open-ended interview questionnaires on the research topic were designed and the respondents were interviewed face-to-face. Details of the interview questionnaires are in Appendix A. A total of 10 people were interviewed, six of whom were students learning in a smart classroom environment and the remaining four were teachers teaching in a smart classroom. All of them had experienced the smart classroom environment and had a good understanding of the overall engagement of students in the smart classroom environment at Baise College, and were able to provide authentic and valid data for the qualitative research of this study. After 10 interview conversations, the researcher coded and summarised the findings

In the initial interview records, relevant keywords and key sentences are summarized, and the keywords and key sentences are numbered, classified and summarized, so as to identify the elements that endanger college students' participation in learning and training in the natural environment of intelligent classroom teaching. According to the conclusions of literature review and qualitative analysis, the research staff established the basic conceptual framework of this study, as shown in Figure 3.3 below.

Figure 3.3: Conceptual Framework



Quantitative analysis

This is also a questionnaire designed for smart classroom customers using the Likert scale. Likert scoring scale is especially suitable for in-depth excavation of special lectures, detailed analysis of everyone's views on the subject, as well as professional statistical analysis methods such as output power analysis and average value calculation. It consists of a group of sentences. There are five responses to each statement: "significantly allow", "allow", "remain neutral", "disagree" and "significantly disagree" respectively, 5 points, 4 points, 3 points, 2 points and 1 point. Accurately measure the total score of each respondent's mentality. The total score can

indicate that he is OK or different at this level. Generally speaking, the survey report will indicate the average value of each evaluation index system. The standard template of the Likert score scale is shown in Figure 3.5 below.

Figure 3.4: Five-point Likert scale

This is also the application of the categories and variables identified in the qualitative study to build the questionnaire for this separate analysis. According to the categories and variables in Figure 3.4, the questionnaire includes the statistics of social development population, the current situation of students' learning participation in the intelligent classroom environment and various factors that endanger students' participation in class in the intelligent classroom environment.

The detailed document format of the questionnaire on the status of students' learning participation in the intelligent classroom environment and its hazards to the elements of students' learning participation in the intelligent classroom environment is shown in Appendix D.

The questionnaire is divided into three parts. The first part is to collect biostatistics information from the audience of universities in Baise; the second part is to collect the data about the respondents' overall participation in the intelligent classroom environment at this stage and the factors that endanger children's learning. See Appendix D for details of the questionnaire.

In order to better ensure the efficiency and stability of quantitative research data information, scholars limited the respondents to the students who taught in the

intelligent classroom of colleges and universities in Baise, and the respondents had work experience in the intelligent classroom, so as to obtain more accurate applicable data information and improve the authority and appeal of graduation papers.

The data was collected through an online survey from March 2022 to May 2022. 272 valid questionnaire samples were collected, of which 111 were male and 161 were female, 130 were freshmen, 63 were sophomores, 52 were juniors and 27 were seniors.

3.5 Data Analysis

In this scientific research, SPSS software is used to analyze the data obtained from quantitative analysis. "SPSS is a procedure for statistical analysis and analysis of sampled data. The key to this independent scientific research is to use SPSS mobile mobile software to carry out statistical analysis and analysis of the data in the questionnaire, and to carry out exploratory analysis of the data according to the powerful functionality of SPSS, and get some results and conclusions." SPSS mobile software was used to carry out frequency analysis, descriptive analysis, reliability analysis, difference test, correlation analysis and regression analysis.

3.5.1 Frequency analysis, the researcher will conduct frequency analysis on the basic information of the people in the questionnaire to obtain the distribution of the sample. To show the channel of the questionnaire data source and the proportion of basic information such as gender, age and education of different respondents, these two elements provide basic assurance and evidence for the accuracy of the questionnaire data analysis.

3.5.2 Reliability analysis, the second step of questionnaire analysis is to test the reliability of the questionnaire, that is, reliability test. Reliability is a definition of consideration, which focuses on the consistency of the internal structure of the scale. Reliability test is to test the measured table α the cronmozart test of the index value was used to test the consistency of the internal structure of the scale. In general, Cronbach α If the index value exceeds 0.9, it means that the internal structure of the scale is very consistent α The index value is between 0.7 and 0.9, indicating that the internal structure of the scale has good consistency; When the index value is lower than 0.7, the inconsistency among the items of the scale is high, so it is necessary to

carry out revision. Always change the scale.

3.5.3 Reliability and discriminant validity are not the same; High reliability does not mean high efficiency, but when the reliability is not high, the discrimination validity is not high. Reliability tests the consistency of all projects in the scale, while validity tests the efficiency of each item, that is, whether each latest item plays a key role in the scale. There are two data analysis methods to test discrimination validity: exploratory elements (EFA) use SPSS mobile app, and authentication elements (CFA) use Amos mobile app. For the improvement of the known dimension classification or scale, CFA must be used to verify whether the known dimension classification is appropriate. For the scale with unknown dimensions, EFA is selected to test the effectiveness of each problem, and scientific and reasonable methods are selected to explore the dimensions of the scale.

3.5.4 Descriptive analysis is to sort out and summarize a lot of information and information obtained from the survey, so as to confirm the internal structure of this information - the development trend of centralization and decentralization. Unilateral analysis relies on various data statistics expressed in the data information, such as average value, percentage, etc. In this analysis, the conclusions of the descriptive analysis will be presented in the form of tables to clearly show the audience's views on the proposed learning status This paper analyzes the scientific and technical personnel who carry out intelligent teaching in the environment for teenagers and the reasons that interfere with their participation in training and practice.

The difference significance test is a "statistical analysis hypothesis test" to test whether there are differences between the control group and the control experiment in the scientific experiment, and whether the differences are obvious. In this study, variance test will be used to examine the plasticity of each variable in the respondents, so as to clarify the manipulated variables of the natural environment for students to participate in intelligent classroom teaching.

3.5.5 Correlation analysis is the whole process of determining whether two variables are related according to whether the correlation coefficient between one variable and another factor variable exceeds the zero boundary point. In the positive middle of the related variables, according to the number of the correlation coefficient,

the close level of the relationship between the two variables can be distinguished; the larger the correlation coefficient is, the closer the correlation is. This discussion will investigate the correlation between independent variables and dependent variables based on correlation analysis to respond whether each independent variable will harm the dependent variable.

3.5.6 Regression analysis is used to analyse the extent to which one or more independent variables affect the dependent variable. In this study, regression analysis will be used to examine the extent to which behavioural engagement, cognitive engagement, emotional engagement, self-efficacy, technology acceptance, motivation, teacher factors, interactive behaviour and environmental factors influence student engagement in the smart classroom environment.

3.6 Summary

Through the study of relevant literature and qualitative interviews, independent variables, dependent variables and evaluation indicators were identified. We identified relevant independent variables and evaluation indicators that could help to influence student learning engagement in the smart classroom environment at Baise University, providing data to support the design of the conceptual framework and questionnaire. Research methods and instruments were identified, interview questionnaires and survey questionnaires were developed, and reliability and validity evaluations were conducted to ensure the scientific validity of the questionnaires.

CHAPTER 4
DATA ANALYSIS

4.1 Qualitative Data Analysis

After 10 interview conversations, the researcher coded and summarised the results of the interviews.Relevant keywords and key sentences were summarised from the original interview transcripts, and the keywords and key sentences were coded, categorised and summarised to determine the factors influencing students' engagement in learning in the smart classroom environment at Baise University. The raw interview transcript data is detailed in Appendix B, and the narrative coding sheet for the interviews is detailed in Appendix C.

The researcher invited four experts to assess the validity of the interview qIn order to better ensure the effectiveness of qualitative research, researchers applied content validity. Content validity refers to whether a group of test questions test the content that should be tested, or whether the content of the test reflects the test provisions, that is, the symbolism and coverage of the test. All of them were professors or PhD's at Baise University and had been working at Baise University for many years, and all four experts had worked on the construction of smart classrooms. The four experts' evaluations were used to control whether an item should be included or not. Content validity (IOC) scores of 1 or 0 were used. More than 75% of the items were acceptable survey items and the validity review form can be found in Appendix E.

4.2 Descriptive Statistics of Respondents' Demographic

4.2.1 Hypotheses

Based on the above findings, the research staff established a definition framework (Figure 3.3) and used it as the research model of this study. The model fully shows the mechanism and the whole process that the nine dimensions of

personal behavior participation, cognitive ability participation, emotional participation, self-efficacy, technical acceptance, learning interest, teacher elements, interactive communication personal behavior and environmental elements endanger college students' understanding in the intelligent natural environment, as well as the mechanism and the whole process of each dimension. Internal relations, etc. Based on the above analysis, the following research hypotheses can be inferred.

H1: There are significant differences between gender, grade level, type of domicile, chosen major, knowledge of smart classroom before enrollment, behavioural engagement, cognitive engagement, emotional engagement, self-efficacy, technology acceptance, learning motivation, teacher factor, interaction behaviour, environmental factor, and student engagement in learning. There were no significant differences between gender, grade level, or type of household registration.

H2: There is a significant relationship between behavioural engagement, cognitive engagement, emotional engagement, self-efficacy, technology acceptance, motivation, teacher factors, interaction behaviours, environmental factors, and increased student engagement in learning.

H2A: behavioral project investment is in direct proportion to student learning investment.

H2B: there is a universal and sufficient relationship between the types of thinking ability and the investment of students' learning funds.

H2C: there is usually sufficient relationship between emotional project investment and the improvement of students' learning investment.

H2D: there is an immediate relationship between self-efficacy and the improvement of students' learning participation.

H2E: there is an adequate relationship between technical acceptance and improving student participation.

H2f: there is a sufficient relationship between motivation and improving students' learning participation.

H2G: teacher factor is positively correlated with students' learning capital investment.

H2H: there is a wide and sufficient relationship between the behavior of communication and students' learning.

H2i: there is an adequate relationship between environmental factors and the improvement of students' participation.

4.2.2 Frequency analysis of respondent demographics

Table 4.1: Frequency Analysis Results

Name	Options	Frequency	Percentage (%)	Cumulative percentage (%)
Gender	Male	111	40.809	40.809
	Female	161	59.191	100.000
Grade Level	Freshman year	130	47.794	47.794
	Sophomore	63	23.162	70.956
	Third Year	52	19.118	90.074
	Senior year	27	9.926	100.000
Type of household registration	Cities and towns	228	83.824	83.824
	Rural	44	16.176	100.000
What you are studying	1.0	163	59.926	59.926
	2.0	25	9.191	69.118
	3.0	84	30.882	100.000
Level of knowledge of smart classrooms prior to entry	1.0	184	67.647	67.647
	2.0	86	31.618	99.265
	3.0	2	0.735	100.000
Total		272	100.0	100.0

The above table shows that 59.19% of the sample was female. A further 40.81% of the sample were male. In terms of grade, the highest percentage was 47.79% for "freshman". More than 80% of the sample chose "urban" as their domicile type. In terms of the distribution of your field of study, the majority of the sample was "1.0", with 59.93%. The other 3.0 sample was 30.88%. In terms of knowledge of the Smart Classroom prior to enrollment, over 60% of the sample were "1.0". The other 2.0 sample was 31.62%.

4.2.3 Descriptive analysis

In this paper, descriptive statistics are carried out on some questions of the scale, including the mean, standard deviation, Skewness, kurtosis and other information, so as to clarify the basic level of the questions in the scale and the spread of the data provided.

Table 4.2: Descriptive Statistics of each Problem Item Descriptive Analysis

	Number of cases	Minimum value	Maximum value	Average	Standard deviation	Skewness	Kurtosis
V6	272	1.00	5.00	3.618	0.735	-0.554	0.978
V7	272	1.00	5.00	3.669	0.724	-0.694	0.985
V8	272	1.00	5.00	3.706	0.699	-1.025	2.436
V9	272	1.00	5.00	3.706	0.715	-0.783	1.614
V10	272	1.00	5.00	3.640	0.689	-0.547	1.011
V11	272	2.00	5.00	3.794	0.638	-0.477	0.643
V12	272	1.00	5.00	3.768	0.683	-1.071	2.628
V13	272	1.00	5.00	3.820	0.693	-0.682	1.633
V14	272	1.00	5.00	3.555	0.822	-0.860	1.294
V15	272	1.00	5.00	3.607	0.700	-0.385	0.371

(Continued)

Table 4.2 (Continued): Descriptive Statistics of each Problem Item Descriptive Analysis

	Number of cases	Minimum value	Maximum value	Average	Standard deviation	Skewness	Kurtosis
V16	272	1.00	5.00	3.478	0.778	-0.495	0.547
V17	272	1.00	5.00	3.724	0.688	-0.880	2.078
V18	272	1.00	5.00	3.706	0.672	-0.673	1.024
V19	272	1.00	5.00	3.640	0.651	-0.288	0.534
V20	272	1.00	5.00	3.787	0.612	-0.621	1.607
V21	272	1.00	5.00	3.607	0.657	-0.242	0.430
V22	272	2.00	5.00	3.746	0.594	-0.282	0.214
V23	272	1.00	5.00	3.746	0.670	-1.066	3.115
V24	272	1.00	5.00	3.746	0.653	-0.891	2.609
V25	272	1.00	5.00	3.779	0.684	-0.943	2.462
V26	272	1.00	5.00	3.746	0.664	-0.884	1.994
V27	272	1.00	5.00	3.802	0.652	-0.820	2.256
V28	272	1.00	5.00	3.754	0.683	-0.833	2.188
V29	272	1.00	5.00	3.713	0.681	-0.701	1.459
V30	272	1.00	5.00	3.849	0.695	-0.719	1.757
V31	272	1.00	5.00	3.790	0.640	-0.718	2.150
V32	272	1.00	5.00	3.768	0.661	-0.481	0.988
V33	272	1.00	5.00	3.783	0.602	-0.585	1.589
V34	272	1.00	5.00	3.779	0.639	-0.623	1.402
V35	272	1.00	5.00	3.746	0.675	-0.732	1.667
V36	272	1.00	5.00	3.776	0.641	-0.608	1.351

(Continued)

Table 4.2 (Continued): Descriptive Statistics of each Problem Item Descriptive Analysis

	Number of cases	Minimum value	Maximum value	Average	Standard deviation	Skewness	Kurtosis
V37	272	1.00	5.00	3.757	0.649	-0.615	1.252
V38	272	1.00	5.00	3.838	0.628	-0.765	2.012
V39	272	1.00	5.00	3.658	0.727	-0.883	1.750
V40	272	1.00	5.00	3.768	0.661	-0.790	1.972
V41	272	1.00	5.00	3.761	0.686	-0.967	2.393
V42	272	1.00	5.00	3.790	0.690	-0.920	2.394

It can be seen from the above that according to the results of data statistical analysis on the information included in the questionnaire for each question, including the number of instances, minimum value, maximum value, mean value, relative standard deviation, skewness and kurtosis, it is certified that the information obtained from the survey follows the normal distribution. Whether the data information is normally distributed or not will cause great harm to the following analysis. Kline (1998) noted that when the absolute value of skewness is less than 3 and the absolute value of kurtosis is less than 10, most samples are normally distributed. The results of formal rifle samples in the table show that the absolute value of skewness - for each problem, the absolute value of skewness is less than 3 and the absolute value of kurtosis is less than 10. Both skewness and kurtosis reach the normal distribution specification, indicating that every problem can obey the normal distribution. The data obtained from the questionnaire can be used for the later statistical analysis of reliability and validity data.

