# THE INFLUENCE OF LEARNING ENVIRONMENT AND LEARNING PRESSURE ON THE STUDENT DEVELOPMENT OF UNIVERSITY—BASED ON THE MEDIATING ROLE OF LEARNING ORIENTATION AND ENGAGEMENT

**Jianye Su**

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**Jianye Su**
**International College,**

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..... Major Advisor
( Zhongwu Li, Ph.D.)

The Examining Committee Approved This Dissertation Submitted in Partial Fulfillment of Requirements for the Degree of Doctor of Philosophy (Management).

..... Committee Chairperson
(Associate Professor Vesarach Aumeboonsuke, Ph.D.)

..... Committee
(Associate Professor Jiafu Su, Ph.D.)

..... Committee
( Yu Zhang, Ph.D.)

..... Committee
( Shan Chen, Ph.D.)

..... Committee
( Zhongwu Li, Ph.D.)

..... Dean
(Assistant Professor Sid Suntrayuth, Ph.D.)

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# ABSTRACT


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| **Title of Dissertation** | THE INFLUENCE OF LEARNING ENVIRONMENT AND LEARNING PRESSURE ON THE STUDENT DEVELOPMENT OF UNIVERSITY—BASED ON THE MEDIATING ROLE OF LEARNING ORIENTATION AND ENGAGEMENT |
| **Author** | Mr. Jianye Su |
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Chinese universities are undertaking educational and teaching reforms to create a better university learning environment and improve the quality of higher education. At the same time, the Ministry of Education is also asking universities to raise the academic challenges of university students, reasonably increase the difficulty of university courses, expand the depth of courses, and expand the selectivity of courses (in China, it is called "increase the burden") to improve the quality of teaching and promote the development of students. However, changing learning environments and the pressures caused by "increase the burden" can affect students' deep or surface learning orientation, as well as their degree of engagement, and the influence of these factors on student development is increasingly being watched by researchers, so it is necessary to conduct in-depth research on the relationship between these factors to understand their relationship.

In this research, the learning environment and learning pressure are independent variables, and the deep learning orientation, surface learning orientation, and engagement are intermediate variables, student development as the dependent variable to construct a structural equation model (SEM). Based on the questionnaire data, statistical analysis methods such as exploratory factor analysis, confirmatory factor analysis, path analysis and intermediate analysis were used to discover the interaction relationship between these variables.

The research found that the learning environment, deep learning methods and engagement have a positive and significant impact on the development of students, but the surface learning orientation has a negative and significant impact on the

development of students. Learning pressure has a positive and significant impact on surface learning orientation and engagement. At the same time, deep learning methods and engagement were also found to play a part in mediating between the school environment and student development. Surface learning and engagement play a full mediating role in learning pressure and student development, one is negative and one is beneficial.

The research results provide a useful reference for China's education management departments, university administrators and teachers to improve the effect of the reform of the learning environment, flexibly and reasonably "increase the burden on students", and help students to obtain more learning benefits. Meanwhile, make suggestions for college students' self-learning management.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Research Background

According to the Educational Statistics Yearbook of China (1977-2018) of the Development Planning Department of the Ministry of Education of China, higher education in China is divided into three phases, based on the number of college entrants and the admission rate, namely: 1977-1981, elite education; 1982-1998, popular education; 1999-present, universal higher education. The enrolment rate for college entrance examinations, which was 34% in 1998, was expanded in 1999 to 56% and increased year by year (source: Ministry of Education, China, http://www.moe.gov.cn). As a result, from 1998 to the present, after 20 consecutive years of implementing the policy of expanding the number of students enrolled, higher education in China has gone from popularization to universalization. This process has provided society with a large number of high-level specialists, promoted rapid social and economic development and met the inherent needs of the broad masses for higher education. However, the impact of expanded enrolment on the quality of higher education has attracted widespread concern from all sectors of society. An important indicator of the quality of higher education is the student's personal development, which represents whether the student's gains in knowledge, skills, and emotions meet the expected educational goals (Qin, 2021). In order to understand the learning quality of Chinese university students, the Tsinghua University School of Education introduced the NSSE tool in 2007 and conducted the CCSS survey. The research group found that in the university environment in China, based on the results of the questionnaire on the five comparable indicators of study engagement, the study engagement index of undergraduates in China was significantly lower than that of students in the United States. CCSS further pointed

out that the relatively weak self-reported learning engagement of Chinese university students stemmed from the failure of the undergraduate teaching practice environment to reflect the requirements and cultivation of students' multi-level cognitive abilities, and the lack of learning support, resulting in insufficient efforts and investment by students, which affected the students' individual achievements in knowledge, skills and emotions, and affected the overall quality of education. Therefore, Chinese university students need to strengthen the use of learning strategies and cognitive ability training, while at the university level, they need to improve curriculum teaching practices, improve students' cognitive training level, and promote students' higher-level thinking in the curriculum teaching reform. Some researchers pointed out that to measure the factors affecting the quality of students' learning, an important perspective is to study the students' perception of the university learning environment from the students' perspective, including the experience and perception of teaching practices, learning support and other factors, to understand the degree of student engagement in such an environment and the learning gains of self-evaluation, and to reflect on various aspects of the learning environment (Chi, 2017; Huan et al., 2021). Other scholars have pointed out that Chinese schools need comprehensive reform to change the quality of education, and reform and development of higher education should be given priority (Li, 2016).

The research results of Tsinghua University have had a major impact on the reform of higher education in China. In order to improve the quality of the cultivation of human resources in higher education and promote the acquisition and personal development of students in terms of knowledge, skills and emotions (abbreviated as student development), a reform from the level of students to the level of the nurturing environment of the school opened the prelude. In 2018 and 2019, the Ministry of Education of the People's Republic of China issued two important documents on undergraduate education in Chinese universities, both of which are aimed at improving the environment for educating people in universities, improving the quality of talent cultivation in universities, promoting the engagement of students in learning, and ultimately achieving personal development.

In 2018, the Ministry of Education of China issued the "Notice of the Ministry of Education on Tightening the Implementation of the Spirit of the National Conference on Undergraduate Education in Colleges and Universities in the New Era" No. 8, which is widely interpreted to mean that undergraduate education in colleges and universities should "increase the burden" on university students. Chen Baosheng, then Minister of Education, stressed that "increase the burden" is to improve the academic challenge of university students, reasonably increase the difficulty of undergraduate courses, expand the depth of the courses, expand the selectivity of the courses, stimulate students' learning motivation and professionalism, and truly transform students' learning into deep, difficult and challenging learning. More researchers have interpreted the content and purpose of "increase the burden" as enhancing the breadth of academic content, increasing the challenge of academic content, guiding students to increase their learning engagement, and making students more active, competitive, and participatory (Xiao, 2018). To achieve better development of students and acquire better knowledge, skills and self-development.

In 2019, the Ministry of Education of China issued the document "Opinions of the Ministry of Education on Deepening the Reform of the Undergraduate Education and Teaching Environment and Comprehensively Improving the Quality of Talent Training" No. 6, which provides four major items for strict education and teaching practice management, deepening the reform of the education and teaching system, guiding teachers to cultivate their talents, and strengthening support and protection. A total of 22 rules put forward opinions on the reform of the education and teaching environment of Chinese universities. The aim is to achieve "student-centered", establish ethics and people, promote students' active learning, establish a sense of competition, promote the improvement of teachers' professional abilities, achieve rigorous management, the teaching practice is effective, students in the comprehensive development of morality, intelligence, beauty and labor. The details of the reform provisions are set out in the following table:

Table 1.1 Provisions of the Ministry of Education on Deepening the Reform of the Undergraduate Education and Teaching Environment

| **Item** | **Rules** |
|---|---|
| 1. Strict education and teaching practice management | 1. Carry out ideological and political education throughout the whole process of talent training |
| | 2. Encourage students to study hard |
| | 3. Improve the quality of course teaching practice |
| | 4. Promote the writing and use of high-level teaching materials |
| | 5. Improve the operation mechanism of internship |
| | 6. Deepen the reform of innovation and entrepreneurship education |
| | 7. Promote scientific research to feed back teaching |
| | 8. Strengthen student management and learning support and services |
| | 9. Strictly control exams and graduation exits |
| 2. Deepening the reform of education and teaching system | 10. Improve the credit system |
| | 11. Deepen the supply-side reform of college majors |
| | 12. Promote the reform of the minor professional system |
| | 13. Carry out the pilot program of dual bachelor's degree talent training |
| | 14. Steadily promote cross-school joint talent training |
| | 15. Comprehensively promote the construction of quality culture |
| 3. Guide teachers to concentrate on educating people | 16. Improve the evaluation and employment system for college teachers |
| | 18. Improve teacher training and incentive system |
| | 19. Improve the teacher assessment and evaluation system |
| | 20. Establish and improve the teaching assistant post |

| Item | Rules |
|---|---|
| | system |
| 4. Strengthen support and guarantee | 21. Strengthen the Party's overall leadership over the education and teaching work in colleges and universities<br>22. Improve the support and guarantee mechanism for improving the quality of personnel training |

Relative to university students, educational and teaching reform inevitably leads to changes in the learning environment. The Ministry of Education's requirements are top-level design, and problems arise when they are implemented at the school level. For every school, there are no success stories of such reform, everyone is in the process of exploration, so there will be inappropriate places and new problems, such as refusal to change, old-fashioned, some are anxious to reform, radical methods, deviations and deficiencies in measures, the reform results are not satisfactory. Importantly, when students are faced with a learning environment that has changed as a result of change, the key question is whether they will be able to adapt to the change and derive good benefits from it that are different from those of the past. The impact on students of the environmental changes brought about by the reforms may be positive, such as promoting classroom teaching practices for teachers and enhancing learning support for students. Improved learning environments can promote the quality of interpersonal interactions, foster linkages between students and their learning environments (e.g., teachers, other adults, student peers, curricula, overall school culture), improve learning environments and increase student engagement (McClure et al., 2010). Growing learning support also has the potential to strengthen teaching relationships or develop interpersonal relationships, facilitating collaborative learning (Wang, 2014). However, the impact can also be negative, such as stricter management and heavier learning requirements that can trigger learning pressure and fatigue. In general, the development of these factors may have a further negative impact on students, such as poor physical and mental health and reduced learning ability and achievement (Stoliker & Lafreniere, 2015). In fact, more workloads can also lead to different learning motivations and strategies, that is,

learning orientations, including deep and superficial ones, and ultimately affect academic performance (Entwistle, 1988; Everaert et al., 2017). The extent to which students are able to respond effectively to environmental change affects their success at university (Collie et al., 2017). If students cannot adapt to such reform changes, it is difficult to achieve the ultimate goal of improving the quality of talent development and promoting student development.

On the other hand, the most immediate problem brought about by "increase the burden" is that students perceive learning pressure, and college students generally have stress distress problems. In fact, from October to November 2019, China Youth Newspaper, China University Media Alliance and Dr. Lin Xiang carried out a survey on the health problems of university students. One aspect of the survey was the psychological stress distress of university students. The sample size covered 12,117 university students in more than 40 universities in China. On January 7, 2020, they released the "2020 University Student Health Survey Report" on the Chinese Youth News Network "Zhongqing Online". The report shows that nearly 90% of Chinese university students have been suffering from psychological stress in the past year, involving academic, interpersonal relations, and employment planning. Among them, learning pressure is the biggest problem. 60% of students say they have problems in this regard, followed by interpersonal relations. Only 13% of students are free from stress. The specific data are as follows:

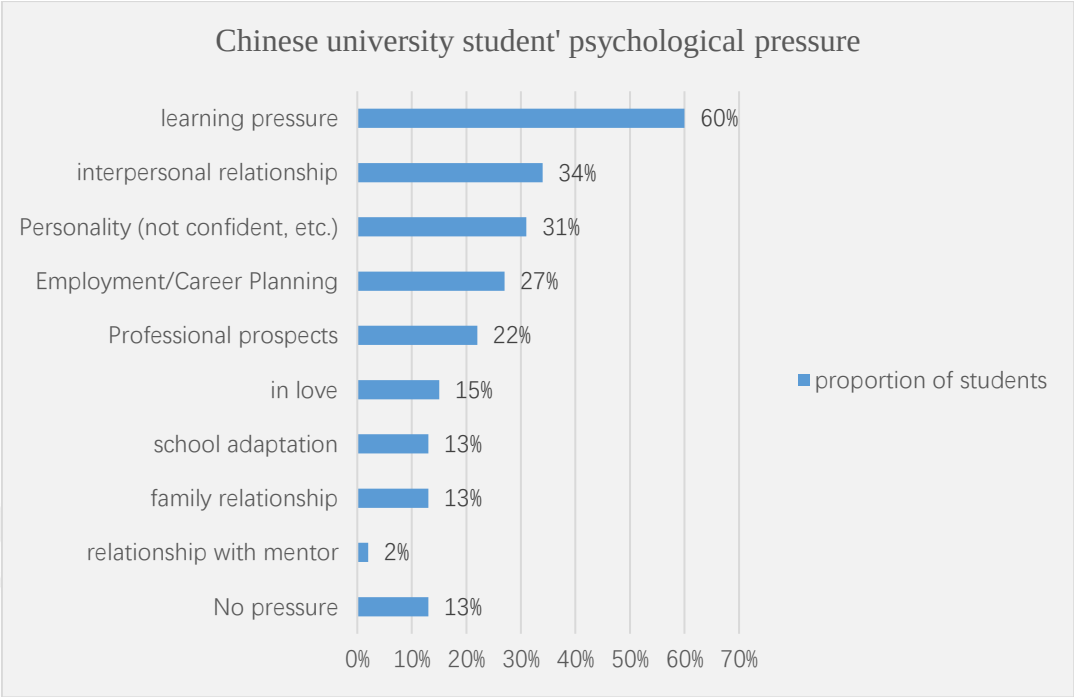


Figure 1.1 Psychological Stress Distress of Chinese College Students Base n = 12117

Source: "What is the health status of college students" 2020).

Other researchers have pointed out that the study pressure of students is related to the requirement of "increase the burden". "increase the burden" can easily increase the study pressure of students, and it is difficult to achieve the goal of making students happy and actively studying (Xiao, 2018). Under the requirement of "increase the burden", university students feel that the study pressure has increased and is great (Xu 2020). Most college students feel that “increase the burden” can cause psychological distress. Of concern is the negative impact of student learning pressure on learning outcomes (Richardson et al., 2012).

As mentioned above, the learning and development of students in Chinese colleges and universities is in a new era of the influence of the two factors of reforming and changing learning environment and "increase the burden". There are questions about how these two factors affect the students' learning orientation and engagement, and ultimately affect the students' development. This study is based on this situation and uses empirical research methods to carry out relevant research work.

## 1.2 Problem Statement

As stated in the background, Chinese university students are facing the reality of reforming the educational and teaching environment and "increase the burden" requirements. Students are experiencing changes in the learning environment in terms of teaching practice and learning support. At the same time, the "increase the burden" brings anxiety and increased learning pressure to students, among which the problem of learning pressure is particularly prominent. From the original point of view, the purpose of environmental reform and “increase the burden" is to improve the quality of talent cultivation and promote the development of students. The literature has shown that good learning environments are generally favourable for students, but that the new learning environments brought about by reform require adaptation for students, which tests their ability to cope. At the same time, learning pressure is also an issue that cannot be ignored, and more literature shows that learning pressure can have a negative impact on students. For Chinese university students, the ultimate impact of these factors on student development is unclear and needs to be studied further.

Considering the current reality of Chinese university students, this research will explore the impact of these factors on student development from the perspective of the learning environment (including teaching practice, learning support) and learning pressure perceived by students.

## 1.3 Research Gaps

Although the learning environment and learning pressures have been the focus of research in the field of student development, there has been particularly little research that combines these two factors to explore the impact on student development. According to the current reality of Chinese universities, this is a research gap that needs to be filled urgently.

In addition, while previous studies have shown the impact of learning environments and learning pressures on student development, there is not much literature in China that explores the relationships between these variables through

mediating factors. In abroad, engagement and learning orientation (including deep or superficial learning motivations and strategies) have received considerable attention in the area of student development, and the literature has shown that both are important factors in student success. Astin (1984) pointed out that the concept of student engagement is similar to that of learning motivation and strategy, but it needs to be distinguished that motivation and strategy are psychological and methodological, whereas engagement implies behavioral depth. The mediating effect between the learning environment and student development was tested in the participatory theory of Astin (1984), the combined causal theory of Pascarella (1985), and the “3P” learning theory of Biggs (1987), respectively. However, the existing literature shows that there are few studies at home and abroad that simultaneously include engagement and learning orientation as mediators in the model of the impact of the learning environment or learning pressure on student development, which seems to be an urgent research gap. This study argues that attention should be paid to both students' learning behaviors and psychology and methods, which will facilitate a comprehensive understanding of what happens to students in the learning process.

## 1.4 Research Purposes

In the field of higher education student learning and student development research, the theory of student development represented by Astin (1984); Pascarella (1985) and others pointed out that learning environment factors affect student learning engagement and thus student development. The learning theory represented by Biggs (1987) and others believed that learning environment factors affect students' deep or superficial learning motives and strategies, i.e., learning orientation, thus affecting student development. In addition, in the field of study of learning pressure, researchers generally believe that learning pressure has an impact on students' learning behavior and learning gains. Considering the problems mentioned in the problem statement section, the current reform of the teaching of Chinese universities has caused changes in the learning environment and the "increase the burden" has caused the students to struggle with learning pressure. It is necessary to understand the impact of the learning environment and learning pressure factors perceived by

students on the students' learning engagement and learning orientation, and how it will ultimately affect the students' learning achievement, that is, the students' development.

Therefore, combining the problem statement and the research gap, the purpose of this study is to explore the impact of the learning environment and study pressure of Chinese universities on the development of students. This includes examining the perceived learning environment, engagement and learning orientation, and the relationship between student developments. And the relationship between learning pressure, engagement, learning orientation, and student development. Then, an attempt is made to reveal the potential impact of learning orientation and engagement on student development. Finally, an attempt was made to measure the mediating role of learning orientation and engagement in the learning environment and learning pressure and student development.

## 1.5 Research Problem

Based on the above statement, this study will explore how the personal development of university students in China is affected by the learning environment and study pressure. At the same time, under the influence of these two factors, how the engagement and study orientation of university students is affected, and how these factors further affect the personal development of students. Therefore, in order to achieve the above objectives, this study will study the following questions based on the relevant literature:

1) Establish a structural equation model (SEM) with learning environment and learning pressure as independent variables, learning orientation (including deep and superficial layers) and engagement as intermediate variables, and student development as dependent variables, and propose hypotheses.

2) Based on this approach, the fit, path coefficient and significance of the model are tested in combination with the questionnaire survey data to find out what kind of relationship exists between these variables and to test the hypothesis.

3) According to the test results of the relationship between variables, constructive suggestions are made for the top-level design and "increase the burden"

measures of the teaching reform of Chinese universities and colleges, as well as the teaching management of schools and teachers. Specifically, there are two aspects, one is to combine the impact of the learning environment on other variables, at the school and teacher level, to propose methods and strategies to promote students' deep learning and increase engagement. Second, in combination with the influence of learning pressure on other variables, at the school and teacher levels, put forward suggestions to reduce students' superficial learning and promote greater engagement.

## 1.6 Research Significance

### 1.6.1 Theoretical Significance

1) First, after anchoring the thesis research topic of student development, this study examined a large number of references for investigation and analysis, and found that the current academic research on the field of student development has a lot of results. In this field, Astin (1984) Student Engagement Theory and Pascarella (1985) comprehensive causal theory, both of which discuss the impact of the learning environment with student engagement as an intermediary factor on student development. The National Large-Scale Student Engagement Survey, which lasted for many years in the United States, was also designed on the theoretical basis of Astin's (1984) Student Engagement Theory, which shows the importance and breadth of its influence. Astin (1984) defines student engagement as the physical and psychological energy invested in students' academic-related activities, and later many researchers define student engagement as engagement, referring to the amount of time and effort spent by students in learning and other educational activities (G. D. Kuh, 2009). Both theories confirm that engagement as an intermediate factor plays a significant role in the relationship between the learning environment and student development. Another theory of student development is Biggs' (1987) "3P" learning theory, which describes the relationship between the learning environment and student characteristics, the student's learning methods (also known as learning orientation, including deep and superficial learning motives and strategies) and learning outcomes. The learning environment and student characteristics are referred to as Presage, the learning orientation is referred to as Process, and the learning

outcomes are referred to as Product. The learning orientation has a significant intermediary between the learning environment and the learning outcomes. Engagement represents behavior, motivation and strategy (learning orientation) represent psychology. This study takes these two variables together as mediators to explore the indirect impact of learning environment on student development. This not only pays attention to the depth of students' participation in learning, but also pays attention to the learning motivation and strategic psychology of students in the process of participation. It can more accurately explain the impact of independent variable learning environment on dependent variable students' development from students' behavior and psychology.

In summary, a theoretical significance of this study is: based on Astin (1984) student engagement theory and Pascarella (1985) comprehensive cause and effect theory, combined with Biggs (1987) "3P" learning theory, to construct a deep and surface learning orientation and engagement as intermediate variables, the learning environment is independent variables, the student develops into a basic research model, the aim is to discover the internal influence mechanism between these variables, and finally to more accurately explain the influence of the independent variable learning environment on the dependent variable student development from the student behavior and psychology, enrich the connotation of the theories of Astin (1984) and Pascarella (1985), and form a new theoretical model of student development.

2) Secondly, based on the reality described in the background, learning pressure inevitably becomes a factor to be considered in student development issues. In the previous theoretical model of the impact of the learning environment on the development of students, learning pressure factors were rarely taken into account. This study combines the learning environment and learning pressure as two factors affecting the development of students, and forms a two-factor theoretical model of the impact on the development of students, expanding the connotation of this theoretical model.

3) Finally, the literature shows that a large number of scholars have studied the relationship between learning pressure and various factors affecting student development. However, they often draw the opposite conclusion. Some

scholars believe that learning pressure can greatly promote student learning, but some scholars believe that learning pressure is very easy to form students' psychological anxiety, which is not conducive to student development. Other scholars have come to the interesting conclusion that Chinese university students often achieve outstanding results when they are under pressure to study. In addition to the above kinds of contradictions, there are still quite few studies on learning pressure and engagement, learning orientation, but in reality, there are such situations as when the student's course assignment or task pressure is high, it will reduce communication, extracurricular reading and other engagement. There are also cases when the learning task is heavy and stressful, the use of perfunctory, the use of superficial learning strategies, this aspect of the empirical theory is quite lacking, it is necessary to conduct research to clarify these relationships.

Therefore, the final theoretical significance of this study is that this study will further clarify the appropriateness of the pathway of the influence of learning pressure on student development, and previous studies often come to the opposite conclusion. At the same time, the results of this study may find the theory of the influence of learning pressure on student engagement and learning orientation, which is a further extension of the theory of learning pressure.

### 1.6.2 Practical Significance

At present, in China, in order to improve the quality of student training and promote the development of students, the reform of the teaching environment of colleges and universities and the "increase the burden" has become the main theme of the daily work of colleges and universities. Like many reforms, the reform and the "increase the burden" requirements issued by the Ministry of Education are only guiding documents. This is the top-level design. The implementation plan and specific measures are formulated by colleges and universities around the spirit of the document. When it comes to a college, there are three main issues to consider when formulating implementation plans and measures: 1) Problems and reform priorities of the current learning environment; 2) Reformed learning environment assessment; 3) Add negative content, means, means, institutional safeguards, and impact assessment; 4) Amendments to programmes and measures. For many colleges and universities,

due to the lack of success stories to learn from, from the current situation, many colleges and universities in the planning and implementation of the radical approach, understanding deviation, incompetence and other situations, learning environment reform and "increase the burden" in the promotion of students' development is not satisfactory. Therefore, there is an urgent need to assess the existing problems and understand what happens to students in the learning behavior in the process, and from the students' perspective to explore these problems can fully listen to students' voices and feelings, and is more conducive to formulating or amending "student-centered" programs and measures that can fully and effectively promote students' development. Therefore, the practical significance of this study is as follows:

1) The results of the research can provide practical suggestions and a basis for future reform of the university learning environment and the top-level design and implementation plan of "added value" from the perspective of promoting student development.

2) Being guided by the results of students' development is conducive to the school's reflection on the current learning environment and the effectiveness of "increase the burden" measures, as well as on the outstanding problems among them.

3) The overall level of learning pressure, learning orientation and engagement shown by the research results provides a basis for schools to take appropriate interventions. It is also conducive to teachers to understand the current situation of classroom teaching and learning pressure, and to reflect on and change teaching methods. Not only to "increase the burden" reasonably, but also promote students' deep learning and active engagement.

# CHAPTER 2

# LITERATURE REVIEW

increase the burden" of Chinese universities, this chapter focuses on the discovery of various factors and related theoretical foundations that affect the personal development of students. By consulting the various literature in related research fields, it brings out the theories with wide influence in three fields of student development research: student engagement theory, comprehensive cause and effect theory, "3P" learning theory, and learning pressure theory. On the basis of fully understanding the connotations of these four theories and consulting the relevant literature, it summarizes the key variables of learning environment, learning pressure, learning orientation (including deep and superficial layers), engagement, and student development. On this basis, the concepts, connotations and research profiles of these variables are systematically sorted out. Then, on the basis of the previous research, the relevant research literature on the correlation between these variables is further compiled. Finally, this chapter will review relevant research on student development and provide the theoretical reference and research basis for this study.

## 2.1 Three Theories in the Field of Student Development Studies

The basic theoretical framework of this study is based on three related theories in the field of stress theory and student development. Three relevant theories in the field of student development are: Astin (1984) student engagement theory, Pascarella (1985) comprehensive causation theory, and Biggs (1987) "3P" learning theory.

Astin's (1984) student engagement theory and Pascarella's (1985) comprehensive causality theory mainly explore the variables of engagement, student education-related background characteristics, learning environment, and student development, and emphasize the mediating role of engagement. Pascarella's (1985)

comprehensive causation theory is the further development and refinement of Astin's (1984) student engagement theory, with nepotism. Biggs' (1987) "3P" learning theory and the aforementioned two theories are slightly different. This theory explores the learning environment, individual characteristics of students, students' learning methods (also known as learning orientation, including motivation and strategy), learning outcomes and other variables, and emphasizes the intermediary role of learning orientation. These are described separately below.

### 2.1.1 Student Engagement Theory of Astin (1984)

Student engagement theory was developed by Alexander W. of the University of California, Los Angeles (UCLA). In 1984, Astin (1984) proposed that a longitudinal study of university dropouts, originating from Astin (1977), attempted to identify factors in the university environment that significantly affect student adherence at university. Professor Astin is a brilliant psychologist who criticized three traditional pedagogical theories, "subject theory," "resource theory," and "personalized (or compromised) theory," argued that these theories tend to view students as a "black box." The input end of this black box is the college or university setting, including various policy and teaching options, and the output end is the various types of learning achievement measures, such as GPA or standardized test scores. But there seems to be something missing, and people have overlooked the role of intermediaries in translating these educational plans and policies into students' learning achievements and personal development. Astin (1984) pointed out the mediating role of student engagement and made new definitions for this mediating role, based on the results of previous studies and his own research. Astin (1984) argued that student engagement refers to the total amount of physical and psychological energy that a student devotes to an academic experience. Students with a high degree of engagement will invest a lot of energy in their studies, spend a lot of time on campus activities, actively participate in various student organizations, and often interact with teachers and students. Low-participating students spend very little time in school, lack extracurricular activities, and have little interaction with other teachers and students. The engagement theory holds that student time is the most valuable resource, and the extent to which a student achieves his or her personal

development goals depends on the time and effort he or she devotes to learning. The learning environment should encourage the active engagement of students. At the same time, teachers should not only focus on the content of the curriculum, teaching skills, or laboratory teaching resources, but also pay more attention to the behavior and degree of motivation of students, so as to promote students to devote more time and energy to the learning process, so as to maximize the learning effect and capacity development.

In summary, the engagement theory discusses the relationship between the learning environment, student engagement, and student development. In particular, it emphasizes the important intermediary role of student engagement in the learning environment and student development.

### 2.1.2 Pascarella (1985) Comprehensive Causal Theory

Pascarella (1985) is a professor at the National Center for Teaching, Learning and Assessment of Higher Education at the University of Illinois, Chicago, and Director of Student Study Studies at the National University of Chicago. Drawing on the results of some previous theoretical studies on university student development, Ernest T. Pascarella published a comprehensive causal theory in 1985. Pascarella (1985) endorses Astin's (1984) concept of student engagement, arguing that students' success must devote more time and energy to the learning process. At the same time, Pascarella (1985) divides engagement into two dimensions: the interaction with peers and teachers (known as social integration) and the degree of successful and beneficial interaction between students and the school's academic system (known as academic integration), arguing that student development is influenced by the context of the learning environment (such as organizational characteristics, structure, and policies). The following is the main framework of Pascarella's (1985) comprehensive causal theory model:

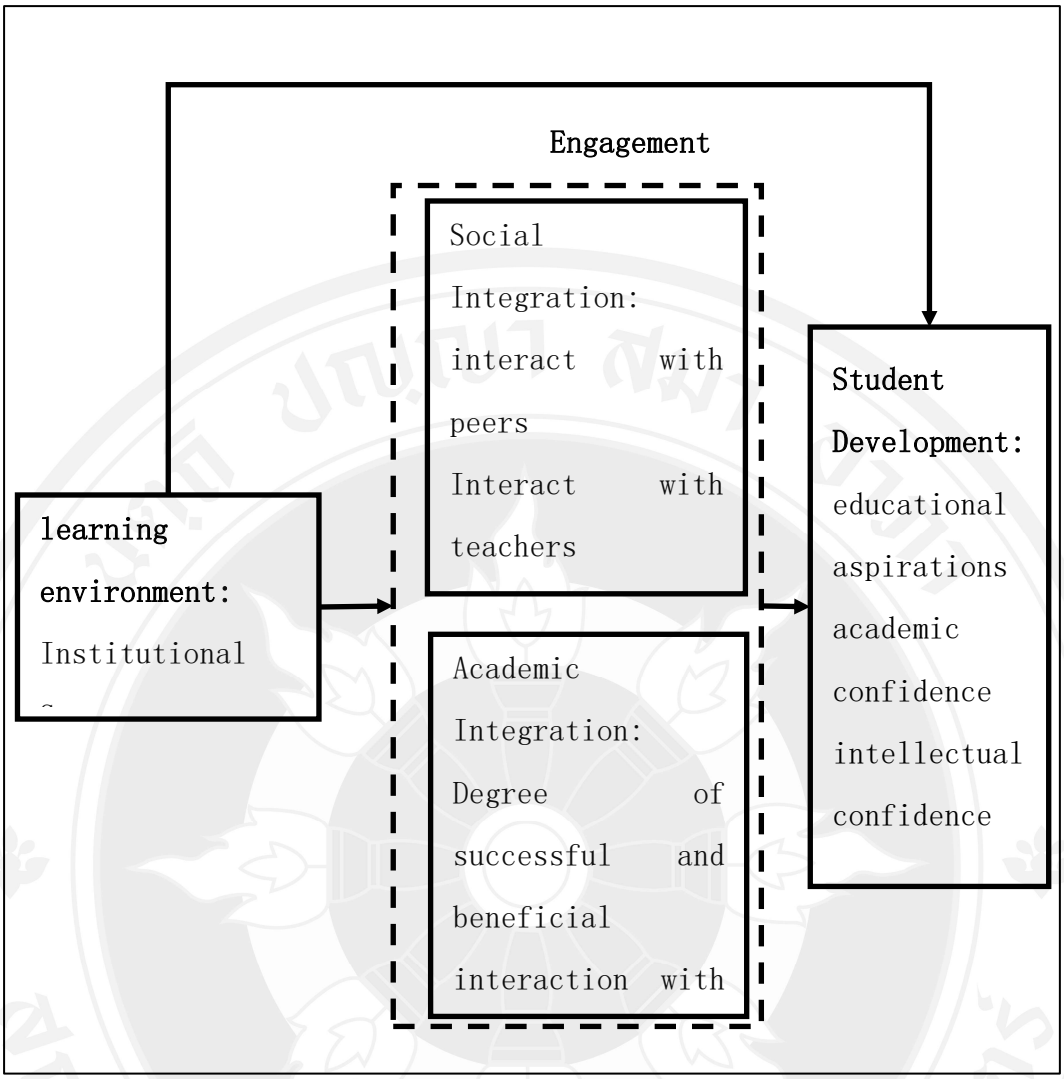


Figure 2.1 Comprehensive Causal Theory Model
Source: Pascarella (1985).

The Comprehensive causal theory concludes that student background and personal characteristics, social integration, and academic integration (i.e., engagement) directly affect student development, while the organizational characteristics of the school have little direct influence on student development, but indirectly affect student development through the intermediary role of academic integration and social integration.

Pascarella's (1985) Comprehensive causal theory was initially used to explain the development of students' educational aspirations, academic self-confidence, and intellectual self-confidence, and was gradually applied to study other aspects of student development.

In addition, Pascarella (1985), in the synthetic causality theory, considers engagement to be the extent of students' efforts to interact with the academic system and others, but this definition was not widely used by later researchers, and there is more agreement with Astin's (1984) definition of engagement. But the theory also has a prominent contribution, such as the NSSE evaluation: Pascarella's (1985) synthetic causality theory emphasizes student interaction with the learning environment, which lays the foundation for the environmental dimension of student engagement.

### 2.1.3 Biggs (1987) "3P" Learning Process Theory

Another influential theory in the field of student development research, the “3P” learning process theory, was proposed by Biggs (1987), a professor at the University of Hong Kong, after nearly 20 years of research on student learning. Biggs (1987) argues that the student learning process consists of three phases: Presage, Process, and Product, hence the abbreviated “3P” learning process theory. Biggs (1987) proposed the following student learning model:

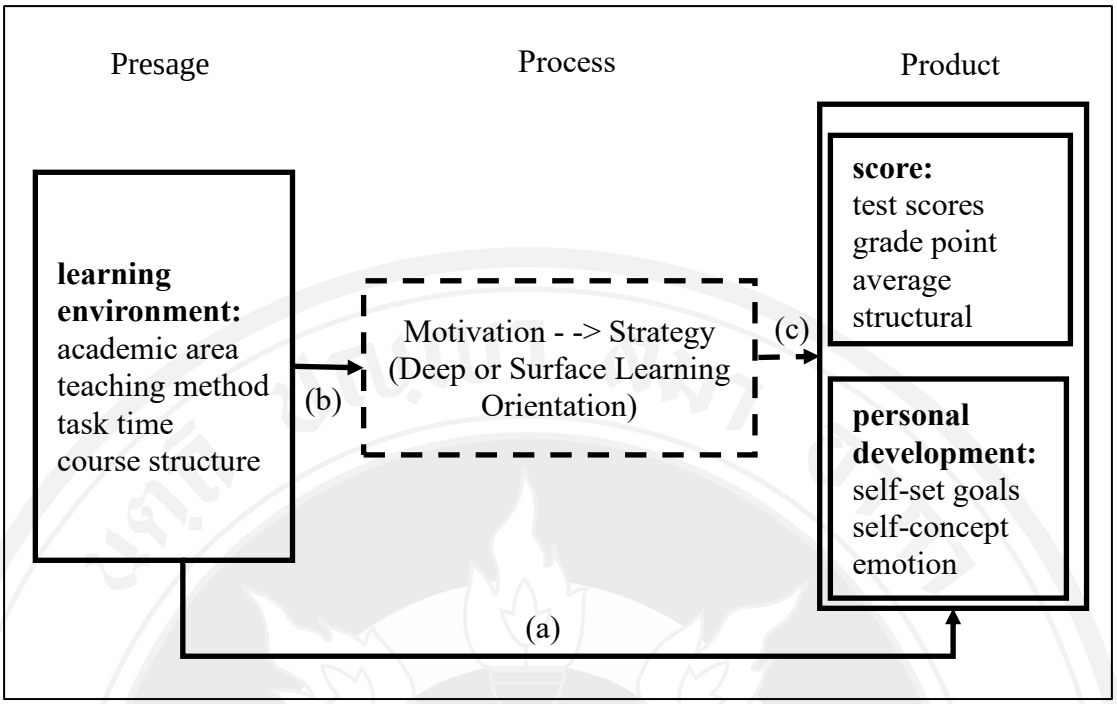


Figure 2.2 "3P" Learning Process Theory
Source: Biggs (1987).

The learning environment as a prediction consists of the discipline, teaching method, task time and curriculum structure. These factors all have a direct impact on student performance, expressed as path (a) in the model, but each factor may also influence student motivation and learning strategies in different ways, expressed as path (b) in the model.

Paths (b) and (c) in the model represent stages of processing and are a synthesis of the learning process, consisting of learning motives and strategies. Learning motivations and strategies are also known as learning orientations, including deep and surface learning orientations (Entwistle, 1983). Many later scholars have followed the concept of a learning orientation (Liang & Wang, 2008). It is a complex learning process embodied in students by the interaction between their individual characteristics and the learning environment. It represents students' perception of the learning environment. Based on this perception, students decide to process the learning content in one way or another to affect the learning outcome. Biggs (1987) believes that the learning orientation has a distinction between deep learning

motivation and strategy (deep learning orientation) and superficial learning motivation and strategy (superficial learning orientation). Deep learning motivation refers to the students' belief that the content that needs to be learned meets personal needs and generates interest. Deep learning strategies refer to how students tend to understand what they are learning, maximizing the meaning that learning produces. A superficial motivation for learning is when a student feels that the content of learning does not meet his or her inner needs and interests, fears that he or she will fail if he or she fails to understand. A superficial learning strategy refers to a way in which students deviate from teaching objectives and learn by simple duplication, mechanical learning, or by doing whatever they want. Different motivations and strategies may lead to different levels of learning quality.

The outcome stage refers to the final achievement of the student, the performance of the learning quality, measured and evaluated by the external performance and the personal development of the student's sense of self. External grades assess the quality of learning using generally regular test results or average learning scores, or the structural complexity of the work (the structure of the work is divided into five levels: discontinuous, linear, conventional, synthetic, and metaphorical); personal development of students' sense of self refers to the degree to which they have achieved their self-established goals, self-concept, and emotional aspects (such as satisfaction).

It is important to note that Biggs (1987) argues that deep learning orientation and surface learning orientation are only two of the many ways students learn. The two are not the only alternatives for students, nor should they be understood as opposing or contradictory approaches. The two orientations may be the simultaneous choice of most students.

Therefore, Biggs' (1987) "3P" learning theory describes that under the influence of individual characteristics and learning environment, students will adopt a deep or surface learning orientation, and then the interaction of individual characteristics and learning environment and learning orientation affects learning achievement and personal development. As with the aforementioned theoretical model, the "3P" learning theory clearly describes the process by which students learn.

Pascarella's (1985) comprehensive causality theory is highly similar to Biggs' (1987) “3P” learning theory in terms of independent variables and dependent variables, indicating that the two are evenly focused on the influence of the learning environment on the development of students. Then, when exploring the mediators of this influence, Pascarella's (1985) comprehensive causality theory is concerned with the degree of engagement, while Biggs (1987) "3P" learning theory is concerned with the learning orientation, which is essentially different from the two. Astin (1984) points out that a learning orientation that includes motivation for learning is a state of mind, whereas engagement implies depth of behavior.

### 2.1.4 Key Concepts in Theory

1) Engagement

Engagement is valued by researchers in this field because of its important intermediary role in the individual characteristics of students and the relationship between the learning environment and the development of students. The emergence of the concept of engagement reflects the historical transformation of modern education thinking from emphasizing teacher-centered, teacher "teaching knowledge and methods" as the main means of education to considering students as the center, and student engagement as the main method of learning. The important task of modern higher education is to create an educational environment that encourages students' engagement in order to promote better learning outcomes and personal development (Zhao, 2013). A considerable number of researchers have expressed the concept of engagement differently.

The name of engagement does not begin with it, but evolves from the concept of engagement. “Engagement” is derived from management and organizational behavior and refers to a state that an individual exhibits when he or she is part of a group, including how and to what extent individuals interact with each other, and how much cognitive and emotional input an individual has in interacting with each other (Zhou, 2010). Student engagement is defined in Astin's student engagement theory as the total amount of physical and psychological energy that students invest in an academic experience. Furthermore, students' learning time is regarded as an important resource, so when measuring the total amount of physical

and psychological energy invested, time and energy invested are considered as factors. In comprehensive causation theory, Pascarella (1985) developed and summarized Astin's (1984) concept of engagement, defining engagement as the degree of social and academic integration of students, that is, the degree of success and usefulness of interaction with peers and teachers, as well as with the school's academic system. The aforementioned definitions of student engagement inherited the results of previous studies and had a significant impact on subsequent studies. Many researchers have since defined engagement essentially as the core idea of both definitions, but some changes have been made in terminology and expressions, especially the definition of Astin, which has a wide range of implications, including that of Astin in the current National Survey of Student Engagement (NSSE) and the China College Student Survey on Learning and Development (CCSS). The definition of engagement has a long historical process. Until 2009, Professor Kuh (2009) of Indiana University of the United States and others sublimated and developed the definition of engagement in Professor (Pace, 1982) 's "Effort Quality Theory" and Professor Astin (1984) 's "Student Engagement Theory", and formally proposed the concept of student "engagement", which has now become the theoretical basis of the National Survey of Student Engagement (NSSE) and is still used by a large number of researchers. Appleton et al. (2008) summarize the concept of student engagement. The following are the more representative concepts given by some scholars in this study in combination with this article and other literature, compiled according to the evolution of historical time, as shown in the following table:

Table 2.1 The Concept of Engagement

| **Scholar** | **The Concept of Engagement** |
|---|---|
| Ralph Tyler (1930). | The time nature of the task, the time students invest in coping with the learning task is directly proportional to the knowledge learned. |
| Tinto (1975). | Degree of learning integration, social integration, i.e. how much time is spent improving academic performance, communicating with teachers, staff and extracurricular activities, friends and peers |
| C. Robert Pace (1982). | Effort Quality Theory. The amount of time and effort students invest in learning, interacting with teachers and students, and applying them is directly proportional to learning gains and experiences |
| Natriello (1984). | Students participate in teaching activities provided by the school |
| Astin (1984). | The total amount of physical and mental energy the student devotes to the academic experience |
| Pascarella (1985). | The degree of social and academic integration of the student, i.e. the degree to which interactions with peers and teachers and with the academic system of the school are successful and beneficial |
| Skinner, Wellborn and Connell (1990). | Student's level of motivation, effort and persistence, and emotional state in academic and non-academic activities |

| Scholar | The Concept of Engagement |
|---|---|
| N. Marks (2000). | The psychological process of students in academic activities, including attention, time investment and effort level, etc. |
| Christenson and Anderson (2002). | Student engagement includes psychological, behavioral, cognitive, learning engagement |
| Fredericks, Blumenfeld, and Paris (2004). | Engagement is divided into three aspects: 1. Behavioural Engagement, which refers to the degree of involvement of students in learning, interpersonal communication and extracurricular activities; 2. Emotional Engagement, the positive or negative attitude shown in school educational activities; 3. Recognition of Knowledge of engagement, the effort put into the face of complex concepts or difficult skills |
| M. Yazzie-Mintz (2007). | The effort and strategies that students invest in cognitive, intellectual activities, their level of social engagement, and their emotional (eg, belonging) engagement |
| Fang Laitan et al. (2008). | It is an emotional and cognitive state of mind that students show in learning-related activities, including three dimensions of vitality, dedication, and concentration. |
| Kuh (2009). | Student engagement has two meanings: 1. At the student level, it represents the amount of time and effort students spend in academic or non-academic educational |

| Scholar | The Concept of Engagement |
|---|---|
| | activities; 2. At the school level, in order to promote student engagement, colleges and universities should Improvements in learning opportunities and services, and ultimately, the development of students for the desired educational output. |
| Axelson & Flick (2010). | How engaged or interested students are in learning and how closely they are connected to the class body and school organization. |
| Lumpkin, Achen, & Dodd (2015). | Student engagement is a human interaction in which interaction with teachers and other students is an important part of the learning experience |
| NSSE (National Survey of Student Engagement) 2020 version | Student engagement represents two key characteristics of college quality: the amount of time and effort students devote to learning and other educationally meaningful activities, and how the college institution uses its resources and organizes courses and other learning opportunities to promote student engagement in these Activity. Learning and other educational activities include: advanced learning, reflective and integrated learning, quantitative reasoning, collaborative learning, discussions with others, teacher-student interaction. |

From the combing of the above literature, it can be found that students' engagement in concept development has passed through the following main stages: task time, effort quality, student engagement (time and energy), academic and social integration, and psychological, cognitive, emotional investment, student engagement (time and energy, institutional promotion). Given the maturity of NSSE (National Survey of Student Engagement) (2020) in practice, this study will adopt its main idea of student engagement (last clause in the table above), but as J. Wang (2018) points out, a considerable number of researchers criticized NSSE (2020) for failing to distinguish clearly between the two key features of engagement, namely learning input itself and its influencing factors, thus causing confusion in understanding and measurement about what exactly measures student engagement and what measures its influencing factors in its metric system (J. Wang, 2018). Therefore, this study will be carefully distinguished when using the NSSE (2020) measurement to examine engagement later.

In conclusion, this study will use the first characteristic of NSSE (2020) on engagement in conjunction with the statements of Astin (1984); Pascarella (1985), among others, to define engagement as the time and effort spent by students in learning and other educationally meaningful activities, including two aspects: 1. Reflecting and integrating learning refers to students' learning of curriculum materials, linking their understanding and experience to the learning content, connecting with the world around them, re-examining their beliefs, and considering issues and ideas from the perspective of others; 2. Collaborative learning refers to cooperation between students and peers in solving problems or mastering difficult materials, participating in group projects, seeking help from others or explaining difficult materials to others, and completing courses by preparing examination materials.