4.3 Confidence and Validity Analysis

4.3.1 Confidence analysis

Stability is used to ensure the effectiveness of model fitting evaluation and hypothesis testing. Cronbach is selected in the text α Coefficient test the consistency of scientific research variables of each high-precision measurement item in the questionnaire. Generally speaking, most of the structures used to improve reliability indicators are reduced according to the independent variables of two specifications: 1. The correlation between the deleted items and the total score of other items (total correlation of change items (CITC)) is lower than the total score of other items.
If the correlation (CITC) is less than 0.5, delete this item; After deleting an item, cron Mozart α If the coefficient is enlarged, delete the item. This analysis takes the above two points as the basic premise of the purification treatment project.

Table 4.3: Cronbach's Reliability Analysis of Learning Input Status

Dimensionality	Name	Correction Item Total Correlation (CITC)	Item deleted alpha factor	Cronbach alpha coefficient
Behavioural input	V6	0.665	0.811	0.847
	V7	0.701	0.801	
	V8	0.601	0.828	0.846
	V9	0.645	0.816	
	V10	0.652	0.814	
Cognitive input	V11	0.586	0.710	
	V12	0.620	0.672	0.770
	V13	0.607	0.687	

(Continued)

Table 4.3 (Continued): Cronbach's Reliability Analysis of Learning Input Status

Dimensionality	Name	Correction Item Total Correlation (CITC)	Item deleted alpha factor	Cronbach alpha coefficient	
Emotional engagement	V14	0.632	0.807		
	V15	0.634	0.804		
	V16	0.701	0.784	0.836	0.847
	V17	0.610	0.810		
	V18	0.619	0.808		

It can be seen from the above that the reliability coefficient of the investment of learning and training funds is 0.847, The reliability coefficients of the three levels exceed 0.7, indicating that the scientific research website has high security. For deleted items α Index ", when all items are deleted, the reliability index is not easy to be significantly improved, so this means that the item cannot be deleted. For the "CITC value", the CITC value of the analysis item exceeds 0.5, indicating that the analysis item has good relevance and maintains a stable reliability level. In a word, the reliability index value of scientific research information and information is above 0.7, indicating that the overall stability of the website is high, which can be used for further analysis.

Table 4.4: Cronbach's Reliability Analysis of Factors Influencing Learning Engagement

Dimensionality	Name	Correction Item Total Correlation (CITC)	Item deleted alpha factor	Cronbach alpha coefficient	
Self-efficacy	V19	0.666	0.733		
	V20	0.644	0.757	0.810	
	V21	0.670	0.729		
Technology Acceptance	V22	0.608	0.727		
	V23	0.549	0.755	0.785	
	V24	0.605	0.726		
	V25	0.611	0.723		
Motivation for learning	V26	0.682	0.789		
	V27	0.680	0.790	0.838	
	V28	0.670	0.795		0.863
	V29	0.647	0.805		
Teacher Factor	V30	0.650	0.722		
	V31	0.649	0.723	0.800	
	V32	0.636	0.736		
Interaction behaviour	V33	0.593	0.733		
	V34	0.621	0.703	0.781	
	V35	0.648	0.673		
Environmental factors	V36	0.647	0.691		
	V37	0.622	0.718	0.788	
	V38	0.614	0.726		

In general, the reliability coefficient of the risk training learning investment fund factor is 0.863, and the reliability coefficient of the six levels included is also

above 0.7, indicating that the quality of scientific research information is high. For deleted items α Coefficient ", when all items are deleted, the reliability coefficient is not easy to be significantly improved, which means that items cannot be deleted. For the "CITC value", the CITC value of the analysis item exceeds 0.5, indicating that the analysis item has good relevance and ensures a good reliability level. In a word, the reliability coefficient of scientific research information is above 0.7, indicating that the overall stability of the website is high, which can be used for further analysis.

Table 4.5: Cronbach's Reliability Analysis of Learning Engagement Improvement

Name	Correction Item Total Correlation (CITC)	Item deleted alpha factor	Cronbach alpha coefficient
V39	0.680	0.802	0.843
V40	0.730	0.780	
V41	0.672	0.804	
V42	0.636	0.819	

The above shows that the reliability coefficient is 0.843, exceeding 0.8, indicating that the quality of scientific research data is high. For deleted items α Index when all items are deleted, the reliability index is not easy to be significantly improved, which means that items cannot be deleted. For the "CITC value", the CITC value of the analysis item exceeds 0.5, indicating that the analysis item has good relevance and maintains a stable reliability level. In a word, the reliability index value of scientific research information is above 0.7, indicating that the overall data quality is high and can be used for further analysis.

4.3.2 Validity analysis

Validity analysis is the key component of demonstration research. Generally speaking, researchers do not have a long period of time or Internet resources to

develop design measurement tools. Therefore, in order to save time and effort, time and energy and cost, they referred to the current measurement tools, such as questionnaire survey, and used the original measurement tools to help the research find out whether the same measurement tools are compatible in various studies. Therefore, the key is to consider whether the special tools are effective, whether they accurately apply and reflect the subject elements of the current research.

Content validity and structure validity are usually used in questionnaires. The questionnaire used in this study is built on the basis of looking back at the literature review of the positive and intermediate relevance or relevance of the variables. The special terms and descriptions of the new items have been further modified and improved based on the role of pre survey. Therefore, we can feel that the rating scale has the required content validity. In this study, the key is structural validity, that is, the latest project accurately considers the professional ability of the measured variables. Based on the information collected, exploratory factor analysis (EFA) was conducted to determine the structural validity of the rating scale.

Generally speaking, exploratory factor analysis is carried out according to the first feasibility study and test factor analysis, which must comply with two standard industries (2007): 1. Kmo > 0.72, Bartlett's spherical test was significant (SIG < 0.05). SPSS 22.0 was used to carry out exploratory factor analysis to test kmo and Bartlett's spherical scale. The results are shown in the following table.

4.3.2.1 Learning input state validity analysis

Table 4.6: Learning Input State KMO and Bartlett's Test

KMO values		0.872
Bartlett sphericity test	Approximate cardinality	1298.053
	df	78
	p-value	0.000

Using factor analysis to carry out research has a variety of information. First analyze whether the research data is suitable for factor analysis. As shown in the previous table: kmo is 0.872, more than 0.6, which meets the prerequisite of factor analysis, that is, the data can be used for factor analysis research. In addition, according to Bartlett sphericity test ($p<0.05$).

Table 4.7: Component Matrix after Learning Input State Rotation

Dimensionality	Title item	Ingredients		
		1	2	3
Behavioural input	V6	0.785	0.128	0.096
	V7	0.800	0.143	0.136
	V8	0.741	0.052	0.106
	V9	0.781	0.054	0.101
	V10	0.715	0.188	0.275

(Continued)

Table 4.7 (Continued): Component Matrix after Learning Input State Rotation

Dimensionality	Title item	Ingredients		
		1	2	3
Cognitive input	V11	0.159	0.124	0.791
	V12	0.188	0.096	0.810
	V13	0.154	0.164	0.794
Emotional engagement	V14	0.087	0.762	0.106
	V15	0.105	0.756	0.121
	V16	0.164	0.790	0.174
	V17	0.090	0.761	0.001
	V18	0.080	0.748	0.118
Sum of squared rotating loads	Total	3.071	3.046	2.108
	Percentage variance	23.623	23.427	16.217
	Cumulative%	23.623	47.050	63.268

Then, principal component analysis and orthogonal and rotation methods are used to extract the common factors of learning and training input, and three common factors are extracted. See the above for the actual effect. The variance expression rates of the three factors are 23.623%, 23.427% and 16.217% respectively, and the total variance expression rate after rotation is 63.268%>50%. This means that the information of scientific research terms can be reasonably extracted. Finally, please integrate the factor load coefficient to determine the corresponding relationship between the factor (level) and new scientific research projects.

4.3.2.2 Validity analysis of factors influencing learning inputs

Table 4.8: KMO and Bartlett's Test for Factors Influencing Learning Engagement

KMO values		0.841
Bartlett sphericity test	Approximate cardinality	2024.120
	df	190
	p-value	0.000

Factor analysis is used to carry out research with rich and colorful information. It is the first to analyze whether the research data is suitable for factor analysis. As shown in the previous table: kmo is 0.841, more than 0.6, which meets the prerequisite of factor analysis, which means that the data can be used for factor analysis research. Moreover, according to Bartlett sphericity test.

Table 4.9: Rotated Component Matrix of Learning Input Influences

Latitude	Title item	Ingredients					
		1	2	3	4	5	6
Self-efficacy	V19	0.147	0.219	0.795	0.070	0.131	0.061
	V20	0.170	0.004	0.827	0.102	0.010	0.135
	V21	0.097	0.173	0.826	0.070	0.083	0.076

(Continued)

Table 4.9 (Continued): Rotated Component Matrix of Learning Input Influences

Latitude	Title item	Ingredients					
		1	2	3	4	5	6
Technology Acceptance	V22	0.172	0.759	0.111	0.144	0.030	0.002
	V23	0.086	0.729	0.025	0.066	-0.012	0.182
	V24	0.194	0.744	0.155	0.023	0.116	0.066
	V25	0.091	0.758	0.120	0.043	0.112	0.173
Motivation for learning	V26	0.774	0.200	0.088	0.001	0.172	0.112
	V27	0.765	0.107	0.134	0.049	0.125	0.231
	V28	0.812	0.150	0.124	0.073	-0.030	0.069
	V29	0.772	0.112	0.114	0.127	0.130	0.072
Teacher Factor	V30	0.079	0.022	0.053	0.842	0.059	0.107
	V31	0.057	0.089	0.046	0.815	0.016	0.204
	V32	0.075	0.141	0.136	0.802	0.094	0.098
Interaction behaviour	V33	0.171	0.115	0.154	0.120	0.122	0.754
	V34	0.098	0.144	0.139	0.119	0.127	0.783
	V35	0.155	0.148	-0.010	0.203	0.029	0.810
Environmental factors	V36	0.122	0.087	0.081	0.065	0.830	0.026
	V37	0.139	0.069	0.056	0.111	0.803	0.080
	V38	0.054	0.046	0.062	-0.008	0.818	0.146
(Sum of squared rotating loads	Total	2.698	2.499	2.183	2.173	2.162	2.099
	Percentage variance	13.491	12.494	10.915	10.866	10.811	10.494
	Cumulative %	13.491	25.985	36.900	47.766	58.577	69.071

Then, the principal component analysis and orthogonal and rotation methods are used to extract the same elements of the investment in training and learning assets.

Six common factors were extracted. The specific conclusions are shown in the above figure. The variance expression rates of the six factors were 13.491%, 12.494%, 10.915%, 10.866%, 10.811% and 10.494% respectively. The expression rate of accumulated variance after rotation is 69.071% > 50%. This means that scientific research terminology information can be effectively extracted. Finally, please integrate the factor load index value to clarify the corresponding relationship between the factor (level) and the new scientific research topic, which is consistent with the possibility and shows the effectiveness.

4.3.2.3. Validity analysis of increased engagement in learning

Table 4.10: KMO and Bartlett's Test For Increased Engagement in Learning

KMO values		0.817
Bartlett sphericity test	Approximate cardinality	429.314
	df	6
	p-value	0.000

Use factor analysis to carry out research with rich and colorful information, and first analyze whether the research data is suitable for factor analysis, as shown in the previous table: kmo is 0.817, more than 0.6, meeting the prerequisite of factor analysis, which means that the data can be used for factor analysis research. Moreover, according to Bartlett sphericity test ($p<0.05$).

Table 4.11: Learning Engagement Improvement Component Matrix

Latitude	Title item	Ingredients
		1
Increased engagement in learning	V39	0.827
	V40	0.860
	V41	0.821
	V42	0.794
Extraction of sum of squares of loads	Eigenvalue	2.728
	Explanation of variance	68.192
	Cumulative variance explained	68.192

Finally, this paper extracted the public factor of learning engagement degree by principal component analysis and orthogonal rotation method, and extracted 1 public factor, the specific results are shown in the table, the eigenvalue is 2.728, the variance explanation rate is 68.192%, indicating that this 1 factor has a relatively strong explanatory power for the variance. The factor loading coefficients are all greater than 0.5, and overall, the validity of the Learning Engagement Improvement Scale is relatively good.

4.4 Analysis of Variances

4.4.1 Analysis of Gender Differences

Table 4.12: Results of t-Test Analysis

	Gender (mean ± standard deviation)		*t*	*p*
	Male (n=111)	Female (n=161)		
Behavioural engagement	3.568±0.593	3.737±0.527	-2.416	0.017*
Awareness engagement	3.760±0.565	3.818±0.550	-0.846	0.399
Emotional engagement	3.582±0.593	3.636±0.555	-0.767	0.444
Learning engagement states	3.617±0.463	3.717±0.389	-1.853	0.065
Self-efficacy	3.661±0.532	3.689±0.555	-0.427	0.669
Technology Acceptance	3.815±0.496	3.713±0.513	1.643	0.101
Motivation to learn	3.775±0.535	3.739±0.561	0.525	0.600
Teacher factors	3.754±0.579	3.836±0.550	-1.192	0.234
Interaction Behaviour	3.745±0.577	3.787±0.502	-0.638	0.524
Environmental factors	3.769±0.514	3.805±0.551	-0.553	0.580
Learning Engagement Influencing Factors	3.757±0.322	3.758±0.359	-0.020	0.984
Increased engagement in learning	3.709±0.538	3.769±0.592	-0.841	0.401

*p<0.05 **p<0.01 ***p<0.001

From the above table, it can be seen that there is no significant difference (p>0.05) between the gender samples in terms of cognitive engagement, emotional engagement, learning engagement status, self-efficacy, technology acceptance, motivation, teacher factors, interaction behaviour, environmental factors, learning engagement influencing factors, and learning engagement increase, implying that

there is no difference between the gender samples in terms of cognitive engagement, emotional engagement, learning engagement status, self-efficacy, technology acceptance, learning motivation, teacher factors, interaction behaviour, environmental factors, learning engagement influencing factors, and learning engagement increase. ($p>0.05$), implying that there was no difference between the gender samples in terms of cognitive engagement, emotional engagement, learning engagement status, self-efficacy, technology acceptance, motivation, teacher factors, interaction behaviour, environmental factors, learning engagement influences, and learning engagement improvement. In addition, the gender sample showed a significant effect on behavioural engagement ($p<0.05$), implying that there were differences in behavioural engagement between the gender samples. Specific analysis revealed that.