2) Learning environment

For the definition of the learning environment, Astin's (1984) theory of student engagement assumes that the learning environment encompasses a variety of institutional policies and practices within the school, as well as an atmosphere of interpersonal relationships: including pedagogical practices and academic aspects, such as curriculum, study attendance, disciplinary action, teacher time, student

counselling support, and engagement in advanced courses in general education. It also includes many aspects of non-academic issues, such as architectural planning, dormitory location, student council office location; accommodation arrangements and regulations; living and cultural entertainment venue design; student activity support; providing student part-time opportunities; peer-to-peer partnerships, teacher-student relationships; extracurricular activities; student support and policies; canteen catering, etc. Pascarella (1985) comprehensive cause and effect theory defines the learning environment from a more macro aspect, and believes that the learning environment mainly includes the school size, student admission selection, prestige in many universities, enrollment scale, public or private, etc. Understandably, circumstances such as size, selectivity, prestige, public and private may herald some differences in academic merit and non-academic decisions of the university (encompassing all aspects of Astin's (1984) student engagement theory). In China, for example, universities with higher ranking and prestige and entry scores (e.g. 985, 211 universities) have well-known advantages and humanization over ordinary universities in terms of academic education (e.g. teachers and teaching resources) and non-learning environments (e.g. hardware facilities such as cultural entertainment). Biggs' (1987) theory of the "3P" learning process considers the definition of the environment from a more microscopic and narrower perspective. Biggs (1987) believes that the learning environment consists of disciplinary fields, teaching methods, task time and curriculum structure. These factors can be understood as aspects related to curriculum teaching and learning. Later, Astin (1993b) in his book assessment for excellence: The philosophy and practice of assessment and evaluation in higher education. Includes events that will have an impact on student development. Learning environment variables include the following: educational topics, management policies, administrators and curriculum teachers, hardware facilities (life, culture, entertainment), curriculum system, teacher teaching methods and means, learning climate, peer interaction, teacher-student interaction, extracurricular activities, school groups (Astin, 1993a). Astin (1993a) also points out that it is a challenging task for relevant researchers to select the dimensions of the learning environment variables according to their own research purposes. Therefore, there is no uniform concept of the definition of the learning environment, which will be based

on researchers' needs and research purposes. Astin's (1993) concept of the learning environment is reflected in one of the guiding concepts of the former well-known College Student Experiences Questionnaire (CSEQ) and the National Survey of Student Engagement (NSSE). From the perspective of student perception and experience, NSSE (2020) defines the learning environment as three aspects of student perception and experience, namely: (1) Interpersonal interaction quality, including teacher-student interaction, peer interaction quality; (2) Academic support, including school support in learning, cognitive, social, health, family, etc.; (3) Teaching practices, including teacher teaching methods, structuredness, clarity of interpretation, learning feedback, learning tasks, etc.

In summary, based on the research background and research purpose of this study, the definition of learning environment in NSSE (2020) is adopted in this paper. The learning environment refers to the students' perception and experience of the school's educational activities, including perception and experience: 1. Learning support refers to the support provided by the school to students in various fields, including learning, cognitive, social and physical aspects. It heralds students' perception and experience of the importance that the school places on supporting their learning and development, and of providing good service and related activities. 2. Teaching practice: refers to the teaching of the curriculum, including teachers' teaching methods and teaching organization, the clarity of interpretation, the appropriateness of examples, feedback on students' homework, and the time of learning tasks, which indicates whether it can promote students' understanding and improve the teaching effect.

3) Student development

Student development has been the focus of attention in the field of higher education research. Student development is also sometimes referred to as learning outcomes, learning gains or students' personal development, referring to the multidimensional gains of students' knowledge and skills directly or indirectly acquired in school education practice activities (Zhao, 2013). Higher education aims at nurturing students through four years or more to become talents who realize the value of their lives and society, so school education must effectively promote students' gains in many ways in order to achieve the above goals. Studies on the

development of university students abroad, especially in Europe and the United States, have continued for a long time. In the 1960s and 1970s, the Council of Student Personnel Associations began advocating for higher education to foster awareness of student development (Ma & Chen, 2007). Student development theory research needs to answer the following questions: In the university environment, students' intellectual, emotional, and interpersonal relationships change, what factors are working, whether this role promotes or hinders, and what is the final personal development of students (Evans et al., 2009). Many researchers study student development from a psychological and sociological perspective, and then reflect on whether the university environment is effective in promoting student development. Therefore, from the beginning, student development research has always been put together with learning environment factors. Researchers have focused on how individual students transform and grow in college and what factors play a role (Zhou & Zhou, 2012).

To discuss the problem of student development, we must first determine the meaning of the concept of student development. With the attention and in-depth study of many researchers, the field of student development in universities has gradually formed four main theories, including social psychology and identity development theory, cognitive structure theory, typology theory, and rationality theory. At the same time, the meaning of student development is also fully explained by the formation of student development theory. It is also because there are many theories of student development, and the expressions about the meaning of student development are also different. Here are only a few statements that are representative and related to the theoretical basis of this study. Among the most influential are seven statements on the concept of student development in the student development theory proposed by Thomas and Chickering (1984). The table is as follows:

Table 2.2 Chickering (1984) Student Development Concepts

| Serial Number | Aspect | Content |
|---|---|---|
| 1 | capacity development | Intelligence: including learning ability and interest, critical thinking, etc. |
| | | Physical strength and hands-on ability: physical strength, endurance, artistic thinking, skills and physical fitness acquired in cultural and sports activities. |
| | | Interpersonal skills: the ability to work with superiors, teachers and students, peers, and project collaborators. |
| 2 | self-management | Feelings and means independent of parents, elders, or peers. |
| 3 | emotional management | Control over aggression and relationships and expansion of emotional range. |
| 4 | develop mature relationships | Improved tolerance for people and things, able to form intimate relationships with others, and develop relationships with others under the premise of trust, independence and individuality. |
| 5 | growth goals | Purposeful life, career, part-time, and lifestyle planning and improvement of critical judgments. |
| 6 | improvement and integration | Build internal consistency and effective personal beliefs that guide behavior, as well as a sense of personal and social responsibility. |
| 7 | self-identity | Shape personal appearance with appropriate gender identity and role behavior, identify material needs and personality, and discover and establish oneself. |

Source: Thomas and Chickering (1984).

Astin (1977) published his influential book, Critical Four Years: Implications for Beliefs, Attitudes, and Knowledge, in which Astin (1977) divided student university gains into two main areas: emotional and cognitive, and psychological and behavioral. This includes attitudes, beliefs and self-concept, behavioral patterns, abilities and achievements, career development, and satisfaction with the university environment. Later, in Pascarella's (1985) comprehensive cause and effect theory, Astin's (1977) connotation of student development was followed, believing that student development includes three aspects: educational aspirations, academic self-confidence, and intellectual self-confidence. In his book 1993 What's Most Important in University: A Critical Look Back at Four Years, Astin (1984) again describes several dimensions of student development, as shown in the following table:

Table 2.3 Astin Student Development Concepts

| **Dimensions of Student Development** | **Content** |
|---|---|
| cognitive-psychological | Subject knowledge, study ability, study skills, critical thinking, special skills. |
| cognition-behavior | Degrees, Income, Awards. |
| emotional-psychological | Self-concept (attitudes, interests, beliefs, values), satisfaction with university. |
| emotion-behavior | Major choice, educational aspirations, leadership. |

Source: (Astin, 1993b).

Astin (1984); Thomas and Chickering (1984) seem to have different representations about the meaning of student development, but their essence is the same, focusing on the cognitive, skill, and emotional development of students. Relevant literature shows that many scholars after Astin (1993b) have more agreement with their statements, with slight differences in the use of words.

In the "3P" learning model, Biggs (1987) on the meaning of student development is slightly different from the above expression, paying attention to the specific learning achievements of students, and grouping student development into

two aspects: external performance and inner individual sense of self. External grades represent test results or average learning scores, or the structural complexity of the work (the structure of the work is divided into five levels: discontinuous, linear, routine, synthetic, and metaphorical). The gains of individual self-sensitivity include self-setting goals, self-concept.

In China, it is customary to refer to student development as learning outcomes, learning gains or educational outcomes. The Outline of the National Medium- and Long-Term Education Reform and Development Plan (2010-2020) states that the goal of human resource training in higher education is to cultivate socialist builders and successors of all-round development, including moral, intellectual and physical development, and to promote students' knowledge, skills and emotional gains. According to the syllabus statement, the researcher usually understands student development as a three-dimensional goal of education, namely knowledge, skills, and emotions. For example, when introducing the American College Student Engagement Survey (NSSE), the Chinese College Student Learning and Development Tracking Research (CCSS) changed the name of student development to educational outcomes, referring to the development of knowledge, skills and emotions of individual college students in the course of college study. Student development is a consequential indicator of the quality of higher education. This definition has been cited by many researchers in China.

As described above, the connotation of student development takes many forms. Statements such as Thomas and Chickering (1984), Astin (1984), Biggs (1987), and CCSS define student development as the development of knowledge, skills, and emotions acquired by individual students in their university learning experience, including writing ability, expression ability, critical and analytical thinking, work-related knowledge and skills, cooperative ability, personal values and ethics, and informed personal development.

It is noteworthy that both the US Student Engagement Survey (NSSE) and the Chinese Student Learning and Development Tracking Study (CCSS) target one academic year's learning outcomes at the time of the study, which coincides with the school's time cycle for evaluating student learning outcomes. Therefore, this study

also uses the one-year cycle of individual student development outcomes as research data.

4) Learning orientation

In Biggs' (1987) "3P" learning theory, learning orientation refers to the learning process complex, consisting of learning motives and strategies, which is a complex learning process manifested in students' individual characteristics and learning environment interactions, which represents students' views on the learning environment. Based on this view, students decided to handle the learning content with deep learning motives and strategies (deep orientation) and superficial learning motives and strategies (superficial orientation). Different motives and strategies may lead to different learning quality levels, thus affecting learning outcomes. Notably, Marton and Saljo's (1976) research suggests that there is consistency between learning motivation types and learning strategies, and students who support deep or superficial types of motivation will choose consistent learning strategies.

With regard to motivation for learning, many researchers have given different definitions because of the considerable number of theories involved. In Biggs' (1987) "3P" learning theory, motivation is divided into deep learning motivation and superficial learning motivation. If the content of learning meets individual needs and arouses interest, deep learning motivation is generated, and learning motivation and continuous learning behavior are maintained. If the learning content does not meet your inner needs and interests, it creates a superficial motivation for learning, lacks motivation for learning, and learning behavior is not persistent. In China, many studies tend to agree with the definition of motivation by the famous German psychologist Rheinberg (2012). Rheinberg (2012) argues that learning motivation is a motivational tendency to initiate and sustain students' learning behavior and direct it toward certain academic goals. Motivation for learning consists of learning needs and learning expectations, which can be divided into different categories according to different criteria. In teaching practice, strategies for motivating and nurturing learning mainly include heuristic teaching, controlling the level of motivation, giving proper evaluation, maintaining the motivation for learning, and correctly handling competition and cooperation (Rheinberg, 2012).

In the study of student learning, learning strategies have always been an important concern for researchers. However, for the concept of learning strategies, researchers used different angles and research methods, and various definitions were proposed. Biggs (1987) believes that learning strategies are divided into deep and superficial strategies. When students have deep motives and deep strategies, they maximize the meaning of the materials learned. Instead, they learn using the superficial strategy method of mechanical learning. A considerable number of studies believe that learning strategies refer to the thinking patterns of methods, techniques, resources, etc. chosen and used by learners in dealing with learning, which are related to the individual characteristics of the learner, as well as to the teaching style of the teacher, the nature and time of learning tasks, the learning atmosphere and other learning environments. Individuals often use learning strategies for specific purposes, but are unlikely to always use them consciously. Students can spontaneously choose learning strategies to help them learn. In other words, students consciously or unconsciously use learning strategies to help learn or "transfer new knowledge and skills" more effectively (Weinstein et al., 2000). In addition, some scholars believe that the so-called learning strategies are complex plans about the learning process purposefully and consciously formulated by the learner in order to improve the effectiveness and efficiency of learning (Mai & Wen, 2013).

This study will adopt the viewpoint of Biggs (1987) to define the concept of learning orientation. Learning orientation refers to the learning process complex, consisting of learning motives and strategies. It is a complex learning process manifested in the student's individual characteristics and the interaction of the learning environment. It represents the student's view of the learning environment. Based on this view, the student decided to handle the learning content with deep learning motives and strategies (deep learning orientation) and superficial learning motives and strategies (superficial learning orientation).

It is noteworthy that in Biggs (1987), the Learning Process Questionnaire (SPQ) was developed to measure deep and superficial learning methods, respectively, and was modified in 2001 to form the revised Two-Factor Learning Process Questionnaire (R-SPQ-2F). Justicia et al. (2008) after analyzing the exploratory and empirical factors at the R-SPQ-2F project level, pointed out that

among the multiple models, the first-order two-factor model is the most suitable to describe the learning orientation of students' learning process. In this model, both deep and surface learning orientation are measured by the corresponding ten projects (Justicia et al., 2008). Therefore, in the later conceptual model, the deep and surface learning orientations will appear as two intermediate variables, respectively, to represent the learning orientation.

### 2.1.5 Applied Research on Student Development Theory

The discussion on the development of university students is very broad, forming a considerable number of theories. As mentioned above, Astin (1984), Pascarella (1985), Biggs (1987) three theories are three of them. Astin (1984) proposed the important role of university students' engagement in student development, and then Pascarella (1985) combined student engagement into the relationship model of environment and student development, verifying that the learning environment formed a comprehensive causal theory through the significant influence of student engagement on university students' development. Pascarella (1985) laid the foundation for the environmental dimension of student engagement by emphasizing student interaction with institutions and institutional values, norms, and behaviors (National Survey of Student Engagement, 2013). Numerous literature shows that the three variables of student individual characteristics, learning environment, and student development emphasized by this model and the I-E-O theoretical model (Inputs-Environment-Outputs) proposed by Astin (1993b) have great influence in the following decades, and have become classic student development theoretical models, which have received the attention, quotation, and expansion of many researchers. Later, a theoretical system of student development centered on student engagement was gradually formed. As the motto of Astin (2012): "Good evaluation is really good research"(Astin, 2012), these theories have been used by a very large number of researchers and institutions in educational assessment activities to explore how engagement is influenced by the school education environment, which in turn affects the development of students, so as to reflect on and evaluate the school education environment problems, student engagement, education quality, etc., and form many works.

In China, influenced by the theory of the development of foreign students, relevant theoretical research and practical application gradually emerged after 2000, and promoted the reform of the "student-centered" teaching environment of Chinese universities. The research focuses on several major aspects such as the evaluation index of student learning outcomes, university teaching evaluation, university environment evaluation, engagement measurement, participatory teaching, and the promotion of student learning engagement. Moustache, Martin (2007) demonstrated the relationship between student engagement and higher education, believing that university students are participants, co-producers and contributors of higher education services. The higher the ability of university students to participate, the smoother the engagement process, the longer the engagement time, and the more energy they invest, the higher the quality of higher education services. Higher education institutions should therefore forge new partnerships with university students to promote the quality of higher education through joint engagement. Wang (2014) discusses strategies for promoting student learning engagement, proposing four aspects: the establishment of a student-centered, student-development-oriented educational philosophy; the realization of the shift from re-education to re-education; the emphasis on and promotion of students' rights; and the material and educational technical support of teaching. Wu (2015) discussed the evaluation of students' learning outcomes, and proposed that university institutions can set clear evaluation indicators to measure the effectiveness of participatory learning, and then use public evaluation information to understand the learning situation of university students. Luo (2020) examined the relationship between students' engagement in classroom learning and learning outcomes, and found that students' engagement in classroom learning and learning gains exhibited collective differences in different background dimensions. There was an extremely significant positive correlation between engagement in classroom learning and learning gains in any dimension. It is also suggested that the proportion of classroom teaching in the assessment should be increased, teachers' teaching skills should be improved, and students' engagement in the learning process should be paid attention to. Overall, however, Chinese researchers' research on student development is sporadic and unsystematic. Meanwhile, the results of practical research and theory on the reform of schools and

the development of “increase the burden “for students in transition are still particularly scarce.

The most important example of the application of student engagement-centred student development theory is the National Survey of Student Engagement (NSSE), which was conceived in 1998 as a new approach to gathering information on university quality and piloted in 1999 with funding from the Pew Charitable Trust. The 2000 project has been officially launched for 21 years. More than 1,650 colleges and universities participate under the auspices of the Centre for Higher Education Studies at the Indiana University College of Education. More than 6 million students participated. The aim is to investigate information and student engagement in programmes and activities provided by university institutions for students' learning and personal development, as well as to estimate the benefits to students in the university. China introduced NSSE by the research team of Tsinghua University in 2012, and carried out the Chinese Student Learning and Development Tracking Study (CCSS). The survey evaluated the environment of Chinese universities, student engagement, and student learning outcomes. The results of the assessment played an important role in the reform and "value-added" of undergraduate teaching in Chinese universities. The two survey evaluations have provided important inspiration for this study. It is useful and urgent to focus on the development of Chinese university students, especially those in the transitional period of higher education. It is at the forefront of research in this field.

Although Biggs' (1987) "3P" learning theory did not have the wide influence of Astin (1984); Pascarella (1985) theory, "3P" learning theory in practice and theory application provided a large number of researchers with another perspective on student development, "3P" learning theory of deep learning methods and later researchers proposed advanced learning concept. Practice shows that students using deep learning methods are more likely to have stronger motivation and interest in learning, focus on understanding multiple parts of the learning material, and relate new knowledge to previous knowledge and experiences (Guo & Ji, 2019). As stated in the theoretical background, based on the great changes in the learning environment and the transition period of the "add-on" requirements, it is necessary to comprehensively understand the various factors affecting the development of

students, the degree of engagement, the motivation for learning and the learning strategy. It is necessary to expand the classic student development theory. The "3P" learning theory is used as a useful supplement to the classic student development theory described in this study, and expand the classic student development theory model.

### 2.1.6 Summary of this Section

This section introduces three theories on student development, of which Astin (1984); Pascarella (1985) theories are widely applied and gradually become classics. Biggs' (1987) theory, as a useful complement to the first two theories, is an extension of the classical student development theory model. This study combines three theoretical models to form a new student development theoretical model. The new student development theoretical model combined with the learning pressure variables introduced later will form the research model of this study. The research model meets the theoretical and practical needs of the transition period of Chinese universities. In addition, it should be explained that these three theories relate to the variables of individual student characteristics, learning environment, engagement, learning orientation (including deep and superficial layers), and student development. Because of the size and time limit of this study, the variable of individual student characteristics is not considered, because it needs to be measured at the time of enrollment, which is obviously difficult for this study, but it does not hinder the study of other variable relationships.

## 2.2 Learning Pressure Theory

### 2.2.1 Pressure and Learning Pressure

Stress is the result of a person believing that they do not have the resources to cope with perceived situations from the past, present or future(Lazarus & Folkman, 1984). Lazarus and Folkman (1984) view stress as the extent to which an individual's load on the environment exceeds physical and psychological adaptations. There are many theories about stress, and different theories arise depending on the field in which the subject is studied. Among them, Selye's (1950) theory of stress, Lazarus's

(1984) theory of stress and coping mode, Holmes & Rahe's (1967) model of relationship between life change and disease, and crisis theory are representative. Lazarus's (1984) theory of stress and coping modes is widely accepted and applied in the field of education, and extends the concept of learning pressure. Learning pressure is a form of stress experienced by students in the field of education and is related to the learning environment. Based on Lazarus' (1984) theory of stress and coping patterns, some researchers have made some representative descriptions of learning pressure. learning pressure is the reactions and feelings that occur when an individual learns in an internal or external environment that requires more than the individual's own ability to cope or feels threatened (Xu, 2004). learning pressure refers to the negative, uncomfortable feelings that student development in the process of achieving learning goals, which affect the motivation for college students to achieve, their engagement in learning, and their learning outcomes (Covington, 2007). In ICD-10, the World Health Organization describes learning pressure as “an event that some students perceive as a challenge or even a threat to the learning process, leading to adverse psychological reactions such as anxiety, depression, or fear (Lan & Ling, 2010).” The World Health Organization definition is widely accepted and recognized, and is used in this study.

In numerous learning pressure theories or definitions, it is generally accepted that learning pressure experiences have three dynamic processes: stimulation, cognitive evaluation, and response. Reactions to learning pressure include cognitive reactions such as confusion, miscalculation, dyslexia, uncontrolled behavior, loss of self-evaluation, and emotional reactions such as anxiety, fear, depression, and anger. Overall, learning pressure has a positive effect: maintaining normal student activity, contributing to the student's individual adaptability, and putting the body in a state of stress in response to stimuli. It also has negative effects: e.g. affects physical health, affects individual function (e.g. learning ability and interpersonal ability).

### 2.2.2 Application of Learning Pressure Theory in Student Development

In discussing student learning pressure and student development in colleges and universities, most researchers prefer to follow the three dynamic processes of the stress experience to explore, including discussing the sources of stimulus for student

learning pressure, discussing student cognitive evaluation and behavioral performance on stress, and studying its impact on learning outcomes and self-development. Other studies have focused on student coping behavior in the face of learning pressure and the impact of this behavior on learning outcomes.

College students are in a learning environment, and the sources of student stress are related to various factors in the learning environment. A large amount of literature shows that Chinese and foreign students have similar sources of learning pressure, concentrating on academic burdens, insufficient time for tasks, peer competition and interpersonal relationships. The main sources of stress for college students are: lack of leisure time, poor academic performance, fear of failure, excessive academic burden, financial situation, peer competition, and relationship with facultyand staff (Kamtsios, 2015). Numerous literature shows that the main source of pressure for Chinese students at present is learning pressure, which some scholars have pointed out is very much related to the current school reform and the “load-bearing” environment. Lower learning outcomes are often not attributed to an individual's intelligence, but rather to his or her learning environment and other environmental factors (Lim et al., 2015). Therefore, it is recommended that colleges and universities should reasonably “increase the burden ". Promoting educational reform needs to focus on the psychological response of students. Under the reform of China's learning environment and the demands of "increase the burden", students' pressure stems from insufficient study time, too many complicated tasks demanded by the school, heavy workload of the society, curriculum arrangement, difficulty of examinations and courses, employment pressure, peer competition, lack of recreational activities, limited personal interests and hobby development, etc. (Wang et al., 2019).

Students often exhibit stress-related reactions, including mild anxiety, sleep and eating disorders, which lead to reduced levels of learning engagement and, ultimately, reduced learning achievement, failure to focus on learning, and manifestations of antagonism, frustration, and debilitation (Stewart et al., 2006). In fact, the emotional response to learning pressure affects the investment in learning, and both positive and negative emotional responses are directly related to the student's level of engagement (Reschly et al., 2008). The more positive emotions that emerge

from learning, the higher student engagement will be; conversely, the frequency of negative emotions is associated with lower engagement. Student development theory has shown a close relationship between student engagement and student learning outcomes, so learning pressure is inextricably linked to student learning outcomes. In fact, there are quite a few studies that show this relationship. In addition to compromising overall health and well-being, learning pressure, depression and anxiety symptoms can further negatively affect academic achievement (Bernal-Morales et al., 2015). It is also interesting to note that researchers have found that low levels of learning pressure do not necessarily drive students to perform better, and in fact students may perceive tasks as less challenging, boring, or even lacking motivation (Uchil, 2017). While appropriate learning pressures can drive optimal student performance, failure to effectively manage learning pressures due to insufficient resources can have negative consequences for student development and schools (Jayasankara Reddy et al., 2018).

Other researchers have studied the relationship between learning pressure and learning motivation and strategy, and have pointed out that stress and depth processing (strategy) caused by setbacks, as well as stress-induced emotions, are significantly negatively correlated with structured learning (strategy) (Gadzella et al., 1998). Other scholars have found that disability stress is negatively correlated with learning motivation, challenge stress is positively correlated with learning motivation, and learning motivation is positively correlated with learning achievement (LePine et al., 2004). As Virtanen et al. (2015) points out, the choice and use of motivated learning strategies significantly influences the weighted average grades and other development of students (Virtanen et al., 2015). Learning pressures resulting from higher performance requirements from regulatory agencies or schools often lead to more control over students' motivation to learn (Deci & Ryan, 2016).

### 2.2.3 Summary of this Section

The theory of stress and learning pressure introduced in this section, this study focuses on the impact of learning pressure on student development. As mentioned earlier, the literature of real-life research shows that learning pressure is caused by different factors in the learning environment, and therefore the situation of learning

pressure of students in the learning environment under “increase the burden” requirement requires attention. Stress can lead to cognitive and emotional reactions, which can affect student engagement, motivation, and strategies, which in turn can affect learning outcomes. Interestingly, however, the magnitude of the stress is likely to give rise to different or even opposite results, which is a cause for concern.

## 2.3 Overview of the Study of Variable Relationships

Combining the previous section, this research theoretical model is based on Astin's (1984) engagement theory and Pascarella's (1985) comprehensive cause-and-effect theory to establish the initial basic model of learning environment - engagement - student development. The basic model is shown in the following figure:


Figure 2.3 Initial Basic Model of this Study

As an extension of the basic model, then combined with the "3P" learning theory of Biggs (1987), the deep and surface learning orientation was added to the basic model as an intermediate variable. Finally, considering the reality of "increase the burden" to the students' learning pressure, the learning pressure was also added to the basic model as an independent variable, and finally formed the theoretical framework of this study. This section first discusses the relationship between the learning environment, engagement, and student development variables in the basic model, and then discusses the relationship between the extended learning orientation, learning pressure, and other variables.

### 2.3.1 Study on the Correlation between Learning Environment and Engagement

This study found that the literature has shown that the relationship between the learning environment and engagement initially emerged from people's research engagement, and the emergence of engagement promoted the transformation of modern education concepts, from emphasizing the teacher's "teaching knowledge" and "teaching methods" as the main body to encouraging the school's all education and teaching affairs should be student-centered to promote students' engagement. Thus, it is recognized that the main task of higher education is to create a learning environment that encourages student engagement, and that the relationship between the learning environment and student engagement has received wide attention from researchers. Using an overview of the initial Astin (1984) student engagement, Pascarella (1985) established a comprehensive causal theory model in which Pascarella (1985) verified the relationship between institutional background and engagement. Institutional characteristics have indeed had a significant impact on the academic integration of students and the degree of interaction with the main agents of campus socialization (Pascarella, 1985). The comprehensive causal theory model lays the foundation for the dimension of the learning environment in which students participate. Krapp (1999) points out that the extent to which a student meets his or her psychological needs in a learning environment affects his or her investment in school.

As mentioned earlier, this study focuses on the learning support and pedagogical practices aspects of the learning environment. A supportive environment leads to student satisfaction and engagement (Kuh, 1993). The learning environment supports students in various areas, including cognitive, social, and physical aspects. When examining the relationship between supportiveness and engagement in the environment, the first consideration is the teacher. Teachers' learning support and positive relationships with teachers can create a supportive and encouraging environment that promotes student engagement (Furrer & Skinner, 2003). The impact of learning support, as an external factor, may develop other internal factors to increase student engagement (Helgeson & Lopez, 2010). Indeed, the importance of teacher learning support in influencing student learning engagement has been confirmed by a considerable number of researchers (Kyriakides et al., 2013; Slater et

al., 2012). Other researchers point out that the greater the institutional support for the creation of a supportive learning environment, the higher the level of student engagement, and the evidence suggests that institutional support in various areas has a significant positive impact on student engagement (Amora et al., 2016). High-quality learning support is positively associated with student behavioral input, cognitive input metrics, and emotional input (Quin, 2017). In general, the school's institutional environment, dominant norms and values have a supportive or disincentive effect on students' behavior, influencing students' thinking and thus their engagement in meaningful educational activities.

Teaching practice is another aspect of the learning environment. Considering the course teaching method, structure, learning feedback, learning task time and other aspects, many researchers have clarified the relationship between teaching practice and student engagement from various perspectives. Organizing pre-class discussions can alleviate students' class concerns and have a positive impact on students' engagement (Neer & Kircher, 1989). The willingness of students to participate in class discussions increases when engagement has a positive impact on their performance (Fassinger, 2000). Teachers and students in-class conversations are respectful and open to mutual criticism, and positive opposition is significantly related to the level of student engagement (Hyde & Ruth, 2002).The clarity of the content of the teacher's classroom teaching, the organization of the classroom and the learning feedback will affect the students' learning engagement and development (Pascarella & Terenzini, 2005), and is an important feature of the effectiveness of teaching (Ginsberg, 2007). Teacher style prefers tactile learning, visual learning, auditory learning, individual learning, and group learning to have a positive impact on students' classroom engagement (Xu, 2014). Students demonstrate greater behavioral involvement in academic tasks when teachers are clear about their expectations, provide a consistent response, and adjust teaching strategies to their level (Skaalvik & Federici, 2016). Appropriate scoring of students in the classroom will increase student engagement. Clear interpretation of teacher course expectations, activity objectives, and activity expectations, rule setting, engagement scoring, and careful design significantly reduce student resistance to active learning and are significantly related to student engagement (Tharayil et al., 2018).

In summary, in most cases, students' learning engagement is positively influenced by the learning support and teaching practices of the learning environment. It should be noted, however, that in some directional influences are confusing, such as in teaching practice, Susak (2016) points out that students' interests and personalities influence the way they choose to participate in the classroom. Suitable for one group of students' classroom style does not necessarily have a positive impact on the engagement of another group of students, which requires more research and clarification.

Based on the findings of the above related literature, this study presents the following hypotheses:

$H1_{D:}$ Learning environment positively correlated with engagement

### 2.3.2 Study on the Correlation between the Learning Environment and Student Development

This study examines the literature to show that earlier, Pascarella (1985) discussed the relationship between the learning environment and student development in a causal model of her learning outcomes. Pascarella (1985) concludes that various aspects of the learning environment may have little direct impact on student development, but this does not mean that the learning environment has no real impact on student development at all; rather, the impact may be moderate and indirect. The NSSE (2013) evaluation of Pascarella (1985) laid down the environmental dimension of the university to student development.

Many researchers have studied the impact of the overall school environment on student development. Henderson et al. (2000) argue that various characteristics of the learning environment influence students' learning gains. In addition, researchers have pointed out that students' perceptions of the teaching environment directly or indirectly affect learning outcomes, that positive perceptions directly affect academic performance, and that students' knowledge and skills can be best developed in a good teaching and independent learning environment (Lizzio et al., 2002). Doppelt (2004) found similar results, with learning outcomes related to the quality of the learning environment perceived by students, and the technical characteristics of the learning environment having an important influence on students' learning outcomes in the

cognitive and emotional fields. An important variable that determines a student's performance is the learning environment or the social atmosphere of the school (Roberts et al., 2008). In addition to the students' own factors, the students' perception of the learning environment has a significant impact on their own development (Lu & Yang, 2008). Hallinger and Heck (2011) argue that, in fact, school-level factors have a direct and indirect impact on student performance, not only because they affect student performance as a whole, but also because these factors directly and indirectly affect and reflect the composition of the classroom, as well as teaching and learning, which affect learning outcomes (Hallinger & Heck, 2011). The learning environment indirectly influences the cognition of learning gains and influences the research direction of many investigators. Many researchers believe that the impact of the learning environment on student development tends to be an intermediary of transmission rather than a direct and specific relationship between the two factors. At the same time, many studies consider that evidence of a learning environment that has an impact on learning outcomes is sometimes unreliable because it is not systematically assessed or analyzed. Indeed, little is still known about whether or to what extent the overall learning environment in different schools affects students' learning or learning outcomes (Blackmore et al., 2011).

More researchers have explored the impact of teaching practice and learning support on student development, respectively.

In terms of the teaching practice environment, some researchers believe that both formal classroom and extracurricular experiences influence educational outcomes (Terenzini et al., 1995). An effective incentive for students to collaborate, rather than to dictate to students, fosters a good classroom atmosphere, and encourages learning in which classroom teaching enhances students' success (Wubbels et al., 2014). Classroom management of physical, socio-emotional and organizational conditions is a value category of student achievement and has a significant impact on learning outcomes (Saggaf et al., 2017). The classroom environment not only has a direct impact on learning outcomes, but also indirectly affects learning outcomes through learning methods (Liu, 2015; Zhu et al., 2019). Lack of communication between teachers and students and between students often

leads to a dull classroom atmosphere and inefficient teaching, which directly or indirectly affects students' learning outcomes (Zhang, 2021).

In the area of learning support environments, Tinto (2005), a prominent American educationalist, notes that academic advisory support has been identified as a key institutional condition for student success. These conditions include setting high expectations, providing support, providing feedback, and frequent contact between students and faculty (Tinto, 2005). Schools provide service support to students in learning experiences that can be linked to the content of the curriculum, facilitating students' acquisition of "knowledge" (including knowledge of facts, rules, procedures) and "how to use knowledge" (including skills and competencies) (Prentice & Robinson, 2010). However, He (2016) found that there is a direct path between learning support and learning gains. Learning support has an independent direct effect on knowledge skills, but not on higher-order abilities.

A large amount of literature shows that many researchers believe that the learning environment has a positive relationship with student development, but there are also uncertainties. Some scholars believe that such an impact is multidimensional, such as learning support does not improve students' advanced learning ability. Researchers are more likely to agree on the need for an intermediary between the learning environment and learning outcomes, which may be an important reason for promoting the concept of student engagement.

Based on the findings of the above related literature, this study presents the following hypotheses:

$H1_C$: Learning environment is positively correlated with student development.

### 2.3.3 Study on the Correlation between Engagement and Student Development

As mentioned above, engagement includes reflection and integrated learning, collaborative learning, etc. Student development is also called learning outcomes, including knowledge and skills, emotional and behavioral development, etc. Through the combing of the literature, this study found that the engagement of university students is not a single structure concept, engagement is an all-encompassing term,

and contains a series of educational ideas, which are rooted in the study of the learning activities of university students and how students' experience at university affects their own learning and development. At the core of university student engagement is a focus on the activities and experiences of university students that relate to the desired university learning outcomes. From the outset, therefore, engagement has been associated with student learning outcomes.

Astin (1984) argued that the more students are involved, the more successful they will be at university. The active engagement of students in learning is essential for their own development (Pace, 1984b; Pascarella, 1985). Student development depends to a large extent on the quality of individual effort and engagement in school and extracurricular courses (Astin, 1984; Pace, 1984a). A considerable number of student development theories emphasize student learning reflection, which is positively related to student learning outcomes (Pintrich & De Groot, 1990). In addition, engagement in collaborative learning has an important impact on students' own development. Collaborative learning promotes friendship, acquires knowledge about the ways of cooperating with others, and learns from the different methods used by others to broaden the basis of understanding of variation (Bowden & Marton, 1998). Learning outcomes are also influenced by the quality of reflection, which is significantly related to students' learning outcomes (Ridley et al., 1992; Zimmerman, 2000). Student engagement is one of the most closely related variables to learning achievement (Sirin & Rogers-Sirin, 2004). There is also evidence that integrated learning, one of the important factors of engagement, is also a key factor in learning success. Engagement means that students proactively integrate new knowledge and existing information, and connect and expand this information to find answers to difficult questions. Integrating learning helps students learn deeply and gain knowledge beyond superficial understanding, with significant benefits for learning outcomes (Nelson et al., 2005). Students involved in integrative learning do better at applying knowledge to practice, analytical thinking, reflection skills, and critical thinking and new ideas (Fiorini et al., 2014). Students who reflect at a higher level of reflection are more likely to successfully achieve higher quality learning outcomes, such as assumptions, observations, and conclusions (Mäeots et al., 2016). Classroom engagement in collaborative learning also improves students' critical thinking and

discussion skills (Karima, 2016). When students are involved in the activities of peers and teachers, their level of cognitive skills is improved through collaboration, while emotions are harvested (Permatasari, 2016). Many factors of engagement influence student development at various levels. Students who are academically successful are more likely to perform than those who are not actively involved in class-related activities (Konold et al., 2018; Marks, 2000). There are significant differences in the performance of students with low engagement in the classroom compared to students with high engagement in the exam (Precourt & Gainor, 2019).

In summary, various factors in the engagement dimension affect the development of students at multiple levels, which is a complex process, but in any case, adequate engagement will have a positive impact on students' knowledge and skills, emotions and behaviors.

Based on the findings of the above related literature, this study presents the following hypotheses:

H5: Engagement is positively correlated with student development.

### 2.3.4 Study on Correlation between Learning Environment and Learning Orientation

As mentioned above, the researcher defines the learning orientation as the learning process complex, with deep learning orientation and surface learning orientation, including deep and superficial learning motivation and learning strategy. Next, we will review the influence of learning orientation on various aspects of the learning environment in combination with relevant literature.

It has been found in the literature that as early as 1976, (Marton & Säljö, 1976) pointed out that learning orientation is not inherently cognitive in students, but is induced and shaped by specific school learning environments. Entwistle (1983) was then the first to establish a relationship between learning orientation and the perceived characteristics of the learning environment based on experience, and Entwistle (1983) conducted research on undergraduate students at British universities, demonstrating a strong correlation between heavy academic workloads and surface learning orientation. On this basis, later researchers conducted many studies on learning environments and learning orientations. Biggs (1987) verified the correlation between

subject areas, pedagogy, task time, curriculum structure, and learning orientation in the learning environment. Other scholars have come to the same conclusion. Case (2003) pointed out that students' perception of the contradiction between control and loss of control in learning tasks takes a different learning orientation, and at that time, the time can be controlled using the deep learning method, while the surface learning method is adopted (Case, 2003). Entwistle (1983) studied the relationship between the learning environment and student learning orientation using quantitative and qualitative methods and found something. Learning orientation is related to the students' perception of the environment, and the perceived heavy learning task volume is significantly related to the surface learning orientation at the level of the students individually and in the group. Perceived good teaching is significantly associated with deep learning orientation (Entwistle & Ramsden, 2015). However, with respect to the conclusions of Entwistle (1983), Meyer (1990) found that a positive relationship between heavy learning tasks and surface learning orientation could not be detected at the individual level. This suggests that this relationship was controversial at the time, but many subsequent literature studies support the conclusions of Entwistle & Ramsden (1983). College students' perception of the classroom teaching situation will affect the learning methods they adopt. For students who actively perceive the classroom teaching situation, they adopt a deep learning orientation, while for students who negatively perceive the classroom teaching situation, they often adopt a superficial learning method (Zhang et al., 2006). A more constructive teaching and learning environment will guide students in reorienting their learning to promote deeper and less surface learning orientations in their learning (Wang et al., 2013).

In the segmented field of motivation and strategies, many researchers have presented the results of the impact of the learning environment on motivation and strategies. First, in a collaborative learning environment, student relationships with peers, teachers, and managers influence student behavior, including motivation and strategies. Yamane (1967) noted that certain attitudes and qualities present in the personal relationship between facilitator and learner have important learning effects. Cleveland-Innes and Emes (2005) pointed out the importance of dialogue and collaboration in a learning environment, and argue that collaborative learning in a

higher education environment affects not only the student's learning outcomes, but also the student's learning orientation itself, especially when it affects the student's motivation and learning strategies. The quality of teacher-student collaboration is a determinant of student motivation (Pascarella et al., 1981; Patrick et al., 2011; Rugutt & Chemosit, 2009). Good interaction variables in teacher-student relationships are effective in enhancing intrinsic motivation for learning (Alt, 2016). Students with good collaborative learning relationships have a higher motivation to learn (Li et al., 2013; Tu & Chu, 2020). Engagement in motivating university students, positive and communicative teacher-student collaborative relationships can also promote students' inner desires and motivations for learning (Cayubit, 2021).

For learning motivation, the classroom learning environment in the teaching practice environment is the most important influence factor (Wang et al., 1990).Teachers give full and useful feedback in classroom teaching, clarify goals, evaluation criteria, classroom fun, create opportunities for questions and time for consultation, be good at explaining problems, try to understand students' difficulties, and students acquire a certain learning independence is positively correlated with deep learning orientation (Trigwell & Prosser, 1991). , Perceiving the relevance of social relations, teachers' interests, and content, as well as the clarity and fit of learning requirements and self-learning motivation, are significantly related (Müller & Louw, 2004). The dimensions of reality-oriented learning, cohesion, task-orientedness, and clarity of rules are positively correlated with students' motivation and performance (Herrington et al., 2014). In a supportive environment, a learning environment that fosters autonomy and self-direction, and emphasizes collaborative learning, is significantly associated with motivation to learn (Radovan & Makovec, 2015). In China, researchers have pointed out that autonomously oriented classroom environments and environments with targeted learning objectives have a significant impact in promoting student motivation (Fan, 2006). Considerable research has shown that teachers' levels of teaching, curriculum design, the handling of teaching materials, teaching styles, and extracurricular teacher support for students in a classroom teaching environment are key factors influencing motivation for learning. The curriculum, pedagogical philosophy and extracurricular activities of colleges and universities and their members as compassionate learning companions of the school

significantly influence students' motivation (Zhu & Yu, 2015). In fact, the linguistic charisma of teacher classroom teaching, the emotional state, attention to students, and the interest of teaching materials are positively related to students' motivation for learning (Jia, 2017).

On the other hand, the learning environment is also influencing students' learning strategies. The instructional practice environment is an important factor influencing the learning strategy, as it is in the classroom environment. The student's perception of the emphasis on mastery or performance goal orientation in the classroom is closely related to the use of learning strategies (Ames & Archer, 1988). The teacher-student relationship embodied in the quality of interaction has an impact on students' motivation and strategy, and the positive relationship with university teachers can promote students' adoption of deep learning motivation and strategy (Trigwell, 2005). Many scholars have pointed out that learning strategies are influenced by learning motives, so learning motivation is an important factor when discussing the influence of teacher-student relationships on learning strategies. Similar recommendations are made in the relationship between peer partnerships and learning strategies. Positive learning environment, direct interaction between teachers and students, promoting open-mindedness, mutual respect for the opinions of others, letting students personally participate in learning activities will directly affect students' adoption of active learning strategies (Shaaruddin & Mohamad, 2017). Teachers' teaching methods in the classroom are often associated with different learning strategies. Simple content display, lack of comprehensive teaching methods, simple transmission of information to the students' classroom is related to the students' superficial learning strategies. Conversely, classroom teaching that provides positive feedback, allows students to learn freely, and defines the goals of relevant professional practice is related to students' deep learning strategies (Gozalo et al., 2020). Good classroom management and task-oriented teacher teaching accurately convey the goal choices that students need to make, which is closely related to the effective learning strategies that students adopt (Cayubit, 2021).

Researchers have noted that support outside of the classroom learning environment also affects the use of students' learning strategies. In terms of learning support, learning communities that link students' academic learning and university

campus life experiences can significantly influence the use and development of learning strategies (Lenning & Ebbers, 1999).

In summary, this section discusses the impact of teaching practice and learning support on learning orientation (motivation and strategy) in the learning environment. Regarding the relationship between these factors, many researchers have given positive correlations between the learning environment and the deep learning orientation, while there are negative correlations with the surface learning orientation. It should be noted that psychological theory points out that motives and strategies often have a causal relationship, that is, that strategies are often governed by motives, and from another perspective, motives and strategies are a synthesis, which also validates the view of Biggs (1987) that learning motives and strategies are referred to as learning process complexes and need to be considered together.

Based on the findings of the above related literature, this study presents the following hypotheses:

$H1_A$: Learning environment positively correlates with deep learning orientation.

$H1_B$: Negative correlation between learning environment and surface learning orientation.

### 2.3.5 Study on the Correlation between Learning Orientation and Student Development

This section will discuss the relationship between learning orientation and various aspects of student development. Learning orientation encompasses deep and surface learning orientation, and is a synthesis of learning motivation and strategy. Student development represents student learning quality and outcomes at the university. This study examines the literature, which has shown that a long time ago, a research team at the University of Gothenburg in Sweden conducted a study on the relationship between learning orientation and learning outcomes, and concluded that deep learning methods are associated with high-quality learning outcomes and superficial methods are associated with low-quality learning outcomes (Saljo, 1984; Watkins, 1983). Prosser (1989) validated this result again. Biggs (1987) studied the relationship between learning orientation and student development and found that

students with a deep (or superficial) learning orientation had significant differences in test scores or average grade points (GPA), writing structure complexity; self-set goals, self-concept, and satisfaction. More interestingly, Meyer (1990) found that when students learn in a way that encompasses both deep and superficial learning methods, or in a way that does not encompass either, they tend to fail in university exams, or learning outcomes are significantly worse than those of students who have been using superficial or deep learning methods. This suggests that the impact of learning orientation on learning outcomes is complex and multifaceted, but then more scholars believe that there is a positive relationship between deep learning orientation and learning outcomes. High-quality learning outcomes are independent of superficial learning methods, and improving the quality of learning outcomes may be due to a learning environment that encourages deeper learning (Trigwell, 1991). Garcia and Pintrich (1996) found that only deep learning strategies, rather than motivation, had a significant impact on the prediction of average grade points, and American students using deep strategies obtained higher GPA. Research by Wilson et al. (1997) suggests a statistically significant correlation between learning orientation and learning achievement, but previous research by Watkins (1983) suggested no correlation between academic achievement scores and learning orientation. The motivation associated with deep learning is intrinsically motivating, suggesting that students seek to satisfy personal curiosity. Such students are more aware of and acquire experience in their own learning than are students using superficial learning methods (Prosser & Trigwell, 1999). Tosome extent, the relationship between learning orientation and academic achievement may vary from school to school (Zhang, 2000). However, the benefits of a deep learning orientation for learning outcomes have been recognized by many researchers. It was found that a deep learning orientation improves students' exposure to learning subject matter materials, as well as analytical and conceptual thinking skills (Hall et al., 2004). The degree of deep learning motivation significantly affects the development of students' abilities, while the intensity of superficial learning motivation has no significant impact on the development of abilities (Chan & Yeung, 2019). The deep method has a positive impact on the development of students' attributes (Kember et al., 2020).

Overall, abundant literature shows that deep learning orientation is important compared to surface learning orientation, and students using this approach tend to achieve higher learning scores and be able to remember, integrate, and communicate various knowledge messages more quickly (Biggs，John, 1988; Entwistle, 1983; Prosser, 1989; Ramsden, 2003). It also affects students' interest in learning, reading, making full use of resources, interacting with others in a targeted way and reaping rewards, thinking about the relevance of personal information to the collective and future, and applying knowledge to practice and gaining benefits in the emotional dimension (Biggs, 2003; Heikkilä, 2006; Hu & Yeo, 2020; Nelson Laird et al., 2014). The general conclusion is that deep learning orientation will yield better educational outcomes than using superficial learning methods (Howie & Bagnall, 2013).