The significant level of gender investment in personal behavior is 0.05 ($t=-2.416$, $p=0.017$). The actual difference shows that the average value of men (3.57) is significantly lower than that of women (3.74).

In general, it can be seen that the different version of sex has different effects on cognitive ability investment, emotional investment, learning and training investment, self-efficacy, technology acceptance, motivation, teacher factors, interaction behaviour, environmental factors, learning engagement influencing factors, learning engagement increase, and the gender samples show significant differences in behavioural engagement.

4.4.2 Analysis of grade differences

Table 4.13: Analysis of Variance Results

	Grade (mean ± standard deviation)				*F*	*p*
	Freshman year (n=130)	Sophomore year (n=63)	Junior year (n=52)	Senior year (n=27)		
Behavioural engagement	3.705±0.554	3.654±0.540	3.546±0.606	3.756±0.536	1.241	0.295
Awareness engagement	3.779±0.592	3.836±0.497	3.718±0.500	3.914±0.610	0.888	0.448
Emotional engagement	3.602±0.584	3.673±0.530	3.531±0.546	3.696±0.645	0.800	0.495
Learning engagement states	3.682±0.427	3.703±0.412	3.580±0.404	3.769±0.445	1.441	0.231
Self-efficacy	3.667±0.544	3.683±0.537	3.641±0.523	3.790±0.621	0.478	0.698
Technology Acceptance	3.673±0.551	3.833±0.475	3.793±0.413	3.889±0.487	2.390	0.069
Motivation to learn	3.713±0.528	3.794±0.547	3.731±0.577	3.898±0.602	0.995	0.396
Teacher factors	3.790±0.583	3.799±0.554	3.744±0.531	3.988±0.535	1.191	0.314

(Continued)

Table 4.13 (Continued): Analysis of Variance Results

	Grade (mean ± standard deviation)				*F*	*p*
	Freshman year (n=130)	Sophomore year (n=63)	Junior year (n=52)	Senior year (n=27)		
Interaction Behaviour	3.733±0.514	3.831±0.580	3.718±0.542	3.901±0.488	1.189	0.314
Environmental factors	3.767±0.545	3.831±0.486	3.833±0.542	3.728±0.599	0.433	0.729
Learning Engagement Influencing Factors	3.721±0.364	3.797±0.328	3.745±0.287	3.869±0.366	1.745	0.158
Increased engagement in learning	3.629±0.612	3.798±0.516	3.788±0.498	4.093±0.455	5.704	0.001***

*p<0.05 **p<0.01 ***p<0.001

The above table shows that the 11 items of Behavioural Engagement, Awareness Engagement, Emotional Engagement, Learning Engagement Status, Self-efficacy, Technology Acceptance, Motivation, Teacher Factors, Interaction Behaviour, Environmental Factors and Learning Engagement Influencing Factors were not significant ($p>0.05$) across the different grade levels, which means that there were no differences across the different grade levels for Behavioural Engagement, Awareness Engagement, Emotional Engagement, Learning Engagement Status, Self-efficacy, Technology Acceptance, Learning Motivation, Teacher Factors, Interaction State, Self-efficacy, Technology Acceptance, Motivation, Teacher Factors, Interaction Behaviour, Environmental Factors, and Learning Engagement Influencing Factors all showed consistency across grade levels and did not differ. A total of one item was found to be significant ($p<0.05$), meaning that there was a difference in the increase in engagement in learning between the grade level samples. Specific analysis shows that.

The mean scores of the groups with significant differences were "sophomore > freshman; senior > freshman; senior > sophomore; senior > junior".

To summarise, there were no significant differences between the year groups in the 11 categories of behavioural engagement, cognitive engagement, emotional engagement, learning engagement status, self-efficacy, technology acceptance, motivation, teacher factors, interaction behaviour, environmental factors, and learning engagement influencing factors.

4.4.3 Analysis of differences in types of household registration

Table 4.14: Results of t-test Analysis

	Type of household registration (mean ± standard deviation)		*t*	*p*
	Towns (n=228)	Rural (n=44)		
Behavioural engagement	3.645±0.566	3.786±0.522	-1.539	0.125
Awareness engagement	3.785±0.544	3.841±0.620	-0.609	0.543
Emotional engagement	3.599±0.564	3.691±0.606	-0.977	0.330
Learning engagement states	3.660±0.423	3.762±0.412	-1.479	0.140
Self-efficacy	3.654±0.549	3.803±0.515	-1.671	0.096
Technology Acceptance	3.763±0.469	3.710±0.678	0.496	0.622
Motivation to learn	3.734±0.556	3.858±0.507	-1.377	0.170
Teacher factors	3.794±0.561	3.848±0.573	-0.589	0.556
Interaction Behaviour	3.751±0.534	3.864±0.525	-1.279	0.202
Environmental factors	3.784±0.555	3.826±0.422	-0.477	0.634
Learning Engagement Influencing Factors	3.747±0.342	3.815±0.349	-1.204	0.230
Increased engagement in learning	3.755±0.562	3.688±0.615	0.723	0.470

*p<0.05 **p<0.01 ***p<0.001

From the above table, it can be seen that there is no significance (p>0.05) for behavioural engagement, cognitive engagement, emotional engagement, learning engagement status, self-efficacy, technology acceptance, learning motivation, teacher factor, interaction behaviour, environmental factor, learning engagement influencing factor, learning engagement increase among the different household type samples, implying that there is no difference among the different household type samples for

behavioural engagement, cognitive engagement, emotional engagement, learning engagement status, self-efficacy, technology acceptance, learning motivation, teacher factor, interaction behaviour, environmental factor, learning engagement influencing factor, learning engagement increase. ($p>0.05$), implying that there is no difference between the different household types for behavioural engagement, emotional engagement, learning engagement status, self-efficacy, technology acceptance, motivation, teacher factors, interaction behaviours, environmental factors, learning engagement influences, and learning engagement improvement.

4.5 Correlation Analysis

In the previous section, according to the analysis of validity and reliability, the structural characteristics and related problems of each dimension are clarified. The average score of each dimension can be the score of this dimension, and then relevant analysis is carried out. The key of correlation analysis is the correlation between scientific research factors. The correlation index value R is between -1 and 1. The larger the square root, the stronger the correlation between independent variables. Clearly pointed out the main classification of relevant index values, $|R|=1$, completely related; $|R| \leq 0.70 < 0.99$, highly correlated; $0.40 \leq |R| < 0.69$, slightly to moderately correlated; $0.10 \leq |R| < 0.39$, low correlation; $|R| < 0.10$, weakly correlated or uncorrelated.

Table 4.15: Pearson Correlation

	Average	S.D.
Behavioural input	3.668	0.56
Cognitive input	3.794	0.556
Emotional engagement	3.614	0.571
Self-efficacy	3.678	0.545
Technology Acceptance	3.755	0.508
Motivation for learning	3.754	0.55
Teacher Factor	3.803	0.562
Interaction behaviour	3.77	0.533

(Continued)

Table 4.15 (Continued): Pearson Correlation

	Behavioural input	Cognitive input	Emotional engagement	Self-efficacy	Technology Acceptance	Motivation for learning	Teacher Factor	Interaction behaviour	Environmental factors	Increased engagement in learning
Behavioural input	1									
Cognitive input	0.391***	1								
Emotional engagement	0.298***	0.311***	1							
Self-efficacy	0.279***	0.244***	0.262***	1						
Technology Acceptance	0.203***	0.289***	0.343***	0.333***	1					

Continued)

Table 4.15 (Continued): Pearson Correlation

	Behavioural input	Cognitive input	Emotional engagement	Self-efficacy	Technology Acceptance	Motivation for learning	Teacher Factor	Interaction behaviour	Environmental factors	Increased engagement in learning
Motivation for learning	0.298***	0.289***	0.327***	0.349***	0.384***	1				
Teacher Factor	0.197**	0.175**	0.206***	0.230***	0.232***	0.217***	1			
Interaction behaviour	0.335***	0.319***	0.366***	0.282***	0.351***	0.366***	0.367***	1		
Environmental factors	0.207***	0.206***	0.175**	0.214***	0.208***	0.281***	0.170**	0.255***	1	
Increased engagement in learning	0.426***	0.443***	0.491***	0.423***	0.514***	0.509***	0.403***	0.492***	0.366***	1

The table above shows that correlations were used to investigate the relationship between increased engagement in learning and nine items: behavioural engagement, cognitive engagement, emotional engagement, self-efficacy, technology acceptance, motivation, teacher factors, interactional behaviour and environmental factors. The specific analysis revealed that.

The correlation coefficients were 0.426, 0.443, 0.491, 0.423, 0.514, 0.509, 0.403, 0.492 and 0.366 respectively, all exceeding 0. The correlation coefficients are greater than 0, which means that there is a positive correlation between the improvement of learning and training investment and a total of nine new projects: personal behavior investment, cognitive ability investment, emotional investment, self-efficacy, technical acceptance, motivation, teacher elements, interactive communication personal behavior and environmental factors.

4.6 Regression Analysis

According to the conclusion of correlation analysis, it is found that there is an obvious correlation between independent variables, but the correlation analysis does not take into account the doping effect between factors, and the causal relationship of correlation is unknown. Therefore, in order to better explain the causal relationship between variables, multiple regression analysis is used to test some hypotheses.

4.6.1. Analysis of the impact of learning engagement status on the increase of learning engagement

Table 4.16: Results of Linear Regression Analysis (n=272)

	Non-standardized coefficients		Standardization factor	t	p	VIF	R^2	Adjustment R^2	F
	B	Standard error	Beta						
Constants	0.686	0.244	-	2.812	0.005**	-	0.376	0.369	F (3,268)=53.866,p=0.000
Behavioural input	0.230	0.054	0.226	4.228	0.000***	1.231			
Cognitive input	0.253	0.055	0.247	4.598	0.000***	1.242			
Emotional engagement	0.346	0.052	0.347	6.689	0.000***	1.154			
Dependent variable: Increased engagement in learning									
D-W value: 1.906									
* $p<0.05$ ** p<0.01 *** p<0.001									

From the previous table, we can see that the entity model equation is: increase in learning input =0.686 0.230* personal behavior input 0.253* cognitive input 0.346* emotional input, the entity model R square value is 0.376, which means that the entity model R square value of personal behavior input is 0.376, which means that personal behavior input, cognitive input and emotional input represent 37.6% of the increase in learning input. This model is based on the F test (f=53.866, p=0.000<0.05), which means that at least one personal behavior, cognitive and emotional input has an impact on the increase of learning input. The D-W value is above and below data 2, which indicates that the entity model has no autocorrelation, and the sample data information has no correlation with the entity model. The final practical analysis shows that.

The correlation coefficient of individual behavior input is 0.230 (t=4.228, p=0.000<0.01), which means that individual behavior input will cause obvious active harm to the increase of learning input.

The correlation coefficient of cognitive input was 0.253 (t=4.598, p=0.000<0.01), indicating that cognitive input was significantly proportional to the increase of learning input.

The correlation coefficient of psychological input is 0.346 (t=6.689, p=0.000<0.01), which means that psychological input will cause obvious active harm to the increase of learning input.

From the summary and analysis, it can be seen that personal behavior, cognition and emotional participation have obvious active harm to the increase of learning participation.

4.6.2. Analysis of the impact of learning engagement influencing factors on the increase of learning engagement

Table 4.17: Results of Linear Regression Analysis (n=272) 2

	Non-standardized coefficients		standardization factor	t	**p**	VIF	R^2	Adjustment R^2	F
	B	Standard error	Beta						
Constants	-0.694	0.273	-	-2.542	0.012*	-	0.512	0.501	*F* (6,265)=46.390,p=0.000
Self-efficacy	0.147	0.050	0.140	2.932	0.004**	1.245			
Technology Acceptance	0.278	0.055	0.248	5.048	0.000***	1.309			
Motivation for learning	0.227	0.052	0.219	4.378	0.000***	1.359			
Teacher Factor	0.176	0.048	0.173	3.698	0.000***	1.193			
Interaction behaviour	0.197	0.054	0.184	3.672	0.000***	1.371			
Environmental factors	0.156	0.049	0.146	3.195	0.002**	1.136			
Dependent variable: Increased engagement in learning									
D-W value: 2.085									
* *p<0*.05 ** p<0.01 *** p<0.001									

It can be seen from the above that self-efficacy, technical acceptance, learning motivation, teacher elements, interactive communication personal behavior and environmental factors are taken as variables, while the increase of learning capital investment is taken as the independent variable of linear regression analysis, The entity model equation is: increase in learning capital investment = -0.694 0.147* self-efficacy 0.278* technical acceptance 0.227* learning motivation 0.176* teacher elements 0.197* interactive communication personal behavior 0.156* environmental factors. The R-square value of this model is 0.512, which means that self-efficacy, technical acceptance, motivation, teacher elements, interactive communication, personal behavior and environmental factors represent a 51.2% increase in learning capital investment. This model is based on the F test (f=46.390, p=0.000<0.05), which means that at least one self-efficacy, technical acceptance, motivation, teacher elements, interactive communication personal behavior and environmental factors have an impact on the increase of learning participation. The D-W value is above and below data 2, which indicates that the entity model has no autocorrelation, and the sample data information has no correlation with the entity model. The final actual analysis shows that

The regression coefficient of self-efficacy was 0.147 (t=2.932, p=0.004<0.01), which means that self-efficacy is significantly proportional to the increase of learning participation.

The regression coefficient of technical acceptance is 0.278 (t=5.048, p=0.000<0.01), which means that technical acceptance will cause obvious active harm to the increase of learning capital investment.

The regression coefficient of learning motivation is 0.227 (t=4.378, p=0.000<0.01), which means that learning motivation causes obvious active harm to improving learning participation.

The regression coefficient of teacher factor was 0.176 (t=3.698, p=0.000<0). 01), indicating that the teacher factor has obvious positive harm to the increase of

learning capital investment.

The regression coefficient of interaction is 0.197 (t=3.672, p=0.000<0.01), which means that interactive personal behavior has obvious active harm to the increase of learning participation.

The regression coefficient of environmental factors is 0.156 (t=3.195, p=0.002<0.01), which means that environmental factors have obvious active harm to the increase of learning capital investment.

Summary and analysis: self-efficacy, technical acceptance, motivation, teacher elements, interactive communication, personal behavior and environmental factors all have obvious active harm to the increase of learning participation.

CHAPTER 5
CONCLUSION AND DISCUSSION

5.1 Conclusion and Interpretation of Findings

According to ANOVA, correlation and regression analysis, there are nine important variables that affect the dependent variable student engagement in the smart classroom environment.