In summary, the learning orientation affects the learning gains in cognitive, emotional, behavioral and other aspects, and affects the development of students in all aspects. It is generally accepted that the use of deep learning by students in the learning process has a positive impact on their own development, while surface learning orientation plays a negative role.

Based on the findings of the above related literature, this study presents the following hypotheses:

H3: Deep learning orientation is positively correlated with student development.

H4: The surface learning orientation is negatively correlated with student development.

### 2.3.6 Study on the Correlation between Learning Pressure and Engagement

As mentioned earlier, engagement represents the level of effort and time spent by students. Learning pressure is when some students perceive an event in the learning process as a challenge or even a threat, and can lead to some emotional and cognitive reactions, such as anxiety, fear, depression, confusion of perception, misjudgment, dysmorphism, etc. Therefore, when discussing the impact of learning pressure on engagement, stress-inducing learning process events and stress responses are two major influencing factors.

In this study, it has been found that the literature has shown that the effect of stress on learning in the field of university students was not considered as the focus of the study before (Michie et al., 2001), people began to pay attention to this issue to learn more about the stress experienced by students (Robotham, 2008). Numerous literature studies show that reactions to learning pressure have both positive and negative effects on student engagement, such as evaluations of sage topics conducted by university research groups such as New York University in the United States show no significant differences in academic effort and stress (Molnar et al., 2001). However, other scholars have pointed out that higher learning pressure is related to students' overall mood, passive learning, and non-participatory coping (Asghar, 2014). Evidence such as the one presented below, among others, suggests that the relationship between learning pressure and engagement is complex.

Events that are perceived as challenging tend to lead to positive reactions, such as efforts to engage in learning, when it comes to event factors in the learning process that cause learning pressure. In fact, the challenges and threats faced by students and the subsequent stress responses may appear in various learning and life segments, such as classroom learning, interpersonal communication, peer learning, etc. In classroom teaching, students who felt threatened and stressed by their mentors responded less and were less engaged. When students perceive a teacher as threatening, the high level of anxiety caused by stress inhibits students from answering teacher questions (Peters, 1988). Students who feel pressured by peers or teachers do not actively seek help and lack peer learning and teacher interaction (Ryan & Pintrich, 1997). Events perceived as threats often lead to negative reactions, such as non-engagement or dropping out of school (Shields, 2001). Myers & Rocca (2001) found that when students felt that teachers were hypo-argumentative and highly aggressive, students who felt stressed had less involvement in motivation, emotional learning, and cognitive learning. In a classroom atmosphere that affects personal appearance, people with moderate stress have similar cognitive and communicative behaviors to those with high stress, and face support and engagement are positively correlated (Frisby et al., 2014). In addition, university students often feel pressured by challenging tasks and abandon their engagement (Civitci, 2015). Engagement in classroom discussions can lead some students to feel alienated,

fearful, and stressed, thus avoiding engagement, especially for women and students from ethnic minority backgrounds (Huggins & Steel, 2016). Interestingly, however, some scholars have come to the opposite conclusion, arguing that students prefer challenging tasks and thus have a more positive attitude towards classroom engagement (Ames & Archer, 1988). Low levels of learning pressure do not necessarily promote better performance, and in fact students may perceive tasks as less challenging and therefore less motivating to participate (Uchil, 2017). Therefore, challenging rather than threatening learning events may not affect learning engagement.

On the other hand, the relevant literature shows that learning engagement is influenced by various emotional response factors arising from learning pressure. Anxiety is a common factor in emotional reactions. When the pressure of greater academic challenges is perceived, anxiety and avoidance of engagement arise (Kashdan & Fincham, 2004). Positive and negative emotional reactions are directly related to the level of student engagement, and the more positive emotions that emerge from learning, the higher student engagement will be; conversely, the frequency of negative emotions is related to lower engagement (Reschly et al., 2008). Students feel overwhelmed by the anxiety response caused by learning pressure and are unable to participate correctly in learning (Eagan et al., 2013). Students who invest more in learning tend to have lower levels of anxiety (Asghar, 2014). When learning pressure levels are too high, they can have negative academic and emotional effects, which can be a potential reason for adopting a variety of unhealthy behaviors (Skinner et al., 2016).

The Chinese researchers presented some different conclusions. When students feel high learning pressure, the state of psychological stress can lead to the consumption of their psychological resources, which further reduces the investment of resources, thus affecting the individual's academic investment (Hua et al., 2016; Zhang et al., 2014). On the contrary, Wang (2018) found that pressure would increase individual learning motivation, increase individual engagement, and ultimately promote learners' learning achievement. Self-influenced peer pressure has a significant positive and direct effect on academic engagement. For example, competitive pressure in terms of academic performance ranking and scholarship has a

positive effect on students, and the greater the competitive pressure, the more students will invest in learning (Liu et al., 2017).

This section discusses the relationship between learning pressure and engagement. From the numerous literature, it can be seen that the influence of learning pressure on student engagement is complex and multi-faceted. This stems from the diversity of learning process events that cause learning pressure and the complexity of learning pressure response. However, the relevant literature still gives clues on the influence of learning pressure on student engagement in some aspects. As mentioned above, perceived teacher threat pressure affects classroom engagement, low intensity learning pressure reduces student engagement, learning pressure affects interpersonal interaction and collaborative learning, and the pressure of academic competition promotes learning input. In the practice of higher education in China, it is more evident that higher academic pressure will force students to commit to more learning.

Based on the findings of the above related literature, this study presents the following hypotheses:

$H2_{D:}$ learning pressure correlates positively with engagement.

### 2.3.7 Study on Correlation between Learning Pressure and Learning Orientation

As mentioned earlier, learning orientation is a combination of learning motivation and learning strategy. There is a distinction between deep learning orientation and surface learning orientation. This study examined the literature and found that from the existing literature, researchers have studied the relationship between learning pressure and learning orientation at an early stage, and found the connection between the two. The researchers discussed the relationship between learning pressure and learning motivation, learning pressure and learning strategies, and the synthesis of these factors.

Earlier, Fransson (1988) found that deep learning methods are used when students perceive learning events to be in line with their interests without stress, while anxiety caused by learning pressure can cause students to adopt superficial learning methods. The superficial learning approach is most susceptible to situational stress

responses (Biggs, 1985). Learning fear is an emotional response to learning pressure, and superficial learning methods are associated with a fear response to failure (Fransson, 1988). Positive emotions are necessary, and learning pressure and dissatisfaction with reality often lead directly to superficial learning (Biggs, 1989). Educational psychologist LePine et al. (2004), in a study of 696 university students, found that stress caused by factors such as role ambiguity and role conflicts in collaborative learning was negatively correlated with learning motivation, while challenging stress caused by the difficulty level or requirements of learning itself was positively correlated with learning motivation. Since then, researchers have found that students experiencing high levels of stress rarely use deep learning strategies, but instead use superficial learning strategies in an attempt to regain control of their learning outcomes (Roussis & Wells, 2008). In addition, depression caused by learning pressure appears to be negatively correlated with strong motivation (Park et al., 2012). Garn & Jolly (2014) found that for highly qualified students, learning motivation diminishes when high levels of external pressure are exerted. Studies by Yuan et al. (2017) show that students adopt a superficial learning mindset in the face of extreme academic stress. Recent researchers have pointed to a significant negative correlation between university student study stress and internal study motivation (Zhao & Chen, 2018). The surface learning orientation is positively correlated with a high level of perceived stress, reflected in a low level of expected achievement. The relationship between deep learning orientation and perceived stress appears to be more contradictory, although there is a positive correlation with expected accomplishments (Maria Öhrstedt & Petra Lindfors, 2018). More researchers say superficial learning methods are always closely related to heavy learning workloads (Lindblom-Ylänne et al., 2019). learning pressure is negatively correlated with motivation, deep learning strategies, critical thinking, and academic achievement (Trigueros et al., 2020). There is a relationship between the level of pressure from normal to severe learning pressure and the level of motivation from low to high (Alda et al., 2020).

In conclusion, learning pressure does have an impact on learning orientation. Most of the findings suggest that the relationship between the two is negative, that is, students tend to adopt superficial methods of learning and, conversely, deeper

methods of learning in situations of high learning pressure. It is worth noting that this relationship has not always been the case, as mentioned earlier by some scholars: when academic competitive pressure is high, students are more likely to adopt deep learning methods, and students have stronger motivation to learn in the face of challenging learning task pressure. Further, some researchers noted that students using superficial learning methods had lower learning outcomes than students using deep learning methods (Diseth & Martinsen, 2003; Minbashian et al., 2004), but there is additional evidence that superficial methods can also be used to achieve good learning outcomes (Asikainen et al., 2013). Therefore, this relationship needs to be further verified and clarified when considering the impact of learning pressure on learning orientation and ultimately on learning outcomes.

Based on the findings of the above related literature, this study presents the following hypotheses:

$H2_A$: Learning pressure is negatively correlated with deep learning orientation.

$H2_B$: Learning pressure correlates positively with surface learning orientation.

### 2.3.8 Study on the Correlation between Learning Pressure and Student Development

From the literature review, it is found that a large number of researchers have studied the relationship between learning pressure and student development, but the research results obtained have different conclusions or even contradictions. The conclusions show that learning pressure has a negative or positive impact on learning development, and some emphasize the importance of appropriate learning pressure. The impact of learning pressure on students' learning is thus complex. A review of the relevant literature is provided below.

Long ago, some researchers pointed out that learning pressure affects not only an individual's behavior and mental health, but also academic performance (Elliot & Eisdorfer, 1982). High levels of learning pressure can interfere with cognitive information processing and ultimately lead to lower learning outcomes (Gross & Mastenbrook, 1980; Perry et al., 1993). Sax (1997) believed that university life is a

highly stressful life, and university students are increasingly under pressure to learn, which is followed by behavioral responses and learning performance. Symptoms associated with learning pressure, including anxiety, insomnia, and eating disorders, can all lead to lower learning outcomes (Westerman et al., 1993). An increasing number of learning pressure reactions have become a widespread concern on university campuses (Misra & Castillo, 2004; Sax, 1997). Evidence suggests that while short-term learning pressures rarely negatively affect learning outcomes, recurrent and long-term learning pressures often have potentially detrimental effects on achievement (McEwen & Lasley, 2002). In fact, a large number of researchers conducted cross-sectional and longitudinal studies, and the results showed an overall negative correlation between the learning pressure perceived by students and their learning achievement (Baker, 2003; Richardson et al., 2012; Rosenzweig et al., 2003; Vaez & Laflamme, 2008). A growing number of scholars have since pointed out that learning pressure is linked to academic achievement (Schraml et al., 2012). Higher learning pressure is associated with poor academic performance (Sohail, 2013). In general, the greater the academic stress, the worse the learning outcomes, and the learning pressure has a negative impact on academic achievement (Kötter et al., 2017; Pascoe et al., 2020).

However, some scholars have pointed out that Zia-ur-Rehman and Sharif (2014) pointed out that changes in the magnitude of learning pressure have an impact on student performance, and there is a certain positive correlation between initial stress and student performance, which negatively affects student performance as the stress increases (Zia-ur-Rehman & Sharif, 2014). Karaman and Watson (2017) later demonstrated this relationship again, showing that stress-related factors can affect student academic achievement as college students' learning pressure increases (Mehmet A Karaman et al., 2017). Similarly, it is concluded that low levels of learning pressure do not necessarily ensure that students will perform better. Some degree of learning pressure will promote students to perform at their best, but it will also cause adverse academic consequences when learning pressure is increased and insufficient resources to cope with the stress cannot be managed effectively (Reddy et al., 2018).

More interestingly, other researchers have concluded that students should have moderate levels of learning pressure. Keeley et al. (2008) note that students with moderate levels of learning pressure perform better in learning outcomes than those reporting high or low levels of learning pressure (Keeley et al., 2008). Researchers from the Ghana Polytechnic Institute noted that while there is a positive relationship between learning pressure and learning outcomes, it is weak and there is no significant impact between the two. This means that students can still achieve excellent academic results, no matter how pressured they are to learn (Azila-Gbettor et al., 2015). While students' expected learning pressures may have a significant impact on academic achievement, this impact is manifested differently in different learning bodies, resulting in higher or lower academic achievement (Stoliker & Lafreniere, 2015). In fact, none of the predictors (perceived stress and confusion) are useful in predicting academic achievement (Smejkalová, 2018). From this, it can be seen that the impact of learning pressure on learning is complex. As some researchers have pointed out, the impact of learning pressure on learning achievement is much more complex than a simple linear relationship. Different students have different reactions to the same level of learning pressure. A certain level of learning pressure may be appropriate, without harming learning achievement.

In conclusion, the impact of learning pressure on student development is complex, and numerous literature results are more likely to believe that high levels of learning pressure can be detrimental to learning outcomes. However, as Sohail (2013) suggested, appropriate learning pressures may provide greater benefits to student development.

Based on the findings of the above related literature, this study presents the following hypotheses:

$H2_C$: Learning pressure is negatively correlated with student development.

## 2.4 Theoretical Framework

Based on the previous discussion, the theoretical framework of this study is obtained as follows:

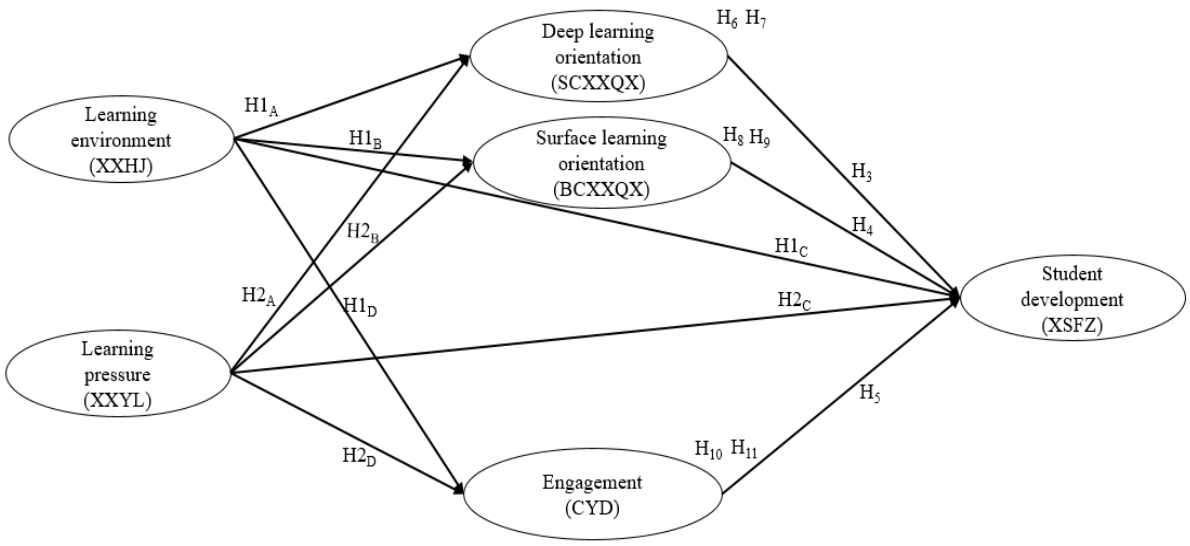


Figure 2.4 Theoretical Framework Diagram

Note: $H1_A$, $H2_A$, etc. are hypothetical identifiers in this study.

## 2.5 Research Hypotheses

Based on the above theoretical framework, combined with the relevant literature review, the hypothesis of this research is put forward, which is summarized as follows:

$H1_A$: Learning environment is positively correlated with deep learning orientation.

$H1_B$: Learning environment is negatively correlated with surface learning orientation.

$H1_C$: Learning environment is positively correlated with student development.

$H1_D$: Learning environment is positively correlated with engagement.

$H2_A$: Learning pressure is negatively correlated with deep learning orientation.

$H2_B$: Learning pressure is positively correlated with surface learning orientation.

$H2_C$: Learning pressure is negatively correlated with student development.

$H2_D$: Learning pressure is negatively correlated with engagement.

H3: Deep learning orientation is positively correlated with student development.

H4: Surface learning orientation is negatively correlated with student development.

H5: Engagement is positively correlated with student development.

H6: Deep student orientation mediates the relationship between learning environment and student development.

H7: Deep student orientation mediates the relationship between learning pressure and student development.

H8: Surface student orientation mediates the relationship between learning environment and student development.

H9: Surface student orientation mediates the relationship between learning pressure and student development.

H10: Engagement mediates the relationship between learning environment and student development.

H11: Engagement mediates the relationship between learning pressure and student development.

# CHAPTER 3

# RESEARCH METHODS

This study used the literature analysis method and the questionnaire method to compile the literature and collect the research data. Mainly based on the background real problems and student development research topics, the theoretical literature is collected and sorted through Google Academic, China Knowledge Network and other Chinese and foreign databases to understand the theoretical models, variable concepts and related relationships, and finally put forward the research theoretical framework, conceptual framework and research hypothesis. Pre-testing and formal questionnaires using mature scales.

## 3.1 Target Population

The survey of this research paper is generally determined to be students of Chinese universities. According to the authoritative data on the "number of general undergraduate students in higher education" released by the Ministry of Education of China in June 2020, the number of students in higher education institutions in China is 303,152,62. (The data comes from the official website of the Ministry of Education, at:
http://www.moe.gov.cn/jyb_sjzl/moe_560/jytjsj_2019/gd/202006/t20200611_464825.html.

It should be pointed out that in the authoritative data on the number of students in higher education, except for the total number of students, it is impossible to obtain detailed information on the proportion of students by sex, major, grade, etc. This may be due to the fact that the State has strengthened data security in recent years. Therefore, in order for the sample population of this study to be representative of the overall population, the descriptive statistical results of the data of the pre-test samples

will be used to get a preliminary understanding of the overall demographic characteristics, and valid samples with similar distribution will be drawn from these demographic characteristics in the official questionnaire.

## 3.2 Sampling Methods

This study will distribute online questionnaires through the China Questionnaire Star website (URL: https://www.wjx.cn). The questionnaire star website is a well-known professional questionnaire platform in China and an effective way for Chinese researchers to collect questionnaire data. According to the information provided by the customer service of the platform, it was learned that the general mechanism for distributing the questionnaire on the platform is to push the questionnaire to the target population related to the research through the network. Those who are willing to participate in the questionnaire will fill in the data according to the questionnaire and then submit it. If the number of samples reaches the prerequisite number, the questionnaire reception will be stopped. This method is a convenient sampling method. Martínez-Mesa et al. (2016) pointed out that for the convenience and accessibility of participants, questionnaires could be distributed using convenient sampling methods in non-probabilistic sampling, that is, participants were continuously selected in the order in which they appeared, and the sampling process ended when the sample size met the study requirements.

The specific steps are as follows: 1. Upload this study questionnaire on the questionnaire star website; 2. Contact the platform for sample services, and the platform will distribute and recycle questionnaires to the target group of university students through paid services; 3. Download questionnaire data for analysis.

The use of convenient samples is widespread, even among researchers who recognize the superiority of probability sampling in other contexts (Couper et al., 2013). Despite the general disadvantages of non-probabilistic convenience samples over probabilistic samples, non-probabilistic convenience samples remain the standard for the development of science and will continue to exist due to the high cost of probabilistic samples and the fact that most of the available probabilistic samples are not suitable for research and development issues (Jager et al., 2017).

## 3.3 Number of Samples

According to Gill and Johnson (2010), when sampling the population. Although the larger the sample, the less likely it will be to discover bias, when the sample exceeds a certain size, the effect decreases rapidly, which requires balancing all aspects with the researchers (Gill & Johnson, 2010). Therefore, the sample size should be kept appropriate. Too large or too small is not conducive to research. Excessive sample size will cause over-identification in the structural equation model. Bentler and Chou (1987) believed that the sample size should be 10-15 times that of the scale item. Wu (2010) considered appropriate that the sample size is 5-10 times that of the scale item. Qiu (2006) noted that the sample size for structural equation analysis was preferably more than 10 times the number of indicator items. Based on the above opinions of many people and the number of formal questionnaire questions obtained after the pre-test (27 items), this study determined that the sample size is no less than 15 times the number of questions, that is, no less than 405.

Based on a valid questionnaire rate of around 70%, approximately 600 questionnaires would be required to collect more than 405 valid questionnaires.

## 3.4 Data processing Methods

The study pre-test and official questionnaire data mainly utilized the software versions of IBM SPSS Statistics 24 (SPSS 24 in short) and IBM SPSS Amos 25 (Amos 25 in short) as statistical and data analysis software. These two types of software are liked and widely used by researchers, and have extremely strong data analysis and processing capabilities, which can guarantee the accuracy and persuasiveness of the data analysis results in this study. SPSS 24 was mainly used in the primary processing of data in this study, including deletion of invalid questionnaire data, sample frequency statistics, descriptive statistics, questionnaire scale reliability analysis and exploratory factor analysis. Amos 25 is mainly used to analyze the covariance structure, and analyze the structural equation model (SEM) in this study, including model fit analysis, path analysis, hypothesis test, etc. The

discussion of the relevant research findings is concluded with the analysis of the reported data.

### 3.4.1 Scale

1) Learning environment

Regarding the learning environment, the two-son scale of learning support and teaching practice in the green version of the "CCSS 2020" was used for measurement. The China College Student Learning and Development Tracking Research (CCSS) Questionnaire is based on the introduction of the National Survey of Student Engagement (NSSE) Questionnaire, and has been improved through cultural adaptation, cognitive interviews, and credibility testing. It has been designed and constructed in accordance with China's higher education practice. As of 2021, a total of 25 million Chinese college students have participated in the survey (website: http://ccss.ioe.tsinghua.edu.cn/index ）. It should be noted that the National Survey of Student Engagement (NSSE) is a globally renowned and far-reaching survey project that has been completed by more than 1,650 American universities and some 6 million students since 2000. The questionnaire scale has good credibility. Based on the results of the analysis of the CFA and EFA of the CCSS, the scale can be considered to have sufficiently strong structural validity evidence to support its use in university and university assessment work (Wang, 2018). In fact, based on the results of the CFA, (Wang, 2018) noted that the standardized regression weights for both learning support and teaching practice were strong, ranging from about 0.4 to 0.9. In general, fit indices and regression weights provide sufficient evidence of structural validity for learning environment variables. The specific scale is as follows:

Table 3.1 Learning Environment Scale

| Scale | Item | Options |
|---|---|---|
| Learning environment (XXHJ) | To what extent does your school:<br>1. Focus on providing support to help you succeed academically.<br>2. Provide you with learning support (such as tutoring services).<br>3. Encourage students from different backgrounds (social background, ethnic background, etc.) to contact each other. | Likert 5-point scale (from 1 "very little" to 5 "very much") |
| | To what extent are your teachers:<br>1. Clearly state the learning objectives and learning requirements of the course.<br>2. Reasonable organization and arrangement of teaching content.<br>3. Use cases or diagrams to explain difficulties.<br>4. Provide guidance and feedback as you complete course assignments (such as essays, designs, etc.).<br>5. Provide immediate feedback on the status of assignments or quizzes. | Likert 5-point scale (from 1 "not at all" to 5 "completely") |

2) Engagement

In the 2020 Green Version of CCSS, student engagement is measured in terms of student effort in the learning process, reflection and integrated learning, and active collaboration with peers. The engagement was measured using these two subscales in this version of the study. For both subscales, Wang (2018) was noted that the results of the confirmatory factor analysis (CFA) showed that the normalized regression weights for all factors were strong, with values ranging from approximately 0.4 to 0.9. Overall, the fit index, the regression weights, showed that

the four subscales had sufficient structural validity. The reflection and synthesis learning comprised four items, and the options were modified to Likert's 5-point scale (from 1 "Never" to 5 "Always"). Collaborative learning consists of three items, with the option modified to a 5-point Likert scale (from 1 "Very few" to 5 "A lot"). The specific scale is as follows:

Table 3.2 Engagement Scale

| **Scale** | **Item** | **Options** |
|---|---|---|
| Engagement (CYD) | In your daily study, you will:<br>1. When completing assignments, combine different curriculum knowledge and ideas.<br>2. Link your learning to social issues.<br>3. Can comprehensively consider problems from different perspectives in course discussions or assignments.<br>4. Reflect or examine the strengths and weaknesses of your point of view. | Likert 5-point scale (from 1 "never" to 5 "always") |
| | In your daily study, how often do you study with your peers:<br>1. Invite another student to help you understand the course material.<br>2. Explain the course study material to another student or students.<br>3. Collaborate with other students on coursework or assignments. | Likert 5-point scale (from 1 "very little" to 5 "very much") |

3) Student development

With regard to student development, similarly, measurements were made using the Personal Development subscale in the 2020 Green Edition of the Chinese Student Learning and Development Tracking Study (CCSS), which measures the contribution of the university experience to the development of students'

individual knowledge, skills, and emotions, including eight subject-items, with options revised to Likert's 5-point scale (from 1 "very few" to 5 "A lot"). Wang (2018) Noted: The results of the factorial analysis (CFA) of the scale sample data showed that the normalized regression weights for all question items were strong, with values ranging from approximately 0.4 to 0.9. In general, both the fit index and the regression weights showed that this subscale had sufficient structural validity. The specific scale is as follows:

Table 3.3 Student Development Scale

| **Scale** | **Item** | **Options** |
|---|---|---|
| Student Development (XXFZ) | University study experience helps you in the following areas:<br>1. How much did your university study experience help you improve your ability to write well?<br>2. How much did your university study experience help you improve your good oral expression skills?<br>3. How much has your university experience helped you improve your critical and analytical thinking?<br>4. How much did your university study experience help you improve your professional knowledge and skills?<br>5. How much did your university study experience help you improve your ability to work effectively with others?<br>6. How helpful has your university study experience helped you to establish a clear outlook on life and values?<br>7. How much did your university study experience help you to improve your ability to solve complex problems in reality?<br>8. How much did your university study experience | Likert 5-point scale (from 1 "very little" to 5 "very much") |

| Scale | Item | Options |
|---|---|---|
| | help you improve your curiosity and imagination? | |

4) Learning orientation

Regarding the learning orientation, measurements were made using the revised two-factor learning process scale (R-SPQ-2F) by Biggs et al. (2001). Two subscales measure students' deep learning orientation and surface learning orientation during the learning process. Each subscale consists of 6 questions, a total of 12 questions, and the options are modified to Likert's 5-point scale (from 1 "Not at all" to 5 "absolutely yes"). Biggs (2001) pointed out that, using four subscales to test a sample of 495 undergraduates from a different discipline at the University of Hong Kong, the results of validation factor analysis (CFA) showed that the comparison fit index CFI value was between 0.997 and 0.998, and the standardized mean square root residue (SRMR) was between 0.01 and 0.02, indicating that the hypothesis model and the observation data fit well. Cronbach alpha values ranged from 0.57 to 0.72, indicating acceptable scale reliability. The specific scale is as follows:

Table 3.4 Learning Orientation Scale

| Subscale | Item | Options |
|---|---|---|
| Deep Learning Orientation (SCXXQX) | During the learning process, your situation is:<br>1. I find that sometimes learning gives me a deep sense of personal satisfaction.<br>2. I found that I have to work hard on a learning content, and I will not form my own conclusions until I am satisfied.<br>3. Almost any learning content, once I get into learning it will be very interesting.<br>4. I find most new learning content interesting and often spend extra time finding out more about it. | Likert 5-point scale (from 1 "Not at all" to 5 "Exactly") |

| Subscale | Item | Options |
|---|---|---|
| | 5. I find that learning content and academic topics can sometimes be as exciting as a good novel or movie.<br>6. I always test myself on important learning content until I fully understand them. | |
| Surface Learning Orientation (BCXXQX) | During the learning process, your situation is:<br>1. My goal: to pass the course with as little effort as possible.<br>2. I only seriously study what is taught in class or on the syllabus.<br>3. I don't find my classes interesting, so I try to do as little homework as possible.<br>4. I learn things by rote memorizing them over and over even if I don't understand them.<br>5. I can pass most exams by memorizing key sections rather than by understanding the learning content.<br>6. I usually limit my studies to a certain range because I don't think it's necessary to do anything extra. | Likert 5-point scale (from 1 "Not at all" to 5 "Exactly") |

5) Learning Pressure

learning pressure was measured using the Learning Pressure Perception Scale developed by Bedewy and Gabriel (2015). The Learning Pressure Scale (SS) consists of seven questions with options modified to a Likert 5-point scale (from 1 "totally disagree" to 5 "totally agree"). According to Bedewy and Gabriel (2015), the internal consistency reliability (Cronbach's alpha) of SS scale sample data is 0.7. The results of the exploratory factor analysis showed that the factor load of the question item was between 0.41 and 0.79, which had acceptable reliability and validity (Bedewy & Gabriel, 2015). The specific scale is as follows:

Table 3.5 Learning Pressure Gauge

| Scale | Item | Options |
|---|---|---|
| Learning pressure (XXYL) | During your studies:<br>1. My teacher is too demanding of my academic performance.<br>2. I'm worried about failing the course exams this year.<br>3. The teacher has unrealistic expectations of me.<br>4. There are too many courses to learn.<br>5. I think the amount of homework is too much.<br>6. My classmates and I compete fiercely in terms of grades.<br>7. Exam questions are often difficult. | Likert 5-point scale (from 1 "Strongly Disagree" to 5 "Strongly Agree") |

### 3.4.2 Pre-testing

The measurement scales for all variables in this study were from abroad. Pre-testing will be conducted to improve the reliability and validity of the questionnaire. The pre-test data was collected from Chinese university students through a web-based survey (https://www.wjx.cn), which resulted in 185 valid questionnaires, which were collected between January and February 2021.

After collecting the data, SPSS software is used to analyze the data, and the valid questionnaire data is analyzed with descriptive statistics and reliability. The reliability analysis utilizes the reliability analysis function of SPSS to determine the reliability of the questionnaire, the reliability of the measurement scale, and the credibility of the response results of the measurement sample. In the analysis results, the Klombach Alpha coefficient based on the standardized term was examined and taken as a value between 0 and 1. If this coefficient is closer to 1, it indicates that the reliability is higher, and it is generally lower than 0.5. It is necessary to consider readjusting the questionnaire. Meanwhile, the Klombach Alpha coefficient after the deletion of the term is studied. This coefficient is useful for judging whether there are inappropriate questions in the dimension or questionnaire. If the coefficient is not

lower than the Klombach Alpha coefficient of the standardized term, the corresponding question needs to be adjusted. The effect analysis is mainly used to judge the validity of the questionnaire, the validity of the measurement scale, the reasonableness of the measurement question design, and the function of SPSS analysis-decrease-factor. The KMO coefficient of the analysis results is in the range of 0-1. The closer to 1 indicates a strong correlation between the original variables, which is very suitable for factor analysis. The significance of the Bartlett spherical test was also examined, and if it was less than 0.05, it also indicated that the data were suitable for factor analysis. Below are the results of the analysis.

1) Descriptive statistics

The following statistical analyses were performed on the sample gender demographic characteristics:

Table 3.6 Pre-test Frequency Statistics

| **Project** | **Options** | **Frequency** | **Percent (%)** | **Valid Percent (%)** | **Cumulative Percent (%)** |
|---|---|---|---|---|---|
| Gender | male | 168 | 40.8 | 40.8 | 40.8 |
| | Female | 244 | 59.2 | 59.2 | 100 |
| | Total | 412 | 100 | 100 | |
| Disciplines | philosophy | 25 | 6.1 | 6.1 | 6.1 |
| | economics | 33 | 8 | 8 | 14.1 |
| | Law | 26 | 6.3 | 6.3 | 20.4 |
| | Pedagogy | 44 | 10.7 | 10.7 | 31.1 |
| | literature | 53 | 12.9 | 12.9 | 44 |
| | History | 19 | 4.6 | 4.6 | 48.6 |
| | science | 37 | 9 | 9 | 57.6 |
| | Engineering | 40 | 9.7 | 9.7 | 67.3 |
| | Agronomy | 33 | 8 | 8 | 75.3 |
| | medicine | 45 | 10.9 | 10.9 | 86.2 |
| | management | 35 | 8.5 | 8.5 | 94.7 |

| Project | Options | Frequency | Percent (%) | Valid Percent (%) | Cumulative Percent (%) |
|---|---|---|---|---|---|
| | art | 22 | 5.3 | 5.3 | 100 |
| | Total | 412 | 100 | 100 | |
| Grade | one | 101 | 24.5 | 24.5 | 24.5 |
| | two | 120 | 29.1 | 29.1 | 53.6 |
| | three | 98 | 23.8 | 23.8 | 77.4 |
| | Four | 93 | 22.6 | 22.6 | 100 |
| | Total | 412 | 100 | 100 | |

2) Reliability analysis

The reliability analysis results of the prediction data are as follows:

Table 3.7 Prediction Data Reliability Analysis

| Dimension | Cronbach's Acoefficient | Totality Cronbach's Aacoefficient |
|---|---|---|
| Learning environment (XXHJ) | 0.961 | 0.978 |
| Learning pressure (XXYL) | 0.903 | |
| Deep Learning Orientation (SCXXQX) | 0.947 | |
| Surface Learning Orientation (BCXXQX) | 0.927 | |
| Engagement (CYD) | 0.964 | |
| Student Development (XSFZ) | 0.956 | |

The overall questionnaire reliability results show that the clonbach alpha coefficient based on standardized items is equal to 0.978, indicating that the reliability of the questionnaire is very high. At the same time, the clonbach alpha coefficient after deleting items is between 0.978 and 0.979, which is lower than the

clonbach alpha coefficient of standardized items of 0.979, indicating that there are no inappropriate questions in the questionnaire and there is no need to consider adjusting the items.

3) Validity analysis

Exploratory factor analysis was conducted on the dimensional validity and overall validity of the prediction test data. The results are as follows:

Table 3.8 Predictive Data Validity Analysis

| **Variable** | **KMO Test** | **Bartlett Test** |
|---|---|---|
| | **KMO Value** | **Significance Level** |
| Overall validity | 0.938 | .000 |
| Learning environment (XXHJ) | 0.935 | .000 |
| Learning pressure (XXYL) | 0.854 | .000 |
| Surface Learning Orientation (BCXXQX) | 0.921 | .000 |
| Surface Learning Orientation (BCXXQX) | 0.902 | .000 |
| Engagement (CYD) | 0.945 | .000 |
| Student Development (XSFZ) | 0.935 | .000 |

As for the overall validity, when the eigenvalue of factor principal component extraction method is greater than 1, excluding the absolute value of small coefficient from 0.33 to 0.7, a more ideal result can not be obtained. Therefore, the method of limiting factor is tentatively used to extract the factor. It is found that the result is ideal when the number of limiting factors is 6 and the absolute value is less than 0.5. The results show that the KMO value is equal to 0.938, indicating that there is a very good correlation between the scale variables, which meets the requirements and is suitable for factor analysis. At the same time, the significance of Bartley spherical test is less than 0.05, which also shows that the data is suitable for factor analysis.

Hair (2009) and Jakobsen and Jensen (2015)et al. pointed out that if only one component was obtained in the principal component analysis or the explanatory power of the first component was greater than 50%, it could be judged that there was a common method bias. The total variance interpretation table shows that although the first component non-rotation cumulative variance reaches 46.508%, it does not exceed the 50% level, and there is no common method bias problem. The cumulative variance contribution rate of the six extractable components is 71.62%, which indicates that the six components explain most of the information of the original data. The following table:

Table 3.9 Total Variance Explained for Learning Environments

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Total | % of Variance | Cumulative % | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 26.045 | 46.508 | 46.508 | 26.045 | 46.508 | 46.508 | 9.384 | 16.757 | 16.757 |
| 2 | 4.882 | 8.719 | 55.227 | 4.882 | 8.719 | 55.227 | 7.056 | 12.599 | 29.356 |
| 3 | 3.697 | 6.601 | 61.828 | 3.697 | 6.601 | 61.828 | 6.462 | 11.540 | 40.896 |
| 4 | 2.166 | 3.867 | 65.695 | 2.166 | 3.867 | 65.695 | 6.306 | 11.262 | 52.157 |
| 5 | 1.950 | 3.482 | 69.177 | 1.950 | 3.482 | 69.177 | 6.286 | 11.225 | 63.382 |
| 6 | 1.368 | 2.442 | 71.620 | 1.368 | 2.442 | 71.620 | 4.613 | 8.237 | 71.620 |

Note: Extraction method: principal component analysis

The extracted six components are consistent with the original scale design dimensions and the six dimensions of the conceptual framework, and the component loadings are between 0.514 and 0.814. Overall, according to the corresponding relationship between the components and the items, it can be considered that:

1) Component 1 explains the items of the learning environment dimension (XXHJ).

2) Component 2 explains the items of the Learning pressure Dimension (XXYL).

3) Component 3 explains the items on the Surface Learning Orientation Dimension (BCXXQX).

4) Component 4 explains the items on the Deep Learning Orientation Dimension (SCXXQX).

5) Component 5 explains the items on the Engagement Dimension (CYD)

6) Component 6 explains the items on the Student Development (XSFZ) dimension.

The specific data are as follows:

Table 3.10 The Rotated Component Matrix A

| **The Rotated Component Matrix [A]** | | | | | | |
|---|---|---|---|---|---|---|
| | **Component** | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **6** |
| XXHJ4 | .853 | - | - | - | - | - |
| XXHJ5 | .847 | - | - | - | - | - |
| XXHJ1 | .835 | - | - | - | - | - |
| XXHJ3 | .830 | - | - | - | - | - |
| XXHJ2 | .804 | - | - | - | - | - |
| XSFZ1 | - | .872 | - | - | - | - |
| XSFZ2 | - | .869 | - | - | - | - |
| XSFZ3 | - | .843 | - | - | - | - |
| XSFZ4 | - | .826 | - | - | - | - |
| XSFZ5 | - | .641 | - | - | - | - |
| SCXXQX2 | - | - | .769 | - | - | - |
| SCXXQX3 | - | - | .763 | - | - | - |
| SCXXQX5 | - | - | .742 | - | - | - |
| SCXXQX1 | - | - | .720 | - | - | - |
| SCXXQX4 | - | - | .693 | - | - | - |
| CYD1 | - | - | - | .860 | - | - |
| CYD3 | - | - | - | .816 | - | - |
| CYD2 | - | - | - | .804 | - | - |

| The Rotated Component Matrix [A] | | | | | | |
|---|---|---|---|---|---|---|
| | Component | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CYD4 | - | - | - | .661 | - | - |
| XXYL2 | - | - | - | - | .840 | - |
| XXYL3 | - | - | - | - | .836 | - |
| XXYL4 | - | - | - | - | .766 | - |
| XXYL1 | - | - | - | - | .644 | - |
| BCXXQX4 | - | - | - | - | - | .812 |
| BCXXQX3 | - | - | - | - | - | .809 |
| BCXXQX2 | - | - | - | - | - | .726 |
| BCXXQX1 | - | - | - | - | - | .633 |
| Extraction method: principal component analysis. | | | | | | |
| Rotation method: Caesar's normalized maximum variance method. | | | | | | |
| a. The rotation has converged after 6 iterations. | | | | | | |

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

For items that cannot be explained in each component, they will be considered for deletion in the formal questionnaire. In conclusion, the prediction questionnaire has good reliability and validity.

### 3.4.3 Data Processing of the Official Questionnaire

Form a formal questionnaire based on the pre-test results and conduct a formal sampling. The sample data were then subjected to statistical analysis including sample characteristics, descriptive statistics, multiple normal distribution test, reliability analysis, validity analysis, homology variance analysis, validity factor analysis, and multiple co-linearity test. Finally, the fitness and path analysis of the structural equation model were carried out, and the intermediate effect test was carried out.

## 3.5 Summary

This chapter presents the subjects of the paper, the scale of the study, data collection and data processing methods. Chapters 4 and 5 analyze and discuss the data collected in the official questionnaire, and finally draw the research conclusions of this paper.

# CHAPTER 4

# DATA ANALYSIS AND DISCUSSION

## 4.1 Data Collection

As mentioned in Chapter 3, this study is aimed at undergraduate students at Chinese universities. A total of 611 respondents participated in the questionnaire, 412 of which were valid questionnaires, representing an effective rate of 67.4%. After that, these data will be analyzed for sample characteristics, descriptive statistics, multiple normal distribution test, homology analysis of variance, multiple co-linearity test, confidence test, structural equation model analysis, and final test hypothesis and discussion.

## 4.2 Sample characteristics

The questionnaire collected information on the gender, grade and discipline of the subjects, which will help to understand the background characteristics of the respondents. It should be noted that the Catalogue of Disciplines for Degree Granting and Talent Training (2011) promulgated by the Academic Degree Committee of the State Council and the Ministry of Education stipulates that undergraduate education in China is divided into 13 disciplines: philosophy, economics, law, education, literature, history, science, engineering, agriculture, medicine, military science, management and art. Table 4.1 provides statistics on the frequency of this information.

Table 4.1 Frequency Statistics Results

| **Project** | **Options** | **Frequency** | **Percent** | **Valid Percent%** | **Cumulative Percent%** |
|---|---|---|---|---|---|
| Gender | male | 175 | 42.5 | 42.5 | 42.5 |
| | Female | 237 | 57.5 | 57.5 | 100 |
| | Total | 412 | 100 | 100 | |
| Disciplines | philosophy | 27 | 6.6 | 6.6 | 6.6 |
| | economics | 35 | 8.5 | 8.5 | 15 |
| | Law | 24 | 5.8 | 5.8 | 20.9 |
| | Pedagogy | 43 | 10.4 | 10.4 | 31.3 |
| | literature | 51 | 12.4 | 12.4 | 43.7 |
| | History | 21 | 5.1 | 5.1 | 48.8 |
| | science | 42 | 10.2 | 10.2 | 59 |
| | Engineering | 38 | 9.2 | 9.2 | 68.2 |
| | Agronomy | 34 | 8.3 | 8.3 | 76.5 |
| | medicine | 39 | 9.5 | 9.5 | 85.9 |
| | management | 33 | 8 | 8 | 93.9 |
| | art | 25 | 6.1 | 6.1 | 100 |
| | Total | 412 | 100 | 100 | |
| Grade | 1 | 103 | 25 | 25 | 25 |
| | 2 | 106 | 25.7 | 25.7 | 50.7 |
| | 3 | 95 | 23.1 | 23.1 | 73.8 |
| | 4 | 108 | 26.2 | 26.2 | 100 |
| | Total | 412 | 100 | 100 | |

In the sample, no military science students were found to participate in the survey. The reason is that Chinese military academies have strict restrictions on students' engagement in online surveys.

## 4.3 Descriptive Statistics

The purpose of descriptive statistics is to describe the midpoint of the score distribution and to understand the central tendency of the data. If a variable is normally distributed, then the mean, median, and multivariate will be equal. For most inference statistics, it is important that the variables must be at least approximately normally distributed (Morgan et al., 2011).

On the other hand, this study uses the Likert scale to measure variables in various dimensions. Typically, researchers are only interested in the composite scores (sum or average) of the variable dimensions (Boone & Boone, 2012). The items of the Likert scale belong to the ordinal measurement scale, and the descriptive statistics recommended by the items of the ordinal measurement scale include the average, volume, or median of the centralized trend (Boone & Boone, 2012). The descriptive statistical results of this study on the comprehensive scores of all dimensional variables of the research model are shown in the table:

Table 4.2 Descriptive Statistics

| Descriptive Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** | **Median** | **Mode** |
| XXHJ | 412 | 1.00 | 5.00 | 3.5750 | 0.60626 | 3.0000 | 3.00 |
| XXYL | 412 | 1.00 | 5.00 | 3.1054 | 0.52466 | 3.0000 | 3.00 |
| SCXXQX | 412 | 1.20 | 5.00 | 3.1274 | 0.49749 | 3.0000 | 3.00 |
| BCXXQX | 412 | 1.40 | 5.00 | 2.9580 | 0.49470 | 3.0000 | 3.00 |
| CYD | 412 | 1.64 | 5.00 | 3.2827 | 0.50335 | 3.0000 | 3.00 |
| XSFZ | 412 | 1.00 | 5.00 | 3.2788 | 0.55564 | 3.0000 | 3.00 |
| Valid N (listwise) | 412 | | | | | | |

## 4.4 Multiple Normal Distribution Test

Normality evaluation can judge the distribution of observed variables. If the data meet the assumption of normal distribution, the maximum likelihood method can be used as the estimation of the statistical quantities of each parameter of the subsequent SEM structural equation model. Wu (2010) pointed out that if the absolute value of the eccentricity coefficient of the variable is greater than 3 and the absolute value of the Preakness coefficient is greater than 10 (the stricter standard is 8), the data distribution may not be normal. The results of the normality assessment of the study data are presented in the table:

Table 4.3 Multiple Normal Distribution Test

| Variable | Min | Max | Skew | c.r. | Kurtosis | c.r. |
|---|---|---|---|---|---|---|
| XSFZ1 | 1.000 | 5.000 | .346 | 2.864 | 1.411 | 5.846 |
| XSFZ2 | 1.000 | 5.000 | .389 | 3.225 | 1.855 | 7.684 |
| XSFZ3 | 1.000 | 5.000 | .676 | 5.602 | 1.195 | 4.950 |
| XSFZ4 | 1.000 | 5.000 | .550 | 4.555 | 1.506 | 6.241 |
| XSFZ5 | 1.000 | 5.000 | .658 | 5.453 | 2.880 | 11.932 |
| CYD1 | 2.000 | 5.000 | .992 | 8.224 | 1.303 | 5.400 |
| CYD2 | 2.000 | 5.000 | 1.017 | 8.427 | 1.074 | 4.451 |
| CYD3 | 2.000 | 5.000 | .751 | 6.222 | .157 | .652 |
| CYD4 | 1.000 | 5.000 | .047 | .388 | 1.568 | 6.495 |
| BCXXQX1 | 1.000 | 5.000 | -.187 | -1.554 | .610 | 2.527 |
| BCXXQX2 | 1.000 | 5.000 | -.195 | -1.618 | .969 | 4.013 |
| BCXXQX3 | 1.000 | 5.000 | -.287 | -2.376 | .156 | .645 |
| BCXXQX4 | 1.000 | 5.000 | -.224 | -1.856 | 1.676 | 6.942 |
| SCXXQX1 | 1.000 | 5.000 | .630 | 5.218 | .680 | 2.819 |
| SCXXQX2 | 1.000 | 5.000 | .547 | 4.535 | 1.630 | 6.755 |
| SCXXQX3 | 1.000 | 5.000 | .269 | 2.229 | 1.001 | 4.148 |
| SCXXQX4 | 1.000 | 5.000 | .505 | 4.186 | 1.112 | 4.606 |
| SCXXQX5 | 1.000 | 5.000 | .210 | 1.743 | 1.455 | 6.030 |

| Variable | Min | Max | Skew | c.r. | Kurtosis | c.r. |
|---|---|---|---|---|---|---|
| XXYL1 | 1.000 | 5.000 | .168 | 1.388 | .500 | 2.071 |
| XXYL2 | 1.000 | 5.000 | .348 | 2.887 | 1.278 | 5.296 |
| XXYL3 | 1.000 | 5.000 | .448 | 3.710 | 1.381 | 5.721 |
| XXYL4 | 1.000 | 5.000 | .447 | 3.705 | 1.928 | 7.987 |
| XXHJ1 | 1.000 | 5.000 | .050 | .416 | .663 | 2.747 |
| XXHJ7 | 1.000 | 5.000 | -.245 | -2.034 | .299 | 1.238 |
| XXHJ3 | 1.000 | 5.000 | -.189 | -1.564 | .233 | .966 |
| XXHJ4 | 1.000 | 5.000 | -.323 | -2.677 | .491 | 2.036 |
| XXHJ5 | 1.000 | 5.000 | -.261 | -2.161 | .589 | 2.441 |
| Multivariate | | | | | 398.238 | 102.133 |

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

## 4.5 Reliability Analysis

Reliability analysis, also known as reliability analysis, aims to understand whether questionnaire data are true and reliable or consistent, and to provide rigorous data for subsequent study model analysis. In particular, the reliability and accuracy of responses to quantitative data need to be tested. Cronbach's Alpha coefficient values are often used to indicate high or low levels of confidence. Note that if the Alpha coefficient in the test results is higher than 0.8, it indicates a high degree of confidence; if the α value is between 0.7 and 0.8, it indicates a good degree of confidence; if theαvalue is between 0.6 and 0.7, it indicates an acceptable degree of confidence; and if theαvalue is less than 0.6, it indicates a poor degree of confidence. Eisinga et al. (2013) The correction item total correlation (CITC) value in the test results can usually be used to determine whether to delete an item. If the CITC value is lower than 0.3, the item can be considered for deletion. In addition, if the "α coefficient of the item deleted" value is significantly higher than the α coefficient, the item can also be considered for deletion (Zhou, 2017). The following is the reliability

analysis of questionnaire data by dimension, and finally the overall dimension Cronbach reliability analysis.