5.1.1 Behavioural engagement, which implies that students' behavioural engagement is very important in increasing students' engagement in learning in the smart classroom environment at Baise University, a finding that is consistent with previous research related to student engagement in learning (Angelino & Natvig, 2009) which suggests that Personal behavior participation refers to the compressive strength of students' participation in learning activities, including collaborative learning, cooperative learning and student interaction, including students' participation in the smart classroom.

5.1.2 Cognitive ability participation, which represents students' personal behavior participation, is very important for improving students' participation in the natural environment of intelligent classroom teaching in Colleges and universities in Baise. This discovery is consistent with the previous analysis on the difference of learning quality: I. conclusion and the whole process (Marton & Saljo, 1976). It is found that in every scientific research, it is possible to identify some types including root differences (conclusion level). The corresponding difference of processing level is expressed as whether the learner is involved in the relative processing level, and is expressed as whether the learner is involved in the surface production and processing or in-depth production and processing. Mastery learning promotes surface learners to obtain better quantitative analysis conclusions in learning, but there are also risks. One of the specific objectives of learning and training is to improve the higher-end cognitive process.

5.1.3 Emotional capital investment, which means that emotional capital investment is very important to improve the training capital investment of students in the natural environment of intelligent classroom teaching in Colleges and universities in Baise. This discovery is consistent with the previous scientific research motivation of classroom teaching - the interaction between teachers' personal behavior and students' participation in all school years (Skinner & Belmont, 1993), that is, emotional participation refers to the emotional experience with students in the classroom. Active emotion means that students are interested in the course content in the smart classroom and show sufficient learning behavior.

5.1.4 Self-efficacy, which means that self-efficacy is very important to improve students' participation in learning and training in the natural environment of intelligent classroom teaching in Universities in Baise. This discovery is consistent with previous scientific research

The present situation of the investment in the study and training of college students and the countermeasures to improve it (Liao & Huang (2009), suggesting that researchers have concluded that self-efficacy has an impact on learning engagement, that this impact is positive, and that organisational level self-efficacy is significantly and positively related to levels of learning engagement.

5.1.5 Accepting new technologies means that it is very important for students to accept new technologies to improve students' participation in learning and training in the natural environment of intelligent classroom teaching in Baise universities, a finding that is consistent with A Study of Cognitive Engagement in Secondary Schools in a Technology-Rich Environment (Gebre, Saroyan, & Bracewell, 2014), suggesting that increasing students' information literacy and improving the assessment and interaction functions of technology platforms have a positive impact on students' cognitive engagement levels. Furthermore, students with higher levels of technology use in a technology-rich environment more often used active and interactive cognitive strategies.

5.1.6 motivation to learn, which implies that motivation to learn is important for increased student engagement in the natural environment of intelligent classroom teaching in Colleges and universities in Baise, this finding is consistent with the previous research on improving students' learning motivation in classroom teaching (Purnamasari, Hadi, & Istiyono, 2018), which believes that learning motivation is related to students' wishes or willingness to participate in learning training; Therefore, students' motivation plays a key role in students' learning motivation. Learning motivation is related to students' desire or willingness to participate in learning and training. Therefore, student motivation plays a key role in students' performance. Learning motivation is a major aspect of the learning process, because it helps to complete the assessment indicators and maintain academic performance.

5.1.7 Teacher awareness, which means that teacher awareness is very important to improve students' participation in learning and training in the natural environment of intelligent classroom teaching in Colleges and universities in Baise. This discovery is consistent with the previous research conclusion on the mediating role of students' learning self-efficacy in test anxiety and This finding is consistent with previous research on the mediating role of high school students' learning self-efficacy in test anxiety and learning engagement (Xu, Xia, & Pang, 2021), which suggests that teachers' IT application ability and their teaching level in the smart classroom, whether teachers are proficient in applying IT teaching tools in the smart classroom, whether teachers can design teaching activities with the characteristics of the smart classroom and can use technology to support innovative teaching models and guide students' learning to think and solve problems. The teacher's teaching activities and teaching behaviors are a key part of the teacher's learning. Teachers' teaching activities and behaviors are important factors influencing learning engagement.

This finding is consistent with the previous scientific research motivation of classroom teaching, that is, the interaction between teachers' personal behavior and

students' participation in all academic years (Skinner & Belmont, 1993). This study found that teacher-student interaction has obvious harm to learning participation, and active teacher-student interaction has active harm to learning participation.

5.2 Research Implication and Recommendations for Further Research

5.2.1 Discussion on students' participation in intelligent classroom environment

From the questionnaire survey and statistical analysis of interview data in the previous section, it can be seen that students' participation in the intelligent classroom environment is high, indicating that the intelligent classroom environment has active harm to students' learning participation.

5.1.1 Smart classroom environments at Bacchus colleges have a positive impact on students' financial investment in learning

Based on the analysis of data on various aspects of university students' learning engagement in the smart classroom environment, it can be found that the average level of university students' learning engagement in the smart classroom environment is high. In the smart classroom, the mean values for personal behaviour, cognitive ability and emotional capital engagement were 3.94, 3.83 and 3.95 respectively, all of which were higher than the mean value of 2.5, indicating that university students' personal behaviour, cognitive ability and emotional capital engagement were high and in an active state. In a smart classroom environment, teachers can use new technologies such as interactive whiteboards and multi-screen projections to enrich teaching strategies and assessment methods to meet classroom teaching requirements. In classroom teaching, teachers can organize collaborative learning in work groups, work presentation, reporting and exchange, mutual evaluation and other classroom teaching according to the course content and schedule, with learners as the core, making students the masters of the classroom, giving them a lot of classroom management rights, stimulating students' learning motivation,

increasing students' enthusiasm for learning, enhancing students' personal behavioral involvement and whole-person emotional involvement. The classroom can have an impact on university students' learning.

5.2.2 In the natural environment of the smart classroom, there were no significant differences in the learning status of university students in terms of gender and individual behavioural engagement

The results of data analysis show that there is no significant difference between the sexes in students' participation in classroom learning and training. It can be seen from the previous data analysis that there is no significant difference between the gender versions in this analysis in terms of cognitive capital investment, affective engagement, learning engagement status, self-efficacy, technology acceptance, motivation, teacher factors, interaction behaviour, environmental factors, factors influencing learning engagement and learning engagement. The gender sample showed a significant difference in behavioural engagement, i.e. girls had significantly higher behavioural engagement than boys.

5.3 Impact of factors influencing students' engagement in learning in the smart classroom environment at Baise University on the increase of learning engagement

In this study, the factors influencing students' engagement in learning in the smart classroom environment at Baise University included self-efficacy, technology acceptance, motivation, teacher factors, interactive behaviours and environmental factors. Self-efficacy, also known as academic self-efficacy, is the student's confidence in being able to complete their studies and achieve a certain level of success, as well as their judgments of their own learning ability. The results of the study show that in the smart classroom environment, students' self-efficacy has a direct and significant impact on their engagement in learning. When students' self-efficacy is high, i.e. when they believe they can complete their learning tasks and

achieve their desired learning goals through hard work, they are more willing to engage in learning more actively, actively participate in classroom activities organised with the teacher, and face difficulties and problems in the learning process. When faced with difficulties and problems in the learning process, students will choose to face the challenges head-on, adopt a positive attitude, take the initiative to explore and put in the necessary effort to use a variety of methods to solve the difficulties. Conversely, the lower the self-efficacy, the less engaged students are in the classroom, the more passive they are and the less engaged they are in the classroom. In the actual teaching process, it is often easier for teachers to find out whether students are actively participating in cooperative group learning and interacting with the teacher. Technology acceptance refers to students' The convenience (PEU) and applicability (PU) of technical special tools in intelligent classroom environment and the harm of technology in IT classroom teaching environment to students' learning participation cannot be ignored.

Scientific research results show that in the intelligent classroom environment, technical acceptance has an immediate and obvious harm to the learning capital investment of college students, and technical acceptance is highly proportional to personal behavior, cognitive ability and emotional capital investment. In the intelligent classroom environment, students' activity content is based on the learners' mobile client, interactive whiteboard, multi-screen projection and other technologies. They must use this technology to participate in classroom teaching, regardless of their technical acceptance of those facilities and systems. When students feel that the supporting facilities and mobile phone software in the smart classroom environment are conducive to their learning and want to actively carry out the classroom, their learning motivation is significantly improved, which endangers their progress in the classroom.

Motivation refers to the mentality of learners in the intelligent classroom in order to better meet special requirements. It comes from the achievement of learning

requirements. The results of this study show that in the intelligent classroom environment, motivation has immediate and obvious harm to students' participation. In the intelligent classroom environment, the higher the motivation, the higher the classroom participation.

Teachers' elements mainly include teachers' educational ability in intelligent classroom and teachers' information technology work ability. In the intelligent classroom, teachers can integrate the characteristics of the intelligent classroom to design classroom teaching, and independently innovate teaching methods and strategies. Teachers can correctly guide students' learning by using the equipment, mobile phone software and information technology learning tools in the intelligent classroom.

Technical special tools related to itch. The entity model shows that teachers' factors do not directly harm students' learning capital investment, but have obvious positive harm to learning capital investment according to the indirectness of learning motivation. The teacher's leading role in the classroom shows that the teacher element is very important at the level of harming students. In a smart classroom environment, teachers can use a variety of teaching equipment and mobile phone software to correctly guide students to carry out a variety of classroom teaching, such as collaborative working group learning and independent research learning, and give teachers a large number of teaching methods and classroom teaching evaluation and selection. In classroom teaching, teachers can comment on students according to their main classroom performance, encourage students to speak actively, and carry out various classroom teaching, arouse their learning motivation, and then enhance their learning participation.

Interactive communication personal behavior refers to cooperative learning and teacher-student interaction in the classroom. Cooperative learning refers to teachers' individual educational behaviors in an intelligent classroom environment, such as efficient classroom teaching interaction with students, encouraging students to

actively carry out collaborative working group learning, etc. Student interaction refers to the communication, discussion, evaluation and performance between students according to questions or daily tasks in an intelligent classroom environment. Cooperative learning and student interaction under technical support are significantly and positively correlated with university students' level of engagement in learning. The analysis shows that in the smart classroom environment, group members and groups can interact with each other through electronic interactive whiteboards, classroom learning software and forums. The communication platform carries out interactive activities such as sharing learning resources, discussing learning contents, reporting learning results, evaluation and feedback, etc. In the process of learning interaction, peers cooperate with each other, influence and help each other, which is conducive to the formation of a learning community, thus increasing the level of learning engagement.

Environmental factors refer to the hardware environment and software environment in the smart classroom. The hardware environment includes the smart classroom electronic interactive whiteboard, wall-mounted LCD screen, mobile tables and chairs and network infrastructure, etc. The software environment mainly refers to teaching resources and learning software. From the model, it is clear that environmental factors have a significant direct impact on learning engagement. The hardware facilities in the smart classroom environment provide students with a comfortable and comfortable learning environment. The electronic interactive whiteboard, wireless screen projection, and free mobile spliced seats also facilitate students' participation in the classroom. The learning software environment provides students with a wide variety of learning materials that they can download and use on demand.

5.4 Limitations of the Study

There are many reasons that seriously endanger learners' participation in learning. Although the minor editor selects the influencing factors based on the paper references, basic knowledge research and interview methods, it is inevitable to ignore some influencing factors.

The analysis in this paper points out some countermeasures to encourage learning investment funds. However, this countermeasure has not been further verified, so it is difficult to understand its effectiveness in practical application.

In addition to the investment of learning funds, learners' requirements will also endanger learners' application of intelligent classrooms. This is the research on the investment of learners' learning funds, not the harm of learners' requirements to the application of intelligent classrooms.

The key of this study is to explore from the direction of college students, and to carry out poor testing on the research related to the teacher population, which is also a major factor that endangers the participation and teaching level of students. It is expected to be improved again in future research.

Although this study has its limitations, it still has its advantages. The establishment of the entity model of the influencing factors of learning capital investment has given some practical value for the following related research. Future researchers can basically carry out a deeper exploration in the entity model established in this paper. It also brings practical foundation for formulating countermeasures and ways to improve the learning participation level of college students in the intelligent classroom. The creators expect that future research can progress and improve this method again, and expect that relevant research can be carried out in a large number of intelligent classrooms in Colleges and universities, further enrich the research on the influencing factors of learning participation of primary and secondary school students in intelligent classrooms, and promote the development trend of intelligent education in Colleges and universities.

The findings of this study are only applicable to students at Baise University. It may not be applicable to other universities either, and has certain limitations.

5.5 Suggestions for the Next Step of the Study

According to the "i-e-o" entity model of Astin, the basic theory of learning input of Kuh (2009) and the basic theory of three element interactive communication management decision-making of Bandura, and referring to the path map and data model, this study investigated the situation of learning input in the natural environment of intelligent classroom teaching and the elements endangering learning input. This study investigates the status of learning input in the natural environment of intelligent classroom teaching and the factors that harm learning input. On this basis, the author clearly puts forward the following aspects for further discussion.

5.5.1 In the future research, we can explore the influencing factors of learning engagement in a deeper and more comprehensive way from different perspectives.

5.5.2 The author mainly discusses the influencing factors of students' learning input in the natural environment of intelligent classroom teaching from the two aspects of College Students' essential elements and external factors, but does not discuss the influencing factors of students' learning input from the level of College Students' experience in the application of intelligent classroom teaching. Future research can investigate the influencing factors of the skin experience of students at different levels using the smart classroom, so as to master other influencing factors of learning investment.

5.5.3 Change the research angle. Explore the learning input and influencing factors from the teacher community; take learning input as an intermediate variable to introduce learning profit and learning effectiveness in detail.

5.5.4 Improve research ideas. In this study, the quasi experimental method is used to compare the learning input in the natural environment of the intelligent classroom with that in the traditional multimedia classroom or interactive whiteboard,

so as to discuss whether the learning input of different types of teachers is significantly different.

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APPENDICES

Appendix A

Interview Questionnaire

Ladies and Gentlemen.

I am a student at Bangkok University, majoring in Master of Business Innovation.

In order to complete my Independent Study (IS) - Exploring the current state and factors influencing university students' learning engagement in a smart classroom environment at Baise University. The Case of Baise University, I would like to conduct an interview with you. I need your cooperation, which is much appreciated.

I promise that the interview will be used for learning purposes only, not for any commercial purposes, and that I will keep it confidential.

1. What is your gender?

☐ Male ☐ Female

2. How old are you?

☐ Under 30 years old ☐31-40 years old

☐ 41-50 years old ☐ 51-60 years old

3. What is your identity at school?

☐ Teacher ☐ Students

Index	Questions	Answers	Remark
Q1	1. (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.		
Q2	2. (1) What do you think about the emotional aspects of the students in the classroom in the smart classroom environment? (e.g. positively engaged, negatively engaged, etc.) (2) Specify how students behave in class.		
Q3	3. What methods do teachers use to engage students in classroom activities in the smart classroom environment? (e.g. teacher-student interaction, student participation in cooperative learning, student-student interaction, etc.)		
Q4	4. (1) In a smart classroom environment, do you think the students can understand the content of the teacher's lessons? (2) What do the students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)		
Q5	5. (1) Are modern technological tools acceptable to you in a smart classroom environment? (2) How has it affected your classes?		

Index	Questions	Answers	Remark
Q6	6. (1) What is your motivation for learning in a smart classroom environment? (2) What factors influence your motivation to learn?		
Q7	7. (1) How do you feel the teacher influences your lessons in a smart classroom environment? (2) What do you think teachers need to do to enable students to learn better?		
Q8	8. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)		
Q9	9. In a smart classroom environment, what technology in the classroom do you find helpful for student learning?		

Appendix B

Original Recorded Data of Interview

QUESTION 1:

1. (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.)

(2) Tell us your understanding for each category of students.

Respondent 1 Answer

1.1.1 I think there is rote learning, self-understanding, reliance on peer understanding and reliance on teacher understanding.

1.1.2 I think shallow rote learning is because the knowledge is not well understood. Deep self-understanding is the result of thinking for oneself and translating the knowledge into one's own set of logic. Relying on the understanding of classmates because their understanding is closer to one's own way of thinking. Reliance on the teacher's understanding is because one already has a habitual memory of the teacher's combing.

Respondent 2 Answer

1.2.1 Superficial rote learning and reliance on classmates and teachers for understanding.

1.2.2 Superficial rote learning: memorising knowledge content for exam purposes.

Dependence on classmates and teachers for understanding: when students are working on after-school assignments and encounter problems that they do not know how to solve, they will ask their classmates around them for help, and when none of

the classmates around them know how to solve the problem, they will contact their teachers for help in answering the problem.

Respondent 3 Answer

1.3.1 Does not understand at all; understands a little; understands most, understands completely.

1.3.2 Does not understand at all: Does not listen carefully in class, does not have the foundation, and does not make up for it in time after class, forming a vicious circle, and does not write homework Knowing a little: having a foundation; half-listening in class, not doing homework

Understands most: listens carefully in class; does not do homework and revision carefully in class

Understands completely: pre-reading before class; listening carefully in class, reviewing after class and writing assignments from the teacher

Respondent 4 Answer

1.4.1 There is shallow rote learning, deep self-understanding and teacher-dependent understanding.

1.4.2 For students with shallow rote learning, they do it more often because they do not have time to revise before the examination; for students with deep self-understanding, they will listen carefully to the teacher in class and learn what they do not understand by reading examples and watching relevant videos after class; for students who rely on the teacher for understanding For those who rely on the teacher's understanding, they usually do not study before class and will only learn new knowledge by listening to the teacher's lectures.

Respondent 5 Answer

1.5.1 Read books on your own (rarely listen to lectures during class time), memorise them by rote, and take them on a whim before the exam.

1.5.2 Read books on their own: feel that there is no need to attend classes, do not listen or listen less to the teacher, prefer to investigate deeply on their own, and also communicate with their classmates

Rote learning: listen carefully in class, memorise the key points covered by the teacher, and spend time in class memorising them so that they can be revisited afterwards.

The pre-testing period is a time when you don't listen carefully to the lectures and don't look at the books after class.

Respondent 6 Answer

1.6.1 Superficial rote learning, deep self-understanding, reliance on classmates and teachers for understanding

1.6.2 rote learning: students may not be very good at understanding and lack comprehension skills; deep self-understanding: students have good comprehension skills and are relatively active; reliance on peers and teachers for understanding: students have some comprehension skills, but self-discipline needs to be improved and needs to be monitored.

Respondent 7 Answer

1.7.1 Knowledge is superficially known, deeply known and deeply understood.

1.7.2 Students with superficial knowledge will mostly learn by rote and will not have a deep understanding. Students with deep knowledge will be able to understand what the teacher says, and students with deep knowledge will be able to understand and grasp the knowledge without the teacher talking about it.

Respondent 8 Answer

1.8.1 Rote memorization, 2. Deep self-understanding 3. Understanding through some specific study skills 4. Communicative understanding through teachers and classmates

1.8.2 .students who learn by rote, who have no method of learning ability skills and cannot fully grasp what they have learned, which is passive learning. 2. students who learn through deep self-understanding, which shows that they can fully grasp what they have learned and can apply their knowledge through their own language, this type of student will make great progress. 3. students who learn through some special learning techniques, which shows a strong learning ability and a good way of thinking. 4. Students who understand through a communicative approach between teacher and student. These students have a good attitude to learning and are able to use the teacher's and their classmates' opinions to analyse and understand, indicating a very active and motivated approach.

Respondent 9 Answer

1.9.1 ① Understands thoroughly and completely ② Can carry out an inversion ③ Understands only superficially

1.9.2 Category 1 students can apply their knowledge well to solve moderately difficult questions, and struggle somewhat with more difficult ones, requiring more thought.

Category 2 students can apply their knowledge flexibly and see through the questioner's intentions.

Category (iii) students also need to improve their understanding and study in depth.

Respondent 10 Answer

1.10.1 Deep self-understanding.

1.10.2 Students with superficial rote learning do not think actively and boldly enough; students with deep self-understanding are open and varied and bold; students who rely on their peers and teachers for understanding have weak independent thinking skills and single-minded ideas.

QUESTION 2:

2. (1) What do you think about the emotional aspects of the students in the classroom in the smart classroom environment? (e.g. positively engaged, negatively engaged, etc.)

(2) Specify how students behave in class.

Respondent 1 Answer

2.1.1 I feel that there is both positive and negative input.

2.1.2 Positive students will interact positively with the teacher. Negative students, on the other hand, do not think for themselves and do whatever the teacher tells them.

Respondent 2 Answer

2.2.1 Active input.

2.2.2 Actively answer questions or ask questions promptly when they are interested or important to them.

Respondent 3 Answer

2.3.1 Seriously positive; semi-positive and semi-negative; negative.

2.3.2 Attentive and active: students listen attentively and do not desert throughout the lesson online Half-active and half-negative: pupils sometimes listen to

the lesson and sometimes talk to the person next to them.

Negative: dozed off throughout; did not listen carefully to the lecture.

Respondent 4 Answer

2.4.1 There are positive and negative expressions of engagement.

2.4.2 Actively engaged students listen attentively to lessons and also ask questions that they do not understand for the teacher to answer. Negatively engaged students do not pay much attention in class.

Respondent 5 Answer

2.5.1 Students were actively engaged and able to answer interactive questions from the teacher during the lesson, and were able to extend their knowledge beyond the teacher's own knowledge and could expand to all aspects of the subject they wanted to link to.

2.5.2 When the teacher asks a question there is a positive response from the students. The addition of pictures makes the students refreshing and increases their impression of the knowledge and better grasp of it.

Some of the students who are more associative are good at coming up with topics related to the points, which makes the class more lively

The students were motivated to participate in the class and remember the knowledge through the extension of knowledge.

Respondent 6 Answer

2.6.1 There is both negative and positive input.

2.6.2 Students who were actively engaged actively interacted with the teacher and participated in class; students who were negatively engaged did not speak.

Respondent 7 Answer

2.7.1 Most active input.

2.7.2 Most of the students were able to listen carefully to the teacher and take notes on their own, while a small number of students would drift off and play with their mobile phones.

Respondent 8 Answer

2.8.1 More active, actively engaged and better understood

2.8.2 Can answer teacher questions positively and is more active, also communicates with the teacher to learn.

Respondent 9 Answer

2.9.1 Some students are more attentive to the lesson, while others tend to be distracted and run off.

2.9.2 Some students listen carefully, take active notes and ask or answer questions, while others do not actively participate in class activities and desert.

Respondent 10 Answer

2.10.1 Proactive.

2.10.2 We are motivated in the first 20 minutes of class and our spirits become lax and loose towards the end of class.

QUESTION 3:

3. (1) What do you think about the emotional aspects of the students in the classroom in the smart classroom environment? (e.g. positively engaged, negatively engaged, etc.)

(2) Specify how students behave in class.

Respondent 1 Answer

3.1.1 Teacher-student interaction and collaborative student learning.

Respondent 2 Answer

3.2.1 Teacher-student interaction and student participation in collaborative learning.

Respondent 3 Answer

3.3.1 Teacher-student interaction, student participation in cooperative learning, student-student interaction and group learning.

Respondent 4 Answer

3.4.1 There is teacher-student interaction and student-student interaction.

Respondent 5 Answer

3.5.1 Teacher-student interaction and student-student interaction are combined in a better way to integrate students into the classroom.

Respondent 6 Answer

3.6.1 Teacher-student interaction and student participation in collaborative learning.

Respondent 7 Answer

3.7.1 Teacher-student interaction and group discussion

Respondent 8 Answer

3.8.1 Teacher-student interaction

Respondent 9 Answer

3.9.1 Ask students questions, students do group activities and students participate in lectures.

Respondent 10 Answer

3.10.1 Teacher-student interaction Students participate in learning activities.

QUESTION 4:

4. (1) In a smart classroom environment, do you think the students can understand the content of the teacher's lessons? (2) What do the students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)

Respondent 1 Answer

4.1.1 Different students have different circumstances; some students can and some cannot.

4.1.2 For example, if they encounter a problem, they skip it, or if they don't think about it and go straight to someone for an answer, or if they try to think about it on their own, and if they can't solve it themselves, they go to a classmate or teacher to try to solve it.

Respondent 2 Answer

4.2.1 Can understand.

4.2.2 Through internet technology, it is possible to find ways to respond with confidence.

Respondent 3 Answer

4.3.1 It is generally understood if one listens carefully.

4.3.2 Confidence that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.

Respondent 4 Answer

4.4.1 Students who listen attentively can understand the content of the teacher's lessons, while those who do not listen attentively will miss some of the key points because they are distracted and are less able to understand the content of the teacher's lessons.

4.4.2 Students will think that the teacher has a poor memory but trust that the teacher will have the confidence to find a way to cope with the situation.

Respondent 5 Answer

4.5.1 The vast majority of the lectures were comprehensible when listened to, and interactive education enabled the students to better remember the points.

4.5.2 Most of the students preferred to work out the questions on their own before asking the teacher to answer them, a process that enabled them to remember the points better.

Respondent 6 Answer

4.6.1 Students who work hard and are motivated to learn understand the teacher's lessons better.

4.6.2 Work out your own solutions after the lesson.

Respondent 7 Answer

4.7.1 Mostly understandable.

4.7.2 Take the initiative to ask the teacher if they do not understand something and try to solve the problem by themselves after class.

Respondent 8 Answer

4.8.1 Part of it may.

4.8.2 See a teacher or classmate between classes to try to solve problems in a timely manner.

Respondent 9 Answer

4.9.1 is possible.

4.9.2 Ask questions on the spot and seek help from the teacher to solve problems.

Respondent 10 Answer

4.10.1 Able.

4.10.2 Confidence in finding ways to respond.

QUESTION 5:

5. (1) Are modern technological tools acceptable to you in a smart classroom environment?

(2) How has it affected your classes?

Respondent 1 Answer

5.1.1 I can understand and accept technological tools to aid teaching and learning.

5.1.2 The acceptance of modern technology allows me to learn better.

Respondent 2 Answer

5.2.1 Acceptable.

5.2.2 It can better grasp the basic theory of IoT technology and also better expand our professional knowledge, which can arouse my great interest in learning.

Respondent 3 Answer

5.3.1 Acceptable.

5.3.2 Problems with the machine can affect the progress of the lesson.

Respondent 4 Answer

5.4.1 is largely acceptable and can be adapted to slowly.

5.4.2 I think the information-based learning tools in the Smart Classroom are helpful to my learning

Respondent 5 Answer

5.5.1 Acceptance.

5.5.2 To provide more time to get to know unseen teaching methods, without knowing them deeply, first will follow the previous teaching methods and wait until

they are familiar to make the students refreshing.

Respondent 6 Answer

5.6.1 Acceptable.

5.6.2 Convenience but no guarantee of class effectiveness

Respondent 7 Answer

5.7.1 Yes, I wish the class was more lively and interesting.

5.7.2 No significant impact

Respondent 8 Answer

5.8.1 Able.

5.8.2 The impact is not significant.

Respondent 9 Answer

5.9.1 is possible.

5.9.2 Sometimes network or equipment problems can affect class progress and class atmosphere.

Respondent 10 Answer

5.10.1 is possible.

5.10.2 The first wisdom teaching has a freshness that attracts our attention and memorises the content of the lesson. Secondly, it enhances motivation, stimulates interest in learning and increases the efficiency of classroom learning.

QUESTION 6:

6. (1) What is your motivation for learning in a smart classroom environment?

(2) What factors influence your motivation to learn?

Respondent 1 Answer

6.1.1 Study well to learn how to make money.

6.1.2 Economic, social, environmental, etc.

Respondent 2 Answer

6.2.1 Curiosity about knowledge and the desire to acquire it.

6.2.2 Visualisation of the smart classroom, and perception, peer recognition, and teacher praise.

Respondent 3 Answer

6.3.1 Study well enough to be able to establish themselves in society and to find a stable job, with the hope of gaining knowledge.

6.3.2 Recreational equipment, various life chores, praise from emotional teachers.

Respondent 4 Answer

6.4.1 Learning the subjects to be studied also provides a good foundation for those to be studied later.

6.4.2 I want to be recognized by my teachers and classmates.

Respondent 5 Answer

6.5.1 A better future. A better quality of life.

6.5.2 Love, friendship, kinship, stumbles between classmates, and teacher

recognition.

Respondent 6 Answer

6.6.1 Learn more.

6.6.2 Learn more.

Respondent 7 Answer

6.7.1 Acquire knowledge and skills to improve their general quality.

6.7.2 School environment, living environment.

Respondent 8 Answer

6.8.1 Acquire well the knowledge taught by their teachers so that they can apply it in society.

6.8.2 Psychological factors.

Respondent 9 Answer

6.9.1 Learn and acquire knowledge.

6.9.2 Personal and environmental factors.

Respondent 10 Answer

6.10.1 I have no examples of failed innovations.

6.10.2 Broaden your horizons and increase your knowledge of ideas to improve your abilities and knowledge, and also to gain credits to be able to graduate and thus find a good job.

6.10.2 Whether you can improve yourself, how many credits you have, and how important this matter is to you.

QUESTION 7:

7. (1) How do you feel the teacher influences your lessons in a smart classroom environment?

(2) What do you think teachers need to do to enable students to learn better?

Respondent 1 Answer

7.1.1 The teacher's praise will give make me more motivated to study.

7.1.2 I feel that there is a need for students to interact more with the teacher and to use more information technology tools to interact with students.

Respondent 2 Answer

7.2.1 The teacher can guide our learning and give us a better understanding of the course content.

7.2.2 Teachers are expected to make full use of information technology tools and to use technological innovations in their teaching models.