1) Cronbach reliability analysis of learning environment dimension

The results of the Cronbach reliability analysis of the learning environment are as follows:

Table 4.4 Cronbach Reliability Analysis of Learning Environment

| **Name** | **Total Correlation of Correction Items (CITC)** | **The Deleted a Coefficient of the Term** | **Cronbach's Alpha Coefficient** · |
|---|---|---|---|
| XXHJ1 | 0.766 | 0.896 | 0.913 |
| XXHJ2 | 0.762 | 0.896 | |
| XXHJ3 | 0.791 | 0.890 | |
| XXHJ4 | 0.783 | 0.892 | |
| XXHJ5 | 0.786 | 0.891 | |

Note: XXHJ: learning environment

It can be seen from Table 4.4 above that the reliability coefficient value is 0.913, which is greater than 0.9, indicating that the reliability of the learning environment data is of high quality. According to the "alpha coefficient of deleted items", it can be judged that the alpha coefficient after any item is deleted is not greater than 0.913, indicating that all items do not need to be deleted. In addition, the CITC values of all analysis items are greater than 0.4, indicating that there is a good correlation between the analysis items, which also indicates a good level of reliability. To sum up, the data of the learning environment dimension has high reliability and quality and can be used for further analysis.

2) Cronbach reliability analysis of learning pressure dimension

The results of the Cronbach reliability analysis of learning pressure are as follows:

Table 4.5 Cronbach Reliability Analysis of Learning Pressure

| **Name** | **Total Correlation of Correction Items (CITC)** | **The Deleted a Coefficient of the Term** | **Cronbach's Alpha Coefficient** |
|---|---|---|---|
| XXYL1 | 0.501 | 0.794 | 0.786 |
| XXYL2 | 0.657 | 0.702 | |
| XXYL3 | 0.666 | 0.698 | |
| XXYL4 | 0.582 | 0.742 | |

Note: XXYL: learning pressure

It can be seen from Table 4.5 above that the reliability coefficient value is 0.786, which is greater than 0.7, indicating that the reliability of the learning environment data is of good quality. According to the "alpha coefficient of deleted item", it can be judged that the alpha coefficient of any item after deletion is not greater than 0.786, indicating that all items do not need to be deleted. In addition, the CITC values of all analysis items are greater than 0.4, indicating that there is a good correlation between the analysis items, which also indicates a good level of reliability. In summary, the data on the learning pressure dimension has good reliability and can be used for further analysis.

3) Cronbach reliability analysis of deep learning orientation

The reliability analysis results of the deep learning orientation dimension are as follows:

Table 4.6 Cronbach Reliability Analysis of Deep Learning Orientation

| **Name** | **Total Correlation of Correction Items (CITC)** | **The Deleted a Coefficient of the Term** | **Cronbach's Alpha Coefficient** · |
|---|---|---|---|
| SCXXQX1 | 0.593 | 0.849 | 0.858 |
| SCXXQX2 | 0.686 | 0.826 | |
| SCXXQX3 | 0.725 | 0.815 | |
| SCXXQX4 | 0.674 | 0.829 | |
| SCXXQX5 | 0.693 | 0.824 | |

Note: SCXXQX: deep learning orientation

It can be seen from the above table 4.6 that the reliability coefficient value is 0.857, which is greater than 0.8, indicating that the reliability of the deep learning orientation data is of high quality. According to the "alpha coefficient of deleted item", it can be judged that the alpha coefficient of any item after deletion is not greater than 0.0.858, indicating that all items do not need to be deleted. In addition, the CITC values of all analysis items are greater than 0.4, indicating that there is a good correlation between the analysis items, which also indicates a good level of reliability. To sum up, the deep learning orientation dimension data has high reliability and quality and can be used for further analysis.

4) Cronbach reliability analysis of surface learning orientation

The reliability analysis results of the surface learning orientation are as follows:

Table 4.7 Cronbach Reliability Analysis of Surface Learning Orientation

| **Name** | **Total Correlation of Correction Items (CITC)** | **The Deleted a Coefficient of the Term** | **Cronbach's Alpha Coefficient** · |
|---|---|---|---|
| BCXXQX1 | 0.599 | 0.757 | 0.800 |
| BCXXQX2 | 0.642 | 0.736 | |
| BCXXQX3 | 0.669 | 0.721 | |
| BCXXQX4 | 0.547 | 0.781 | |

Note: BCXXQX: surface learning orientation

It can be seen from the above table 4.7 that the reliability coefficient value is 0.800, which is greater than 0.8, indicating that the reliability of the surface learning orientation data is very high. According to the "alpha coefficient of deleted items", it can be judged that the alpha coefficient after any item is deleted is not greater than 0.800, indicating that all items do not need to be deleted. In addition, the CITC values of all analysis items are greater than 0.4, indicating that there is a good correlation between the analysis items, which also indicates a good level of reliability. In summary, the data on the surface learning orientation dimension has high reliability and can be used for further analysis.

5) Cronbach reliability analysis of engagement

The results of the Cronbach reliability analysis of engagement are as follows:

Table 4.8 Engagement Cronbach Reliability Analysis

| **Name** | **Total Correlation of Correction Items (CITC)** | **The Deleted a Coefficient of the Term** | **Cronbach's Alpha Coefficient** |
|---|---|---|---|
| CYD1 | 0.750 | 0.750 | 0.831 |
| CYD2 | 0.709 | 0.764 | |
| CYD3 | 0.694 | 0.770 | |
| CYD4 | 0.509 | 0.857 | |

Note: CYD: engagement

It can be seen from Table 4.8 above that the reliability coefficient value is 0.831, which is greater than 0.8, indicating that the reliability of the learning environment data is of high quality. According to the "alpha coefficient of deleted items", it can be judged that the alpha coefficient after any item is deleted is not greater than 0.831, indicating that all items do not need to be deleted. In addition, the CITC values of all analysis items are greater than 0.4, indicating that there is a good correlation between the analysis items, which also indicates a good level of reliability. In summary, the data on the engagement dimension has high reliability and can be used for further analysis.

6) Cronbach reliability analysis of student development

The reliability analysis results of the student development dimension are as follows:

Table 4.9 Student Development Cronbach Reliability Analysis

| Name | Total Correlation of Correction Items (CITC) | The Deleted a Coefficient of the Term | Cronbach's Alpha Coefficient · |
|---|---|---|---|
| XSFZ1 | 0.829 | 0.898 | 0.922 |
| XSFZ2 | 0.834 | 0.897 | |
| XSFZ3 | 0.816 | 0.901 | |
| XSFZ4 | 0.834 | 0.897 | |
| XSFZ5 | 0.678 | 0.926 | |

Note: XSFZ: student development

It can be seen from Table 4.9 above that the reliability coefficient value is 0.922, which is greater than 0.9, indicating that the reliability of the student development data is of high quality. According to the "alpha coefficient of deleted items", it can be judged that the alpha coefficient of any item after deletion is not greater than 0.922, indicating that all items do not need to be deleted.

In addition, the CITC values of all analysis items are greater than 0.4, indicating that there is a good correlation between the analysis items, which also indicates a high level of reliability. To sum up, the data of student development dimension has high reliability and quality and can be used for further analysis.

## 4.6 Common Method Variance

Richardson et al. (2009) Common method variance (CMV) is defined as the system error variance shared between variables measured using the same source or method, which results in a common method deviation. Reio Jr (2010) noted that CMV threatened the validity of the conceptual association conclusion and caused systemic

bias in the study by exaggerating or narrowing the correlation. When respondents respond to all survey items at once, CMV may occur and threaten the validity of the data (Burton-Jones, 2009). Typically, the data are tested for common method variance using the Harman unifactor test method. When performing a non-rotating exploratory factor analysis on all dimensional data, a common method deviation can be determined if only one component or the first component has an interpretive force greater than 50% (Hair, 2009; Jakobsen & Jensen, 2015). The test results for CMV are shown in the table:

Table 4.10 Common Method Variance Analysis

| **Total Variance Explained** | | | | | | |
|---|---|---|---|---|---|---|
| **Factor Number** | **Characteristics of the Root** | | | **Extract the Load Sum of Squares** | | |
| | **Total** | **Percent Variance** | **Cumulative %** | **Total** | **Percent Variance** | **Cumulative %** |
| 1 | 7.213 | 26.716 | 26.716 | 7.213 | 26.716 | 26.716 |
| 2 | 3.832 | 14.193 | 40.909 | 3.832 | 14.193 | 40.909 |
| 3 | 2.669 | 9.887 | 50.796 | 2.669 | 9.887 | 50.796 |
| 4 | 2.056 | 7.616 | 58.412 | 2.056 | 7.616 | 58.412 |
| 5 | 1.776 | 6.579 | 64.992 | 1.776 | 6.579 | 64.992 |
| 6 | 1.294 | 4.794 | 69.785 | 1.294 | 4.794 | 69.785 |

Note: Extraction method: principal component analysis

As shown in Table 4.10, the Harman one-factor test method was used to test the data for common method variance. In the exploratory factor analysis without rotation, the cumulative variance of the first component extracted was 26.716%, which was less than 50%, indicating that Common method variance cannot explain most of the variation among variables, and there is no serious common method variance problem in the questionnaire data.

## 4.7 Validity Analysis

Validity test is to check the validity of the questionnaire. Generally speaking, the validity explains whether the data collected in the questionnaire represent the actual situation (Taherdoost, 2016). Effectiveness means that the questionnaire is able to "measure what is expected to be measured"(Field, 2013). Taherdoost (2016) recommended that the validity test should examine the construct validity. The most commonly used method for testing construction validity is factor analysis. There are two types of factor analysis: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Wu, 2010). Zhou (2017) pointed out that in exploratory analysis, it is usually necessary to combine KMO value, Bartlett test, commonality, variance interpretation rate value, factor loading coefficient value and other indicators to verify the validity level of the data. If KMO > 0.8, it indicates good validity, which is very suitable for information extraction; if KMO value is between 0.7 and 0.8, it indicates good validity, which is more suitable for information extraction; if KMO value is between 0.6 and 0.7, it indicates average validity, which can be used for information extraction; if KMO < 0.6, it indicates low validity, which is not suitable for information extraction. The p-value corresponding to the Bartlett test needs to be less than 0.05. Common degrees represent the amount of information that can be extracted from a subject. The higher the value, the higher the degree to which the indicator can be interpreted by the main ingredient. The more information is extracted, generally taking 0.4 as the standard. The total variance of the interpretation indicates that the extracted ingredients can interpret the amount of information of the raw data, and that more than 50% is acceptable. The factor loading factor reflects the correspondence between the extracted components and the project, and is generally greater than 0.4. The results of the analysis are as follows:

1) Learning Environment Validity Analysis

The results of the validity analysis of the learning environment are as follows:

Table 4.11 KMO and Bartlett's Test of Learning Environment

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | 0.894 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 1324.721 |
| | df | 10 |
| | Sig. | 0 |

Table 4.11 shows that the Bartlett test results are significant, and the KMO value is 0.894, which is greater than 0.8, indicating that the research data is very suitable for extracting information.

Table 4.12 Validity Analysis Results of Learning Environment

| **Name** | **Factor Loadings** | **Common Degree (Common factor variance)** |
|---|---|---|
| | **Factor** | |
| XXHJ1 | 0.853 | 0.727 |
| XXHJ2 | 0.849 | 0.721 |
| XXHJ3 | 0.871 | 0.759 |
| XXHJ4 | 0.865 | 0.748 |
| XXHJ5 | 0.867 | 0.752 |

It can be seen from Table 4.12 that the common degree values corresponding to all items are higher than 0.4, indicating that the data information can be effectively extracted. The absolute values of factor loading coefficients are all above 0.4, indicating that there is a good correspondence between item data and components, so all items are reserved for further analysis.

2) Learning pressure validity analysis

The results of the validity analysis of learning pressure are as follows:

Table 4.13 The KMO and Bartlett's Test of Study Stress

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .779 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 497.684 |
| | df | 6 |
| | Sig. | .000 |

Table 4.13 shows that the Bartlett test results are significant, and the KMO value is 0.779, which is between 0.7 and 0.8, indicating that the research data is very suitable for extracting information.

Table 4.14 Validity Analysis Results of Study Stress

| **Name** | **Factor Loadings** | **Common Degree (Common factor variance)** |
|---|---|---|
| | **Factor** | |
| XXYL1 | 0.696 | 0.484 |
| XXYL2 | 0.834 | 0.696 |
| XXYL3 | 0.839 | 0.704 |
| XXYL4 | 0.774 | 0.600 |

It can be seen from Table 4.14 that the common degree values corresponding to all items are higher than 0.4, indicating that the data information can be effectively extracted. The absolute values of factor loading coefficients are all above 0.4, indicating that there is a good correspondence between item data and components, so all items are reserved for further analysis.

3) Deep learning orientation validity analysis

The results of the validity analysis of the deep learning orientation are as follows:

Table 4.15 Deep Learning Orientation KMO and Bartlett's Test

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .858 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 860.055 |
| | df | 10 |
| | Sig. | .000 |

Table 4.15 shows that the Bartlett test results are significant, and the KMO value is 0.858, which is greater than 0.8, indicating that the research data is very suitable for extracting information.

Table 4.16 Validity Analysis Results of Deep Learning Orientation

| **Name** | **Factor Loadings** | **Common Degree (Common factor variance)** |
|---|---|---|
| | **Factor** | |
| SCXXQX1 | 0.732 | 0.536 |
| SCXXQX2 | 0.808 | 0.652 |
| SCXXQX3 | 0.838 | 0.702 |
| SCXXQX4 | 0.799 | 0.638 |
| SCXXQX5 | 0.815 | 0.665 |

It can be seen from Table 4.16 that the common degree values corresponding to all the items are higher than 0.4, indicating that the data information can be effectively extracted. The absolute values of factor loading coefficients are all above 0.4, indicating that there is a good correspondence between item data and components, so all items are reserved for further analysis.

4) Surface Learning Orientation

The results of the validity analysis of the surface learning orientation are as follows:

Table 4.17 KMO and Bartlett's Test of Surface Learning Orientation

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .789 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 492.530 |
| | df | 6 |
| | Sig. | .000 |

Table 4.17 shows that the Bartlett test results are significant, and the KMO value is 0.789, which is between 0.7 and 0.8, indicating that the research data is suitable for extracting information.

Table 4.18 Validity Analysis Results of Surface Learning Orientation

| **Name** | **Factor Loadings** | **Common Degree (Common factor variance)** |
|---|---|---|
| | **Factor** | |
| BCXXQX1 | 0.780 | 0.608 |
| BCXXQX2 | 0.812 | 0.660 |
| BCXXQX3 | 0.832 | 0.693 |
| BCXXQX4 | 0.736 | 0.541 |

It can be seen from Table 4.18 that the common degree values corresponding to all items are higher than 0.4, indicating that the data information can be effectively extracted. The absolute values of factor loading coefficients are all above 0.4, indicating that there is a good correspondence between item data and components, so all items are reserved for further analysis.

5) Engagement Validity Analysis

The results of the validity analysis of engagement are as follows:

Table 4.19 The KMO and Bartlett's Test of Engagement

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .791 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 699.008 |
| | df | 6 |
| | Sig. | .000 |

Table 4.19 shows that the Bartlett test results are significant, and the KMO value is 0.791, which is between 0.7 and 0.8, indicating that the research data is suitable for extracting information.

Table 4.20 Engagement Validity Analysis Results

| **Name** | **Factor Loadings** | **Common Degree (Common factor variance)** |
|---|---|---|
| | **Factor** | |
| CYD1 | 0.881 | 0.777 |
| CYD2 | 0.861 | 0.742 |
| CYD3 | 0.844 | 0.712 |
| CYD4 | 0.685 | 0.469 |

It can be seen from Table 4.20 that the common degree values corresponding to all items are higher than 0.4, indicating that the data information can be effectively extracted. The absolute values of factor loading coefficients are all above 0.4, indicating that there is a good correspondence between item data and components, so all items are reserved for further analysis.

6) Student Development

The results of the validity analysis of student development are as follows:

Table 4.21 KMO and Bartlett's Test for Student Development

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .897 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 1525.050 |
| | df | 10 |
| | Sig. | .000 |

Table 4.21 shows that the Bartlett test results are significant, and the KMO value is 0.897, which is greater than 0.8, indicating that the research data is very suitable for extracting information.

Table 4.22 Student Development Validity Analysis Results

| **Name** | **Factor Loadings** | **Common Degree (Common factor variance)** |
|---|---|---|
| | **Factor** | |
| XSFZ1 | 0.896 | 0.802 |
| XSFZ2 | 0.899 | 0.808 |
| XSFZ3 | 0.887 | 0.787 |
| XSFZ4 | 0.899 | 0.808 |
| XSFZ5 | 0.781 | 0.610 |

It can be seen from Table 4.22 that the common degree values corresponding to all items are higher than 0.4, indicating that the data information can be effectively extracted. The absolute values of factor loading coefficients are all above 0.4, indicating that there is a good correspondence between item data and components, so all items are reserved for further analysis.

7) Overall validity analysis

The overall validity analysis results are as follows:

Table 4.23 Total Dimension KMO and Bartlett's Test

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .879 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 6338.334 |
| | df | 351 |
| | Sig. | .000 |

Table 4.23 shows that the Bartlett test results are significant, and the KMO value is 0.879, which is greater than 0.8, indicating that the research data is very suitable for extracting information.

Table 4.24 Total Variance Explained for Total Dimension

| Total Variance Explained | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 7.213 | 26.716 | 26.716 | 7.213 | 26.716 | 26.716 | 3.811 | 14.117 | 14.117 |
| 2 | 3.832 | 14.193 | 40.909 | 3.832 | 14.193 | 40.909 | 3.784 | 14.014 | 28.131 |
| 3 | 2.669 | 9.887 | 50.796 | 2.669 | 9.887 | 50.796 | 3.390 | 12.556 | 40.687 |
| 4 | 2.056 | 7.616 | 58.412 | 2.056 | 7.616 | 58.412 | 2.782 | 10.303 | 50.989 |
| 5 | 1.776 | 6.579 | 64.992 | 1.776 | 6.579 | 64.992 | 2.542 | 9.415 | 60.404 |
| 6 | 1.294 | 4.794 | 69.785 | 1.294 | 4.794 | 69.785 | 2.533 | 9.381 | 69.785 |

Note: Extraction Method: Principal Component Analysis.

Table 4.25 The Results of the Validity Analysis of the Total Dimension

| Name | Factor Loadings | | | | | | Common Degree (Common factor variance) |
|---|---|---|---|---|---|---|---|
| | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | |
| XSFZ1 | - | 0.872 | - | - | - | - | 0.818 |
| XSFZ2 | - | 0.869 | - | - | - | - | 0.815 |
| XSFZ3 | - | 0.843 | - | - | - | - | 0.805 |
| XSFZ4 | - | 0.826 | - | - | - | - | 0.803 |
| XSFZ5 | - | 0.641 | - | - | - | - | 0.635 |
| XXHJ1 | 0.835 | - | - | - | - | - | 0.738 |
| XXHJ2 | 0.804 | - | - | - | - | - | 0.722 |
| XXHJ3 | 0.830 | - | - | - | - | - | 0.757 |
| XXHJ4 | 0.853 | - | - | - | - | - | 0.757 |
| XXHJ5 | 0.847 | - | - | - | - | - | 0.760 |
| XXYL1 | - | - | - | - | 0.644 | - | 0.508 |
| XXYL2 | - | - | - | - | 0.840 | - | 0.715 |
| XXYL3 | - | - | - | - | 0.836 | - | 0.713 |
| XXYL4 | - | - | - | - | 0.766 | - | 0.638 |
| SCXXQX1 | - | - | 0.720 | - | - | - | 0.596 |
| SCXXQX2 | - | - | 0.769 | - | - | - | 0.673 |
| SCXXQX3 | - | - | 0.763 | - | - | - | 0.668 |
| SCXXQX4 | - | - | 0.692 | - | - | - | 0.622 |
| SCXXQX5 | - | - | 0.742 | - | - | - | 0.665 |
| BCXXQX1 | - | - | - | - | - | 0.632 | 0.639 |
| BCXXQX2 | - | - | - | - | - | 0.726 | 0.634 |
| BCXXQX3 | - | - | - | - | - | 0.809 | 0.723 |
| BCXXQX4 | - | - | - | - | - | 0.812 | 0.692 |
| CYD1 | - | - | - | 0.859 | - | - | 0.776 |
| CYD2 | - | - | - | 0.804 | - | - | 0.754 |
| CYD3 | - | - | - | 0.816 | - | - | 0.724 |
| CYD4 | - | - | - | 0.661 | - | - | 0.491 |

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

It can be seen from Table 4.24, 4.25 that the common degree values corresponding to all items are higher than 0.4, indicating that the data information can be effectively extracted. The six components extracted after rotation have a cumulative variance explanation rate of 69.785%, which is greater than 50%, indicating that the extracted components explain most of the information in the original data. The absolute values of factor loading coefficients are all above 0.4, indicating that there is a good correspondence between item data and components, so all items are reserved for further analysis.