Respondent 3 Answer

7.3.1 No effect.

7.3.2 The teacher has done a good job

Respondent 4 Answer

7.4.1 None.

7.4.2 Use more information technology tools to interact with classmates and make the lesson interesting.

Respondent 5 Answer

7.5.1 Instead of using the blackboard only to teach students, teachers will teach students with more and better classroom interaction.

7.5.2 Possess an excellent work ethic and be cordial and amiable.

Respondent 6 Answer

7.6.1 There is no way to ensure the quality of the lessons.

7.6.2 Returning the classroom to the students and making them the protagonists of the classroom.

Respondent 7 Answer

7.7.1 There is no significant impact.

7.7.2 Interact more with students, form occasional activities and have a positive and active atmosphere in class.

Respondent 8 Answer

7.8.1 Not adequately understood without face-to-face communication.

7.8.2 It is possible to allow some time in class for our students to learn on their own and then share with their fellow teachers.

Respondent 9 Answer

7.9.1 Sometimes there are delays due to unfamiliarity with the operation of the equipment.

7.9.2 Become familiar with the operation of the equipment and prepare lessons in advance.

Respondent 10 Answer

7.10.1 By providing a deep learning environment through the manipulation of smart classroom equipment, the teacher sets reasonable learning tasks and provides an environment of enquiry to increase our level of behavioural engagement, enabling us to quickly enter a deep learning state and thus gain an enjoyable emotional

experience.

7.10.2 Increase the number of fun activities and interactive sessions between teachers and students in the classroom to expand and extend more knowledge, broaden our knowledge horizons and develop our school information more for us to think independently.

QUESTION 8:

How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)

Respondent 1 Answer

8.1.1 Use of information technology tools for interaction.

Respondent 2 Answer

8.2.1 Use information technology tools to interact and guide student learning.

Respondent 3 Answer

8.3.1 Use information technology tools for interaction, guided student learning, and instructional activity design.

Respondent 4 Answer

8.4.1 Will interact and guide student learning through information technology tools.

Respondent 5 Answer

8.5.1 The teacher asks questions to be answered by the students.

Respondent 6 Answer

8.6.1 Use information technology tools to interact and guide student learning.

Respondent 7 Answer

8.7.1 Use of information technology tools for interaction, plus teaching and learning activities

Respondent 8 Answer

8.8.1 Interaction through information technology tools

Respondent 9 Answer

8.9.1 Use the software to randomly call out answers to questions and play trivia games to call out names.

Respondent 10 Answer

8.10.1 Information technology tools for interaction.

QUESTION 9:

In a smart classroom environment, what technology in the classroom do you find helpful for student learning?

Respondent 1 Answer

9.1.1 I found the screen recording function of the Smart Classroom to be very helpful.

Respondent 2 Answer

9.2.1 LED display systems, classroom systems

Respondent 3 Answer

9.3.1 Whiteboard, computer, screen casting.

Respondent 4 Answer

9.4.1 Making a video recording of the lesson is beneficial for students to watch it again if they do not understand it.

Respondent 5 Answer

9.5.1 Multimedia playback of videos

Respondent 6 Answer

9.6.1 Record the lesson to show the playback to the students.

Respondent 7 Answer

9.7.1 Projection screen, blackboard, chairs, etc.

Respondent 8 Answer

9.8.1 Group discussion speech system

Respondent 9 Answer

9.9.1 After projecting the PPT, you can write directly on the screen to explain the knowledge, and you can play videos of the relevant knowledge on the Internet to help students understand.

Respondent 10 Answer

9.10.1 Online Interactive Interaction Live Recorded On-demand Enables us to review course content at any time and allows for learning and interaction across classroom campus areas. The board can be written with an electronic pen, reducing dust damage to students. The teaching process is data driven, so that students and teachers do not need to worry about grades, attendance, etc. More time and energy can be devoted to learning and learning efficiency can be improved.

Appendix C

Finding and Analysis of Interviews

No.	Age	Sex	Occupation	Education
Respondent 1	20 years old.	Female,	student	Bachelor's degree
Respondent 2	21 years old	Male	Students	-
Respondent 3	20 years old	male	student	undergraduate
Respondent 4	19 years old	female	Student	BSc
Respondent 5	22 years old	female	Student	undergraduate
Respondent 6	37 years old	male	Associate Professor	BSc
Respondent 7	19 years old	female,	student,	undergraduate
Respondent 8	38 years old	male	Lecturer	Master's degree
Respondent 9	35 years old,	female	Lecturer	Master's students
Respondent 10	46 years old	male	Professor	Master

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
1. (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.						
1.1.1 I think there is rote learning, self-understanding, reliance on peer understanding and reliance on teacher understanding.	1.2.1 Superficial rote learning and reliance on classmates and teachers for understanding. 1.2.2 Superficial rote learning: memorising knowledge content for exam purposes.	1.3.1 Does not understand at all; understands a little; understands most, understands completely 1.3.2 Does not understand at all:	1.4.1 There is shallow rote learning, deep self-understanding and teacher-dependent understanding. 1.4.2 For students with shallow rote learning,	1.5.1 Read books on your own (rarely listen to lectures during class time), memorise them by rote, and take them on a whim before the exam.	1.6.1 Superficial rote learning, deep self-understanding, reliance on classmates and teachers for understanding	1.7.1 Knowledge is superficially known, deeply known and deeply understood. 1.7.2 Students with superficial knowledge will mostly learn by rote and will not have a deep understanding.

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
1. (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.						
1.1.2 I think shallow rote learning is because the knowledge is not well understood. Deep self-understanding is the result of thinking for oneself and translating	Dependence on classmates and teachers for understanding: when students are working on after-school assignments and encounter problems that they do not know how to solve,	Does not listen carefully in class, does not have the foundation, and does not make up for it in time after class, forming a vicious circle, and does not write homework Knowing a little:	they do it more often because they do not have time to revise before the examination; for students with deep self-understanding, they will listen carefully to the teacher in class	1.5.2 Read books on their own: feel that there is no need to attend classes, do not listen or listen less to the teacher, prefer to investigate deeply on their own,	1.6.2 rote learning: students may not be very good at understanding and lack comprehension skills; deep self-understanding: students have good	Students with deep knowledge will be able to understand what the teacher says, and students with deep knowledge will be able to understand and grasp

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
1. (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.						
the knowledge into one's own set of logic. Relying on the understanding of classmates because their understanding is closer to one's own way of thinking.	they will ask their classmates around them for help, and when none of the classmates around them know how to solve the problem, they will contact their teachers for help in answering the problem.	having a foundation; half-listening in class, not doing homework Understands most: listens carefully in class; does not do homework and revision carefully in class	and learn what they do not understand by reading examples and watching relevant videos after class; for students who rely on the teacher for understanding For those who rely on the teacher's understanding,	and also communicate with their classmates. rote learning: listen carefully in class, memorise the key points covered by the teacher, and spend time in class memorising	comprehension skills and are relatively active; reliance on peers and teachers for understanding: students have some comprehension skills,	the knowledge without the teacher talking about it.

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
1. (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.						
Reliance on the teacher's understanding is because one already has a habitual memory of the teacher's combing.		Understands completely: pre-reading before class; listening carefully in class, reviewing after class and writing assignments from the teacher	they usually do not study before class and will only learn new knowledge by listening to the teacher's lectures.	them so that they can be revisited afterwards. The pre-testing period is a time when you don't listen carefully to the lectures and don't look at the books after class.	but self-discipline needs to be improved and needs to be monitored.	

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
2. (1) What do you think about the emotional aspects of the students in the classroom in the smart classroom environment? (e.g. positively engaged, negatively engaged, etc.) (2) Specify how students behave in class.						
2.1.1 I feel that there is both positive and negative input. 2.1.2 Positive students will interact positively with the teacher. Negative students,	2.2.1 Active input. 2.2.2 Actively answer questions or ask questions promptly when they are interested or important to them.	2.3.1 Seriously positive; semi-positive and semi-negative; negative. 2.3.2 Attentive and active: students listen attentively and do not desert throughout the lesson online	2.4.1 There are positive and negative expressions of engagement. 2.4.2 Actively engaged students listen attentively to lessons and also ask questions that	2.5.1 Students were actively engaged and able to answer interactive questions from the teacher during the lesson, and were able to extend their knowledge beyond	2.6.1 There is both negative and positive input. 2.6.2 Students who were actively engaged actively interacted with the teacher and participated in class;	2.7.1 Most active input. 2.7.2 Most of the students were able to listen carefully to the teacher and take notes on their own,

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
2. (1) What do you think about the emotional aspects of the students in the classroom in the smart classroom environment? (e.g. positively engaged, negatively engaged, etc.) (2) Specify how students behave in class.						
on the other hand, do not think for themselves and do whatever the teacher tells them.		Half-active and half-negative: pupils sometimes listen to the lesson and sometimes talk to the person next to them. Negative: dozed off throughout; did not listen carefully to the lecture.	they do not understand for the teacher to answer. Negatively engaged students do not pay much attention in class.	the teacher's own knowledge and could expand to all aspects of the subject they wanted to link to. 2.5.2 When the teacher asks a question there is a positive response from the students. The addition of pictures makes the students refreshing and increases	students who were negatively engaged did not speak.	while a small number of students would drift off and play with their mobile phones.

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
2. (1) What do you think about the emotional aspects of the students in the classroom in the smart classroom environment? (e.g. positively engaged, negatively engaged, etc.) (2) Specify how students behave in class.						
				their impression of the knowledge and better grasp of it.Some of the students who are more associative are good at coming up with topics related to the points, which makes the class more lively. The students were motivated to participate in the class and remember the knowledge through the extension of knowledge.		

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
3. What methods are used by teachers to engage students in classroom activities in the smart classroom environment? (e.g. teacher-student interaction, student participation in cooperative learning, student-student interaction, etc.)						
3.1.1 Teacher-student interaction and collaborative student learning.	3.2.1 Teacher-student interaction and student participation in collaborative learning.	3.3.1 Teacher-student interaction, student participation in cooperative learning, student-student interaction and group learning.	3.4.1 There is teacher-student interaction and student-student interaction.	3.5.1 Teacher-student interaction and student-student interaction are combined in a better way to integrate students into the classroom.	3.6.1 Teacher-student interaction and student participation in collaborative learning.	3.7.1 Teacher-student interaction and group discussion

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
4. (1) In a smart classroom environment, do you think the students can understand the content of the teacher's lessons? (2) What do the students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)						
4.1.1 Different students have different circumstances; some students can and some cannot. 4.1.2 For example, if they encounter a problem, they skip it, or if they don't think about	4.2.1 Can understand. 4.2.2 Through internet technology, it is possible to find ways to respond with confidence.	4.3.1 It is generally understood if one listens carefully. 4.3.2 Confidence that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.	4.4.1 Students who listen attentively can understand the content of the teacher's lessons, while those who do not listen attentively will miss some of the key points because they are distracted and are	4.5.1 The vast majority of the lectures were comprehensible when listened to, and interactive education enabled the students to better remember the points.	4.6.1 Students who work hard and are motivated to learn understand the teacher's lessons better. 4.6.2 Work out your own solutions after the lesson.	4.7.1 Mostly understandable. 4.7.2 Take the initiative to ask the teacher if they do not understand something and try to solve the problem by themselves after class.

it and go straight to someone for an answer, or if they try to think about it on their own, and if they can't solve it themselves, they go to a classmate or teacher to try to solve it.			less able to understand the content of the teacher's lessons. 4.4.2 Students will think that the teacher has a poor memory but trust that the teacher will have the confidence to find a way to cope with the situation.	4.5.2 Most of the students preferred to work out the questions on their own before asking the teacher to answer them, a process that enabled them to remember the points better.		

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
5. (1) Are modern technological tools acceptable to you in a smart classroom environment? (2) How has it affected your classes?						
5.1.1 I can understand and accept technological tools to aid teaching and learning. 5.1.2 The acceptance of modern technology allows me to learn better.	5.2.1 Acceptable. 5.2.2 It can better grasp the basic theory of IoT technology and also better expand our professional knowledge, which can arouse my great interest in learning.	5.3.1 Acceptable. 5.3.2 Problems with the machine can affect the progress of the lesson.	5.4.1 is largely acceptable and can be adapted to slowly. 5.4.2 I think the information-based learning tools in the Smart Classroom are helpful to my learning	5.5.1 Acceptance. 5.5.2 To provide more time to get to know unseen teaching methods, without knowing them deeply, first will follow the previous teaching methods and wait until they are familiar to make the students refreshing.	5.6.1 Acceptable. 5.6.2 Convenience but no guarantee of class effectiveness.	5.7.1 Yes, I wish the class was more lively and interesting. 5.7.2 No significant impact

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
6. (1) What is your motivation for learning in a smart classroom environment? (2) What factors influence your motivation to learn?						
6.1.1 Study well to learn how to make money. 6.1.2 Economic, social, environmental, etc.	6.2.1 Curiosity about knowledge and the desire to acquire it. 6.2.2 Visualisation of the smart classroom, and perception, peer recognition, and teacher praise.	6.3.1 Study well enough to be able to establish themselves in society and to find a stable job, with the hope of gaining knowledge. 6.3.2 Recreational equipment, various life chores, praise from emotional teachers.	6.4.1 Learning the subjects to be studied also provides a good foundation for those to be studied later. 6.4.2 I want to be recognised by my teachers and classmates.	6.5.1 A better future. A better quality of life. 6.5.2 Love, friendship, kinship, stumbles between classmates, and teacher recognition.	6.6.1 Learn more. 6.6.2 Learn more.	6.7.1 Acquire knowledge and skills to improve their general quality. 6.7.2 School environment, living environment.

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
7. (1) How do you feel the teacher influences your lessons in a smart classroom environment? (2) What do you think teachers need to do to enable students to learn better?						
7.1.1 The teacher's praise will give make me more motivated to study. 7.1.2 I feel that there is a need for students to interact more with the teacher and to use more information technology tools to interact with students.	7.2.1 The teacher can guide our learning and give us a better understanding of the course content. 7.2.2 Teachers are expected to make full use of information technology tools and to use technological innovations in their teaching models.	7.3.1 No effect. 7.3.2 The teacher has done a good job	7.4.1 None. 7.4.2 Use more information technology tools to interact with classmates and make the lesson interesting.	7.5.1 Instead of using the blackboard only to teach students, teachers will teach students with more and better classroom interaction. 7.5.2 Possess an excellent work ethic and be cordial and amiable.	7.6.1 There is no way to ensure the quality of the lessons. 7.6.2 Returning the classroom to the students and making them the protagonists of the classroom.	7.7.1 There is no significant impact. 7.7.2 Interact more with students, form occasional activities and have a positive and active atmosphere in class.

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
8. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)						
8.1.1 Use of information technology tools for interaction.	8.2.1 Use information technology tools to interact and guide student learning.	8.3.1 Use information technology tools for interaction, guided student learning, and instructional activity design.	8.4.1 Will interact and guide student learning through information technology tools.	8.5.1 The teacher asks questions to be answered by the students.	8.6.1 Use information technology tools to interact and guide student learning.	8.7.1 Use of information technology tools for interaction, plus teaching and learning activities

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
9. In a smart classroom environment, what technology in the classroom do you find helpful for student learning?						
9.1.1 I found the screen recording function of the Smart Classroom to be very helpful.	9.2.1 LED display systems, classroom systems	9.3.1 Whiteboard, computer, screen casting.	9.4.1 Making a video recording of the lesson is beneficial for students to watch it again if they do not understand it.	9.5.1 Multimedia playback of videos	9.6.1 Record the lesson to show the playback to the students.	9.7.1 Projection screen, blackboard, chairs, etc.

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
1 (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.						
1.8.1 1. rote memorisation, 2. deep self-understanding 3. understanding through some specific study skills	1.9.1 ① Understands thoroughly and completely ② Can carry out an inversion ③ Understands only superficially	1.10.1 Deep self-understanding. 1.10.2 Students with superficial rote learning do not think actively and boldly enough; students with deep self-understanding are open and varied and bold;	Don't know anything about it (R3) rote memorisation (R1, R2, R4, R5, R6) Understanding of surfaces only (R7, R2, R9)	rote memorisation and superficial understanding Self-understanding, complete mastery, reading and understanding on your own	Superficial awareness Deep Awareness Reliance on classmates and teachers to meet	Cognitive input is usually the learning strategy used in the learning process. Superficial generalisation is manifested by rote

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
1 (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.						
4. communicative understanding through teachers and classmates 1.8.2 1. students who learn by rote, who have no method of learning ability skills and cannot fully grasp	1.9.2 Category 1 students can apply their knowledge well to solve moderately difficult questions, and struggle	Students who rely on their peers and teachers for understanding have weak independent thinking skills and single-minded ideas.	In-depth understanding (R1, R4, R6, R7, R8, R10) Understood thoroughly and fully mastered (R9)	Understanding through teacher and classmate communication Reliance on teachers and classmates to communicate understanding		memorisation operations in the classroom, without understanding the specific meaning of the knowledge points, which

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
1 (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.						
what they have learned, which is passive learning 2. students who learn through deep self-understanding, which shows that they can fully grasp what they have learned and can apply their knowledge	Somewhat with more difficult ones, requiring more thought. Category 2 students can apply their knowledge flexibly and see through the questioner's		Dependent on classmates and teacher for understanding (R1, R2, R4, R6, R10) Understanding through communication with teachers and classmates (R5, R9)			It is a mechanical learning strategy. The deep level is expressed in the classroom as being clear about the real purpose of the teacher's

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
1 (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.						
through their own language, this type of student will make great progress. 3. students who learn through some special learning techniques, which shows a strong learning ability and a good way of thinking.	intentions. Category (iii) students also need to improve their understandin g and study in depth.		Read and understand for yourself (R9) Understanding through some specific learning techniques (R8)			explanation of knowledge and being able to learn according to one's own understanding of knowledge; the dependent level, which can be understood as seeking help from the teacher and peers in the classroom.

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
1 (1) If you were to categorise the level of understanding that students have during lessons, what categories would you say there are? (e.g. superficial rote learning, deep self-understanding, reliance on peer and teacher understanding, etc.) (2) Tell us your understanding for each category of students.						
4. Students who understand through a communicative approach between teacher and student. These students have a good attitude to learning and are able to use the teacher's and their classmates' opinions to analyse and understand, indicating a very active and motivated approach.						

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
2. (1) What do you think about the emotional aspects of the students in the classroom in the smart classroom environment? (e.g. positively engaged, negatively engaged, etc.) (2) Specify how students behave in class.						
2.8.1 More active, actively engaged and better understood 2.8.2 Can answer teacher questions positively and is more active, also communicates with the teacher to learn.	2.9.1 Some students are more attentive to the lesson, while others tend to be distracted and run off.	2.10.1 Proactive. 2.10.2 We are motivated in the first 20 minutes of class and our spirits become lax and loose towards the end of class.	Active input (R1, R2, R4, R6, R7, 8, R10) Negative inputs (R1, R3, R4, R6, R9) Active engagement with your own interests (R2) Will actively engage	engagement Negative input Active	engagement Negative input Active	engagement refers to the emotional experience that accompanies students in the classroom. Positive emotions mean that students are interested in the lessons in the smart classroom

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
2. (1) What do you think about the emotional aspects of the students in the classroom in the smart classroom environment? (e.g. positively engaged, negatively engaged, etc.) (2) Specify how students behave in class.						
	2.9.2 Some students listen carefully, take active notes and ask or answer questions, while others do not actively participate in class activities and desert.		when teacher asks questions and pictures are added (R5, R8) Easily distracted in class (R7, R9) Semi-positive and semi- negative (R3, R10) Policymakers (R4) Researchers themselves (R6)			Emotional and that they show positive behaviour towards learning; negative emotions: for example, students are afraid of the teacher's questions in class and do not like too many learning tasks, which leads to negative emotions.

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
3. What methods are used by teachers to engage students in classroom activities in the smart classroom environment? (e.g. teacher-student interaction, student participation in cooperative learning, student-student interaction, etc.)						
3.8.1 Teacher-student interaction.	3.9.1 Ask students questions, students do group activities and students participate in lectures.	3.10.1 Teacher-student interaction Students participate in learning activities.	Teacher-student interaction (R1, R2, R3, R4, R5, R6, R7, R8, R10) Student participation in collaborative learning (R1, R2, R3, R6) Interaction between students (R3, R4, R5, R7) Panel discussion (R3, R7, R9)	Interaction between teachers and students Collaborative learning with student participation Interaction between students	Teacher-student interaction Collaborative Learning Student-student interaction	Behavioural engagement refers to the intensity of student engagement in learning activities, including student participation in collaborative learning, teacher-student interaction, and student-student interaction in the Smart Classroom.

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
4. (1) In a smart classroom environment, do you think the students can understand the content of the teacher's lessons? (2) What do the students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)						
4.8.1 Part of it may. 4.8.2 See a teacher or classmate between classes to try to solve problems in a timely manner.	4.9.1 is possible. 8.9.2 Ask questions on the spot and seek help from the teacher to solve problems.	4.10.1 Able. 4.10.2 Confidence in finding ways to respond.	Have the confidence to think back and solve problems (R1, R3, R5, R10) Will try to ask classmates and teachers for help if they can't solve a problem (R1, R4, R5, R7, R8, R9)	Have the confidence to think for themselves and solve problems when they come up	Self-efficacy	In the Smart Classroom, students have an understanding of self-learning capabilities Subjective judgements of ability,

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
4. (1) In a smart classroom environment, do you think the students can understand the content of the teacher's lessons? (2) What do the students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)						
			Encounter problems and work out solutions after class (R6, R7, R8) Does not think about problems and does not have the confidence to solve them (R1, R4, R8)	Confident in solving problems with the help of peers and teachers Having problems and not having the confidence to solve them yourself		problem-solving skills and learning behaviours reflect whether students have a high level of confidence that they will be able to complete the course and related learning tasks well in the Smart Classroom.

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
5. (1) Are modern technological tools acceptable to you in a smart classroom environment? (2) How has it affected your classes?						
5.8.1 Able. 5.8.2 The impact is not significant.	5.9.1 is possible. 5.9.2 Sometimes network or equipment problems can affect class progress and class atmosphere.	5.10.1 is possible. 5.10.2 The first wisdom teaching has a freshness that attracts our attention and memorises the content of the lesson.	Easy access to technology-based tools for better learning in a smart classroom environment (R1, R2, R4, R5, R7, R10) In a smart classroom environment,	Easy access to technology technology tools for better learning The information-based learning tools in the Smart Classroom have helped me in my studies	Technology Acceptance	Perceived ease of use (PEU) and perceived PU) usefulness of technology tools by students in a smart classroom environment. In general, the easier and simpler the information technology tool

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
5. (1) Are modern technological tools acceptable to you in a smart classroom environment? (2) How has it affected your classes?						
		Secondly, it enhances motivation, stimulates interest in learning and increases the efficiency of classroom learning.	technology-based tools can be slowly embraced and better learning can take place ((R4, R5, R6, R7) Equipment failure affecting teaching and learning in a smart classroom environment (R3, R9)	Using information technology to teach in smart classrooms Learning tools can enhance my interest in learning		is to operate and use, the more helpful learners will feel it is to their learning, and conversely if it is not Convenience and lack of technology acceptance will make learning The perceived use of the product by the user is reduced.

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
6. (1) What is your motivation for learning in a smart classroom environment? (2) What factors influence your motivation to learn?						
6.8.1 Acquire well the knowledge taught by their teachers so that they can apply it in society. 6.8.2 Psychological factors.	6.9.1 Learn and acquire knowledge. 6.9.2 Personal and environmental factors.	6.10.1 I have no examples of failed innovations. 6.10.2 Broaden your horizons and increase your knowledge of ideas to improve your abilities and knowledge, and also to gain	Want to learn and acquire knowledge in a smart classroom environment (R2, R3, R6, R7, R8, R9)	Access to knowledge Gaining recognition from classmates and teachers	Motivation for learning	The psychological state of the learner in a smart classroom in order to satisfy a need, motivation for learning stems from the satisfaction of learning needs,

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
6. (1) What is your motivation for learning in a smart classroom environment? (2) What factors influence your motivation to learn?						
		credits to be able to graduate and thus find a good job. 6.10.2 Whether you can improve yourself, how many credits you have, and how important this matter is to you.	In the Smart Classroom, I am keen to gain recognition from my peers and teachers (R2, R3, R4, R5, R10)			which also shows that motivation influences learning goals and learning activities, and thus has an impact on learning engagement.

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
7. (1) How do you feel the teacher influences your lessons in a smart classroom environment? (2) What do you think teachers need to do to enable students to learn better?						
7.8.1 Not adequately understood without face-to-face communication.	7.9.1 Sometimes there are delays due to unfamiliarity with the operation of the equipment.	7.10.1 By providing a deep learning environment through the manipulation of smart classroom equipment, the teacher sets reasonable learning tasks and provides an environment of	Teachers are expected to make full use of information technology tools to teach (R1, R2, R4, R5, R9, R10)	I hope teachers can make full use of information technology tools to teach I hope teachers can use information technology tools to make students interactive	Teacher Factor	The teachers' ability to apply information technology in the smart classroom and their teaching level, whether the teachers can skillfully apply information technology in the smart classroom,

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
7. (1) How do you feel the teacher influences your lessons in a smart classroom environment? (2) What do you think teachers need to do to enable students to learn better?						
7.8.2 It is possible to allow some time in class for our students to learn on their own and then share with their fellow teachers.	7.9.2 Become familiar with the operation of the equipment and prepare lessons in advance.	enquiry to increase our level of behavioural engagement, enabling us to quickly enter a deep learning state and thus gain an enjoyable emotional experience.	Teachers are expected to use information technology tools to make students interactive (R1, R3, R5, R7, R10)	Teachers can interact more with students		whether the teachers can design teaching activities with the characteristics of the smart classroom and can use technology to support

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
7. (1) How do you feel the teacher influences your lessons in a smart classroom environment? (2) What do you think teachers need to do to enable students to learn better?						
		7.10.2 Increase the number of fun activities and interactive sessions between teachers and students in the classroom to expand and extend more knowledge, broaden our knowledge horizons and develop our school information more for us to think independently.	Teachers can interact more with students (R6, R8) The teacher has no influence (R3)			innovative teaching models and guide students to learn and think and solve problems. Title.

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
8. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)						
8.8.1 Interaction through information technology tools	8.9.1 Use the software to randomly call out answers to questions and play trivia games to call out names.	8.10.1 Information technology tools for interaction.	In smart classrooms, teachers often use information technology tools to organise collaborative learning for students (R1, R2, R3, R4, R6, R7, R8)	In smart classrooms, teachers often use information technology tools to organise collaborative learning for students In the smart classroom environment, students	Interaction behaviour	This includes teacher-student interaction and student-student interaction. Teacher-student interaction mainly refers to teachers forming effective teaching and learning interactions with students in the classroom,

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
8. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)						
			Smart classroom environment where students regularly share discussions with their peers (R4, R6, R8, R10)	regularly interact with their peers to discuss Opportunity to work with external agencies		encouraging students to Students actively participate in teaching and learning activities such as cooperative group learning for. Student-student interactions are interactions between students classroom

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
8. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)						
			In the Smart Classroom, students often work together on learning tasks (R2, R5, R7)	In smart classrooms, students often work together on learning tasks		and students in a smart environment based on problems or tasks, such as communication, discussion, evaluation and presentation Behaviour.

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
9. In a smart classroom environment, what technology in the classroom do you find helpful for student learning?						
9.8.1 Group discussion speech system	9.9.1 After projecting the PPT, you can write directly on the screen to explain the knowledge, and you can play videos of the relevant	9.10.1 Online Interactive Interaction Live Recorded On-demand Enables us to review course content at any time and allows for learning and interaction across classroom campus areas.	Recorded lesson function, useful for learning (R1, R4, R6, R9, R10) (Infrastructure in smart classrooms e.g. mobile tables and chairs, multi-screen projection, electronic interactive whiteboards)	function Computer Multimedia video Projectors	Environmental factors	The hardware environment and software environment in the smart classroom, the hardware environment includes the smart classroom electronic interactive whiteboard,

Respondent 8	Respondent 9	Respondent 10	Coding round 1	Coding cycle 2	Categorizing (Keyword)	Evaluation
9. In a smart classroom environment, what technology in the classroom do you find helpful for student learning?						
	knowledge on the Internet to help students understand.	The board can be written with an electronic pen, reducing dust damage to students. The teaching process is data driven, so that students and teachers do not need to worry about grades, attendance, etc. More time and energy can be devoted to learning and learning efficiency can be improved.	Makes me enjoy the learning process more (r2, r3, r5, r7, r8, r9, r10)	Recording Interactive online interaction Live streaming Recorded streaming On-demand		wall-mounted LCD screen, mobile tables and chairs and network infrastructure, etc. The software environment mainly refers to the teaching resources and interactive platform.

Appendix D

Questionnaire Survey

Questionnaire survey on the current situation and influencing factors of learning in the intelligent classroom environment of Baise University

Dear Readers,

Thank you very much for taking the time out of your busy schedule to fill out this questionnaire. The purpose of this questionnaire is to explore the current situation of student learning and the factors influencing it in the smart classroom environment of Baise College. The purpose of this questionnaire is to explore the current situation of student learning and the factors influencing it in the smart classroom environment of Baise College. Your serious answers are very important to me; I hope to receive your support and help. Thank you very much for your participation!

Part I: Basic Information

Please mark √ in the following questions that meet your basic situation

1. What is your gender?

☐ Male ☐ Female

2. What grade are you in?

☐ Freshman year ☐ Sophomore year

☐ Junior year ☐ Senior year

3. What is your domicile?

☐ Rural ☐ Towns

4. What you are studying now is?

☐ Make your own choice ☐ Advice from parents or others

☐ Transfer of volunteers

5. What is the level of knowledge about smart classrooms prior to entry?

☐ Don't know ☐ Some what

☐ Very well informed

Part II: Investigation Items

A survey on the innovation of Baise College and the influencing factors of talent retention, Please tick √ in the following questions where you can explain your environment and express your feelings.

Variables	Serial number	Evaluation Indicators	Strongly disagree → Strongly agree				
			1	2	3	4	5
Cognitive input	6	In the Smart Classroom, I often think about what I need to master, rather than simply listening to the teacher.					
	7	When I encounter unfamiliar problems in the Smart Classroom I often try to turn them into familiar problems to solve					
	8	In the Smart Classroom, when I have a problem, I often ask my teacher or classmates for help.					
	9	In the smart classroom, when completing a task, I think about whether there is a better way to do it.					

Variables	Serial number	Evaluation Indicators	Strongly disagree → Strongly agree				
			1	2	3	4	5
	10	In the Smart Classroom, I will often reflect on myself The way to learn					
Emotional engagement	11	In the Smart Classroom, when completing the tasks assigned by the teacher I feel a sense of satisfaction of success when completing the tasks assigned by the teacher					
	12	I enjoy learning new things in the smart classroom Enjoyed					
	13	In the Smart Classroom, when I was publicly praised by the teacher I feel happy when I am publicly praised by the teacher					
Behavioural input	14	In the Smart Classroom, I like to learn in small groups					
	15	In the smart classroom, the group exchanges during the discussion I often express my views and ideas					
	16	In the Smart Classroom, I feel that it is easier to discuss with my classmates Easier to come up with answers to questions					

Variables	Serial number	Evaluation Indicators	Strongly disagree → Strongly agree				
			1	2	3	4	5
	17	In the Smart Classroom, I like to interact with my classmates to Completion of learning tasks					
	18	In the smart classroom, I often interact with each other					
Self-efficacy	19	I am confident that I will learn the lessons in the Smart Classroom					
	20	When I have a problem in the Smart Classroom, I can usually think of a way to solve it.					
	21	In the Smart Classroom, I believe I can solve most of the problems if I put in the necessary effort					
Technology Acceptance	22	In the smart classroom environment, I found the IT tools in the smart classroom easy and quick to use and helpful for learning.					
	23	I think that the information technology learning work in the smart classroom It will help me in my studies					

Variables	Serial number	Evaluation Indicators	Strongly disagree → Strongly agree				
			1	2	3	4	5
	24	I think the use of information technology teaching tools in the smart classroom will enhance my learning					
	25	I like using the information-based learning tools in the Smart Classroom					
Motivation for learning	26	I want to learn and solve problems in a smart classroom					
	27	Learning in the Smart Classroom has increased my interest in learning interest in learning					
	28	In the smart classroom, I aspire to gain recognition from my peers					
	29	In the smart classroom, I would love to get a teacher commendations					
Teacher Factor	30	In the smart classroom, you will be more interested in the lessons if you meet a teacher you like.					

Variables	Serial number	Evaluation Indicators	Strongly disagree → Strongly agree				
			1	2	3	4	5
	31	In smart classrooms, teachers often use information technology Teaching tools and student communication and interaction					
	32	In smart classrooms, teachers often use technological innovations in teaching models to guide students' learning					
Interaction behaviour	33	In smart classrooms, teachers often organise collaborative learning for students					
	34	In the Smart Classroom, students often work with their peers to communicate and discuss					
	35	In the Smart Classroom, students often work together Work to complete learning tasks					
Environmental factors	36	Teaching and learning resources in the Smart Classroom for my learning Very helpful					

Variables	Serial number	Evaluation Indicators	Strongly disagree → Strongly agree				
			1	2	3	4	5
	37	I love learning in a smart classroom environment					
	38	Infrastructure in the smart classroom (e.g. mobile (tables and chairs, multi-screen projection, electronic interactive whiteboard, etc.) Makes me enjoy the learning process more					
Increased student learning engagement in a smart classroom environment	39	I will be more motivated in a smart classroom environment than in a regular classroom					
	40	My engagement in learning has improved in the smart classroom environment.					
	41	In the smart classroom environment, I feel that the use of information technology tools makes me more engaged in my learning.					
	42	I love learning in the smart classrooms and the modern teaching equipment enhances my engagement in learning.					

Appendix E

IOC Item Content Validity

Title: Study on College Students' Learning Engagement and Related Influencing Factors in the Smart Classroom Environment: A Case Study of Smart Classroom in Baise University

Objective: This paper presents an exploratory analysis of college students' learning engagement in the smart classroom environment at Baise In this paper, we conducted an exploratory analysis of student learning engagement in the smart classroom environment of Baise University through qualitative analysis and quantitative analysis, and came up with factors that can effectively In this paper, we conducted an exploratory analysis of student learning engagement in the smart classroom environment of Baise University through qualitative analysis and quantitative analysis, and came up with factors that can effectively By summarizing the interviewees' opinions and suggestions on student learning engagement in the smart classroom environment of Baise University. By summarizing the interviewees' opinions and suggestions on student learning engagement in the smart classroom environment of Baise University, some optimization strategies to improve student By summarizing the interviewees' opinions and suggestions on student learning engagement in the smart classroom environment of Baise University, some optimization strategies to improve student learning engagement in the smart classroom environment of Baise University are proposed.

Student ID: 7640201450 **Student Name:** Jiaming Nong
Date of Collection March 24, 2022
Purpose: Student no. 7640201450 Student name. Jiaming Nong
Collection date: March 24, 2022

Questions	Expert 1	Comment & Suggestion
	Dr. Xiaolong Huang	
1. (1) In a smart classroom environment, do you think the students can understand the content of the teacher's lessons? (2) What do the students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)	1	
2. (1) Are modern technological tools acceptable to you in a smart classroom environment? (2) How has it affected your classes?	0	This question is directed more towards the students and should read: (1) In a smart classroom environment, do you feel that modern technology tools are acceptable to students? (2) What is the impact on students' lessons?
3. (1) What is your motivation for learning in a smart classroom environment? (2) What factors influence your motivation to learn?	1	

Questions	Expert 1	Comment & Suggestion
	Dr. Xiaolong Huang	
4. (1) How do you feel the teacher influences your lessons in a smart classroom environment? (2) What do you think teachers need to do to enable students to learn better?	1	
5. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)	1	
6. In a smart classroom environment, what technology in the classroom do you find helpful for student learning?	1	

Approved and Endorsed:

黄小龙

(Dr.)

Contact Number:

Lecturer:

IOC Item Content Validity

Title: Research on the innovative talent management model to support the urban innovation of Baise, Guangxi, China

Objective: By using qualitative analysis and quantitative analysis, this paper makes an exploratory analysis on the innovative talent management By summarizing the interviewees' comments and suggestions on the innovative culture and some innovative talent management strategies of THE University. summarizing the interviewees' comments and suggestions on the innovative culture and some innovative talent management strategies of THE University of Baise, some optimization strategies of By summarizing the interviewees' comments and suggestions on the innovative culture and some innovative talent management strategies of THE University of Baise, some optimization strategies of the talent management model of the University of Baise are proposed.

Student ID: 7640201450 **Student Name:** Jiaming Nong
Date of Collection March 24, 2022

Questions	Expert 1	Comment & Suggestion
	Dr. Mengzhen Chen	
1. (1) In a smart classroom environment, do you think the students can understand the content of the teacher's lessons?	1	

Questions	Expert 1	Comment & Suggestion
	Dr. Mengzhen Chen	
(2) What do the students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)		
2. (1) Are modern technological tools acceptable to you in a smart classroom environment? (2) How has it affected your classes?	1	
3. (1) What is your motivation for learning in a smart classroom environment? (2) What factors influence your motivation to learn?	0	This question is directed more towards students and should read: (1) What are students' motivations for learning in a smart classroom environment? (2) What factors influence students' motivation to learn?

Questions	Expert 1	Comment & Suggestion
	Dr. Mengzhen Chen	
4. (1) How do you feel the teacher influences your lessons in a smart classroom environment? (2) What do you think teachers need to do to enable students to learn better?	1	
5. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)	1	
6. In a smart classroom environment, what technology in the classroom do you find helpful for student learning?	1	

Approved and Endorsed:

(Dr.)

Contact Number:

Lecturer:

IOC Item Content Validity

Title: Study on College Students' Learning Engagement and Related Influencing Factors in the Smart Classroom Environment: A Case Study of Smart Classroom in Baise University

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Student ID: 7640201450 **Student Name:** Jiaming Nong
Date of Collection March 24, 2022
Purpose: Student no. 7640201450 Student name. Jiaming Nong
Collection date: March 24, 2022

Questions	Expert 1	Comment & Suggestion
	Dr. Chuan Liang	
1. (1) In a smart classroom environment, do you think the students can understand the content of the teacher's lessons? (2) What do the students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)	1	
2. (1) Are modern technological tools acceptable to you in a smart classroom environment? (2) How has it affected your classes?	1	
3. (1) What is your motivation for learning in a smart classroom environment? (2) What factors influence your motivation to learn?	1	
4. (1) How do you feel the teacher influences your lessons in a smart classroom environment? (2) What do you think teachers need to do to enable students to learn better?	1	

Questions	Expert 1	Comment & Suggestion
	Dr. Chuan Liang	
5. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)	1	
6. In a smart classroom environment, what technology in the classroom do you find helpful for student learning?	1	

Approved and Endorsed:

(Dr.)

Contact Number:

Lecturer:

IOC Item Content Validity

Title: Study on College Students' Learning Engagement and Related Influencing Factors in the Smart Classroom Environment: A Case Study of Smart Classroom in Baise University

Objective: This paper presents an exploratory analysis of college students' learning engagement in the smart classroom environment at Baise In this paper, we conducted an exploratory analysis of student learning engagement in the smart classroom environment of Baise University through qualitative analysis and quantitative analysis, and came up with factors that can effectively In this paper, we conducted an exploratory analysis of student learning engagement in the smart classroom environment of Baise University through qualitative analysis and quantitative analysis, and came up with factors that can effectively By summarizing the interviewees' opinions and suggestions on student learning engagement in the smart classroom environment of Baise University. By summarizing the interviewees' opinions and suggestions on student learning engagement in the smart classroom environment of Baise University, some optimization strategies to improve student By summarizing the interviewees' opinions and suggestions on student learning engagement in the smart classroom environment of Baise University, some optimization strategies to improve student learning engagement in the smart classroom environment of Baise University are proposed.

Student ID: 7640201450 **Student Name:** Jiaming Nong
Date of Collection March 24, 2022
Purpose: Student no. 7640201450 Student name. Jiaming Nong
Collection date: March 24, 2022

Questions	Expert 1 Dr. Shuxin Cao	Comment & Suggestion
1. (1) In a smart classroom environment, do you think the students can understand the content of the teacher's lessons? (2) What do the students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)	1	
2. (1) Are modern technological tools acceptable to you in a smart classroom environment? (2) How has it affected your classes?	1	
3. (1) What is your motivation for learning in a smart classroom environment? (2) What factors influence your motivation to learn?	1	
4. (1) How do you feel the teacher influences your lessons in a smart classroom environment? (2) What do you think teachers need to do to enable students to learn better?	0	This question is directed more towards the students and should read: (1) In a smart classroom environment, what impact do you think the teacher has

Questions	Expert 1 Dr. Shuxin Cao	Comment & Suggestion
		on the students' lessons? (2) What do you think teachers need to do to enable students to learn better?
5. How do students and teachers interact with each other and learn in the smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)	1	
6. In a smart classroom environment, what technology in the classroom do you find helpful for student learning?	1	

Approved and Endorsed:

(Dr.)

Contact Number:

Lecturer:

IOC score table

Item	Questions	Expert 1	Expert 2	Expert 3	Expert 4	IOC score	Comment
		Dr. Xiaolong Huang	Dr. Mengzhen Chen	Dr. Chuan Liang	Dr. Shuxin Cao		
1	(1) In a smart classroom environment, do you think students can understand the content of the teacher's lessons? (2) What do students think when they encounter problems in class? (e.g. confident that they will find a way to cope or that they will solve most of the problems through their own efforts, etc.)	1	1	1	1	1	

Item	Questions	Expert 1	Expert 2	Expert 3	Expert 4	IOC score	Comment
		Dr. Xiaolong Huang	Dr. Mengzhen Chen	Dr. Chuan Liang	Dr. Shuxin Cao		
2	(1) Are modern technological tools acceptable to you in a smart classroom environment? (2) How has it affected your classes?	0	1	1	1	0.75	This question is directed more towards the students and should read: (1) In a smart classroom environment, do you feel that modern technology tools are acceptable to students? (2) What is the impact on students' lessons?

Item	Questions	Expert 1	Expert 2	Expert 3	Expert 4	IOC score	Comment
		Dr. Xiaolong Huang	Dr. Mengzhen Chen	Dr. Chuan Liang	Dr. Shuxin Cao		
3	(1) What is your motivation for learning in a smart classroom environment? (2) What factors influence your motivation to learn?	1	0	1	1	0.75	This question is directed more towards students and should read: (1) What are students' motivations for learning in a smart classroom environment? (2) What factors influence students' motivation to learn?

Item	Questions	Expert 1	Expert 2	Expert 3	Expert 4	IOC score	Comment
		Dr. Xiaolong Huang	Dr. Mengzhen Chen	Dr. Chuan Liang	Dr. Shuxin Cao		
4	(1) In a smart classroom environment, what impact do you feel the teacher has on your lessons? (2) What do you think teachers need to do to enable students to learn better?	1	1	1	0	0.75	This question is directed more towards the students and should read: (1) In a smart classroom environment, what impact do you think the teacher has on the students' lessons? (2) What do you think teachers need to do to enable students to learn better?

Item	Questions	Expert 1	Expert 2	Expert 3	Expert 4	IOC score	Comment
		Dr. Xiaolong Huang	Dr. Mengzhen Chen	Dr. Chuan Liang	Dr. Shuxin Cao		
5	How do students and teachers interact with learning in a smart classroom environment? (e.g. using information technology tools for interaction, guiding student learning, teaching activity design, etc.)	1	1	1	1	1	
6	In a smart classroom environment, what technology in the classroom do you find helpful for student learning?	1	1	1	1	1	

BIODATA

Name	Nong Jiaming
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Educational Background	September 2007 to June 2011\ Baise University and obtained my Bachelor's Degree. 2021 To Present Master's degree at Bangkok University.