## 4.8 Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is a powerful statistical tool for examining the nature and relationships of underlying structures. CFA is an important part of the Structural Equation Modeling (SEM) approach, and measurement model validation plays a crucial role in structural analysis (Brown & Moore, 2012). When performing structural model analysis, the measurement model is usually evaluated first to see if the measurement accurately reflects the desired structure or dimension, and then to evaluate the structural equation model (Jackson et al., 2009).

Confirmatory factor analysis (CFA) analysis of the measurement model mainly examines the standardized factor loading, aggregation validity, differentiation validity, and the degree to which the model fits the data (Wu, 2013). Wu (2013) noted that a standard loading factor value greater than 0.7 and significant indicated a strong correlation between the indicator item and the factor, and that if the indicator item standard loading factor value was low (e.g., below 0.4) or not significant, deletion should be considered. Ave (mean variance extraction) and CR (combined reliability) were used for the aggregation validity (convergence validity) analysis, where Ave greater than 0.5 and CR value greater than 0.7 indicates higher aggregation validity. The Pearson correlation with the Ave square root value is used to examine the differential validity between structures. Meanwhile, it is necessary to study the chi-square freedom ratio, GFI, RMSEA, RMR, CFI, NFI, NNFI index, etc. of the model fit, and modify the model according to the modification index to improve the fit.

1) Confirmatory factor analysis of learning environment (XXHJ)

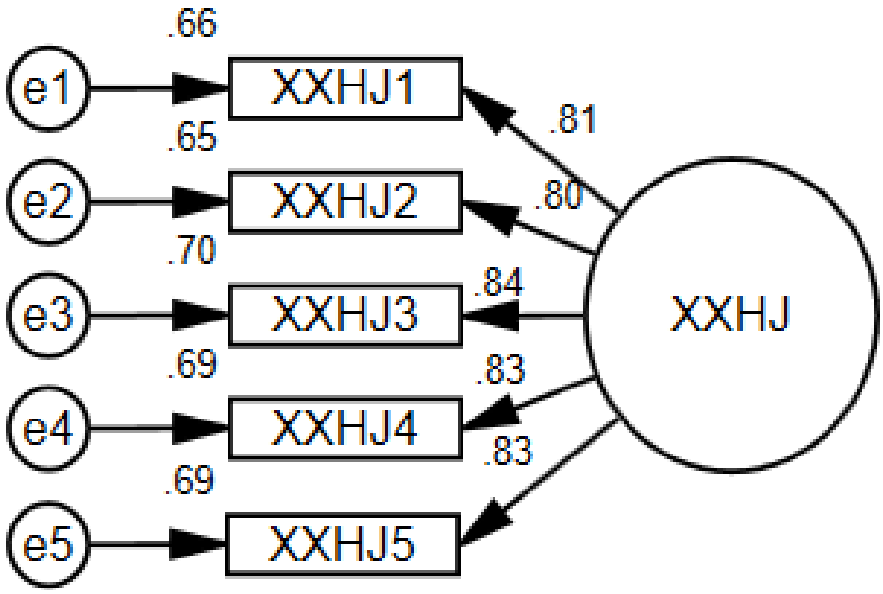


Figure 4.1 Learning Environment Confirmatory Factor Analysis Model Diagram

Table 4.26 Learning Environment Validation Factor Analysis Model Fit

| **Model Fit Metrics** | **Common Indicators** | **Judgment Standard** | **Value** |
|---|---|---|---|
| | $\chi^2$ | - | 11.571 |
| | *df* | - | 5 |
| | *p* | >0.05 | 0.041 |
| | $\chi^2$/df | <3 | 2.314 |
| | GFI | >0.9 | 0.989 |
| | RMSEA | <0.08 | 0.057 |
| | RMR | <0.05 | 0.009 |
| | CFI | >0.9 | 0.995 |
| | NFI | >0.9 | 0.991 |
| | NNFI | >0.9 | 0.99 |

It can be seen from Table 4.26 that although the significance level p value of the chi-square test is 0.041, which is less than 0.05, as Wu (2013) pointed out, since the chi-square value is greatly affected by the sample size, its significance p value is likely to appear 0.05 The significance level of , if the estimated value of the chi-square test is used as the test index of the model fitting, it may be difficult to support the fitting of the research model. Therefore, the chi-square test estimate is generally only used as a reference indicator for the fit of the hypothetical model. The $\chi 2/df$ value is recommended for assessing model acceptability, although there is no consensus on an acceptable ratio for this statistic, a range of 5 or less is recommended (Tabachnick et al., 2007; Wheaton et al., 1977).

The results show that $\chi 2/df = 2.314<3$, RMSEA = 0.057<0.08, RMR = 0.009<0.05, and the values of GFI, CFI, NFI, and NNFI are all above 0.9, indicating that the learning environment (XXHJ) dimension measurement model has a good fit. Degree of fit.

Table 4.27 Learning Environment Dimension Factor Loading Factor

| **Factor (latent variable)** | **Measurement Item (explicit variable)** | **Non-standard Load Factor (Coef.)** | **Std. Error** | ***z (CR value)*** | ***p*** | **Standard Load Factor (Std. Estimate)** |
|---|---|---|---|---|---|---|
| XXHJ | XXHJ1 | 1.000 | - | - | - | 0.810 |
| XXHJ | XXHJ2 | 1.041 | 0.057 | 18.350 | 0.000 | 0.805 |
| XXHJ | XXHJ3 | 1.147 | 0.059 | 19.372 | 0.000 | 0.838 |
| XXHJ | XXHJ4 | 1.094 | 0.057 | 19.092 | 0.000 | 0.829 |
| XXHJ | XXHJ5 | 1.115 | 0.058 | 19.185 | 0.000 | 0.832 |

It can be seen from the table 4.27 that the absolute value of the standardized load coefficient is between 0.805 and 0.838, all of which are greater than 0.7 and are significant, which means that there is a very good measurement relationship between the indicators and the latent variable learning environment (XXHJ).

Table 4.28 Learning Environment Measurement Model AVE and CR Indicator Results

| Factor | Average Variance Extracted AVE Value | Combined Reliability CR Value |
|---|---|---|
| XXHJ | 0.677 | 0.913 |

It can be seen from Table 4.28 above that the AVE value corresponding to the factor learning environment (XXHJ) is 0.677, which is greater than 0.5, and the CR value is 0.913, which is greater than 0.7, which means that the data has good convergent validity. Therefore, all the measurement items of the learning environment dimension will be reserved for the next step of analysis.

2) Confirmatory factor analysis of learning pressure dimension

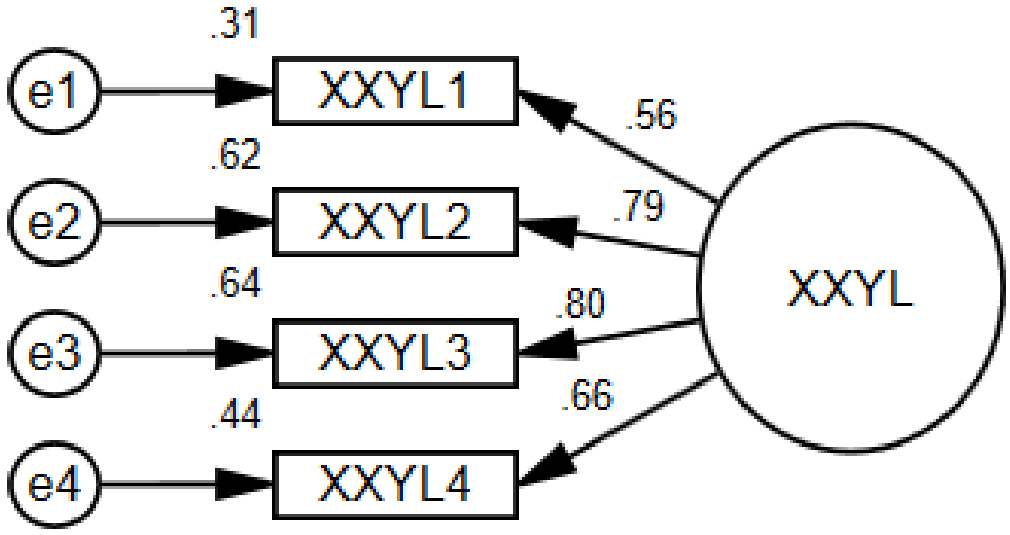


Figure 4.2 Learning Pressure Confirmatory Factor Analysis Model Diagram

Table 4.29 Learning pressure Validation Factor Analysis Model Fit

| **Model Fit Metrics** | **Common Indicators** | **Judgment Standard** | **Value** |
|---|---|---|---|
| | $\chi^2$ | - | 0.908 |
| | *df* | - | 2 |
| | *p* | >0.05 | 0.635 |
| | $\chi^2$/df | <3 | 0.454 |
| | GFI | >0.9 | 0.999 |
| | RMSEA | <0.08 | 0 |
| | RMR | <0.05 | 0.005 |
| | CFI | >0.9 | 1.002 |
| | NFI | >0.9 | 0.998 |
| | NNFI | >0.9 | 1.007 |

It can be seen from Table 4.29 that $\chi$2/df = 0.454<3, RMSEA = 0<0.08, RMR = 0.005<0.05, and the values of GFI, CFI, NFI, and NNFI are all above 0.9, indicating that the learning pressure (XXYL) dimension measurement model have a good fit.

Table 4.30 Learning Pressure Dimension Factor Loading Factors

| **Factor (latent variable)** | **Measurement Item (explicit variable)** | **Non-standard Load Factor (Coef.)** | **Std. Error** | ***z (CR value)*** | ***p*** | **Standard Load Factor (Std. Estimate)** |
|---|---|---|---|---|---|---|
| XXYL | XXYL1 | 1.000 | - | - | - | 0.555 |
| XXYL | XXYL2 | 1.205 | 0.116 | 10.371 | 0.000 | 0.790 |
| XXYL | XXYL3 | 1.206 | 0.116 | 10.404 | 0.000 | 0.801 |
| XXYL | XXYL4 | 0.918 | 0.096 | 9.553 | 0.000 | 0.664 |

It can be seen from Table 4.30 that the absolute value of the standardized load coefficient is between 0.555 and 0.801, not less than 0.4, and it is significant, which means that there is a better measurement between the index and the latent variable learning pressure (XXYL). Relation.

Table 4.31 Learning Pressure Measurement Model AVE and CR Indicator Results

| **Factor** | **Average Variance Extracted AVE Value** | **Combined Reliability CR Value** |
|---|---|---|
| XXYL | 0.503 | 0.799 |

It can be seen from Table 4.31 above that the AVE value corresponding to the learning pressure factor is 0.503, which is greater than 0.5, and the CR value is 0.799, which is greater than 0.7, which means that the data has good convergent validity. Therefore, all the measurement items of the learning pressure dimension will be reserved for the next step of analysis.

3) Confirmatory factor analysis of deep learning orientation dimension

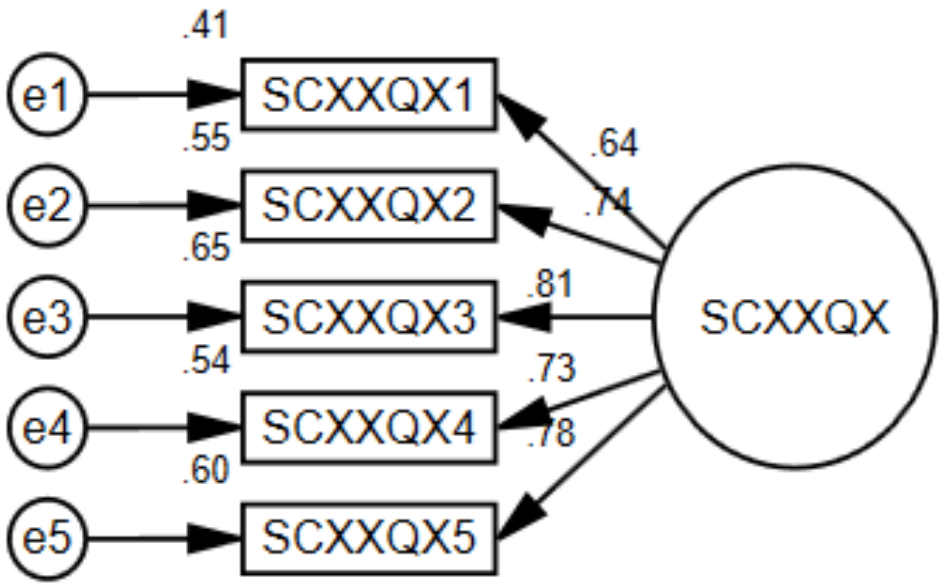


Figure 4.3 Deep Learning Orientation Confirmatory Factor Analysis Model Diagram

Table 4.32 Deep Learning Orientation Verification of the Fit of the Factor Analysis Model

| **Model Fit Metrics** | **Common Indicators** | **Judgment Standard** | **Value** |
|---|---|---|---|
| | $\chi^2$ | - | 14.77 |
| | *df* | - | 5 |
| | *p* | >0.05 | 0.005 |
| | $\chi^2$/df | <3 | 2.954 |
| | GFI | >0.9 | 0.983 |
| | RMSEA | <0.08 | 0.076 |
| | RMR | <0.05 | 0.011 |
| | CFI | >0.9 | 0.986 |
| | NFI | >0.9 | 0.981 |
| | NNFI | >0.9 | 0.973 |

It can be seen from Table 4.32 that $\chi$2/df = 2.954<3, RMSEA = 0.076<0.08, RMR = 0.011<0.05, and the values of GFI, CFI, NFI, and NNFI are all above 0.9, indicating that deep learning orientation (SCXXQX) dimension measurement The model has a good fit.

Table 4.33 Deep Learning Orientation Dimension Factor Loading Coefficient

| **Factor (latent variable)** | **Measurement Item (explicit variable)** | **Non-standard Load Factor (Coef.)** | **Std. Error** | ***z (CR value)*** | ***p*** | **Standard Load Factor (Std. Estimate)** |
|---|---|---|---|---|---|---|
| SCXXQX | SCXXQX1 | 1.000 | - | - | - | 0.638 |
| SCXXQX | SCXXQX2 | 1.172 | 0.096 | 12.205 | 0.000 | 0.741 |
| SCXXQX | SCXXQX3 | 1.344 | 0.104 | 12.941 | 0.000 | 0.808 |
| SCXXQX | SCXXQX4 | 1.121 | 0.093 | 12.116 | 0.000 | 0.734 |
| SCXXQX | SCXXQX5 | 1.271 | 0.101 | 12.611 | 0.000 | 0.777 |

From Table 4.33, the absolute value of the standardized load coefficient is between 0.638 and 0.808, not less than 0.4, and it is significant, which means that there is a good measurement relationship between the index and the latent variable SCXXQX.

Table 4.34 Deep Learning Orientation Measurement Model AVE and CR Indicator Results

| **Factor** | **Average Variance Extracted AVE Value** | **Combined Reliability CR Value** |
|---|---|---|
| SCXXQX | 0.550 | 0.859 |

From Table 4.34 above, it can be seen that the AVE value corresponding to the deep learning orientation factor is 0.550, which is greater than 0.5, and the CR value is 0.859, which is greater than 0.7, which means that the data has good convergent validity. Therefore, all the measurement items of the deep learning orientation dimension will be reserved for the next step of analysis.

4) Confirmatory factor analysis of surface learning orientation dimension

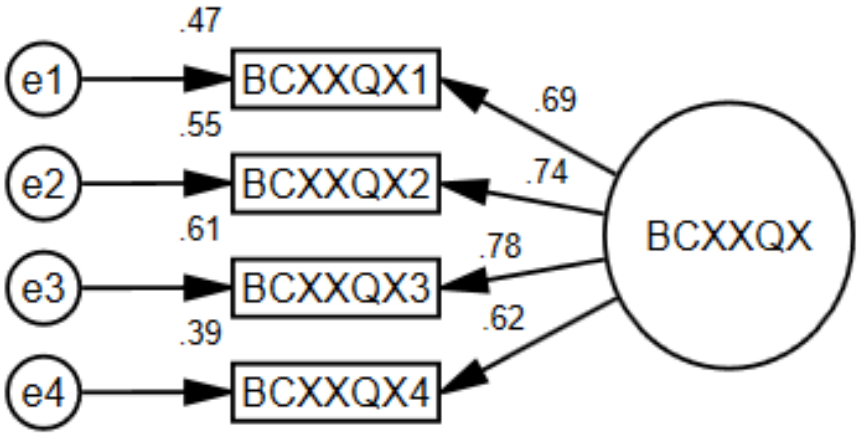


Figure 4.4 Surface Learning Orientation Confirmatory Factor Analysis Model Diagram

Table 4.35 Surface Learning Orientation Validates the Fit of the Factor Analysis Model

| **Model Fit Metrics** | **Common Indicators** | **Judgment Standard** | **Value** |
|---|---|---|---|
| | $\chi^2$ | - | 3.059 |
| | *df* | - | 2 |
| | *p* | >0.05 | 0.217 |
| | $\chi^2$/df | <3 | 1.53 |
| | GFI | >0.9 | 0.996 |
| | RMSEA | <0.08 | 0.036 |
| | RMR | <0.05 | 0.009 |
| | CFI | >0.9 | 0.998 |
| | NFI | >0.9 | 0.994 |
| | NNFI | >0.9 | 0.994 |

It can be seen from Table 4.35 that $\chi$2/df = 1.53<3, RMSEA = 0.036<0.08, RMR = 0.009<0.05, and the values of GFI, CFI, NFI and NNFI are all above 0.9, indicating that the surface learning orientation (BCXXQX) dimension measurement The model has a good fit

Table 4.36 Surface Learning Orientation Dimension Factor Loading Coefficient

| **Factor (latent variable)** | **Measurement item (explicit variable)** | **Non-standard load factor (Coef.)** | **Std. Error** | ***z (CR value)*** | ***p*** | **Standard Load Factor (Std. Estimate)** |
|---|---|---|---|---|---|---|
| BCXXQX | BCXXQX1 | 1.000 | - | - | - | 0.688 |
| BCXXQX | BCXXQX2 | 1.082 | 0.089 | 12.109 | 0.000 | 0.742 |
| BCXXQX | BCXXQX3 | 1.246 | 0.101 | 12.389 | 0.000 | 0.780 |
| BCXXQX | BCXXQX4 | 0.828 | 0.078 | 10.598 | 0.000 | 0.621 |

From Table 4.36, the absolute value of the absolute value of the standardized load coefficient is between 0.621 and 0.780, not less than 0.4, and it is significant, which means that there is a good measurement relationship between the index and the latent variable surface learning orientation (BCXXQX).

Table 4.37 Surface Learning Orientation Measurement Model AVE and CR Indicator Results

| **Factor** | **Average Variance Extracted AVE Value** | **Combined Reliability CR Value** |
|---|---|---|
| BCXXQX | 0.505 | 0.802 |

From Table 4.37 above, it can be seen that the AVE value corresponding to the surface learning orientation factor is 0.505, which is greater than 0.5, and the CR value is 0.802, which is greater than 0.7, which means that the data has good convergent validity. As a result, all items of the surface learning orientation dimension will be retained for the next step of analysis.

5) Engagement confirmatory factor analysis

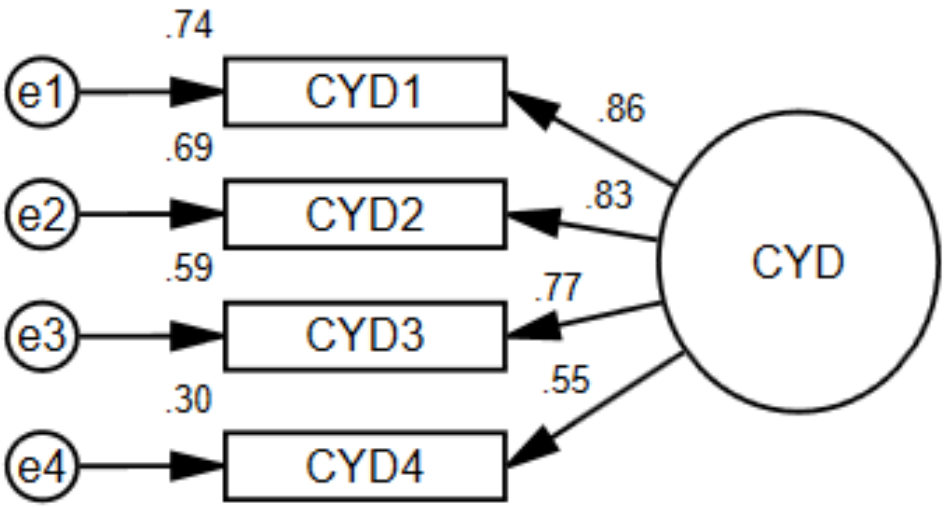


Figure 4.5 Engagement Confirmatory Factor Analysis Model Diagram

Table 4.38 Engagement Validation Factor Analysis Model Fit

| **Model Fit Metrics** | **Common Indicators** | **Judgment Standard** | **Value** |
|---|---|---|---|
| | $\chi^2$ | - | 5.71 |
| | *df* | - | 2 |
| | *p* | >0.05 | 0.058 |
| | $\chi^2$/df | <3 | 2.855 |
| | GFI | >0.9 | 0.993 |
| | RMSEA | <0.08 | 0.067 |
| | RMR | <0.05 | 0.007 |
| | CFI | >0.9 | 0.995 |
| | NFI | >0.9 | 0.992 |
| | NNFI | >0.9 | 0.984 |

It can be seen from Table 4.38 that $\chi$2/df = 2.855<3, RMSEA = 0.067<0.08, RMR = 0.007<0.05, and the values of GFI, CFI, NFI, and NNFI are all above 0.9, indicating that the engagement degree (CYD) dimension measurement model have a good fit.

Table 4.39 Engagement Dimension Factor Loading Factor

| **Factor (latent variable)** | **Measurement item (explicit variable)** | **Non-standard load factor (Coef.)** | **Std. Error** | ***z (CR value)*** | ***p*** | **Standard Load Factor (Std. Estimate)** |
|---|---|---|---|---|---|---|
| CYD | CYD1 | 1.000 | - | - | - | 0.862 |
| CYD | CYD2 | 1.032 | 0.056 | 18.387 | 0.000 | 0.832 |
| CYD | CYD3 | 1.003 | 0.059 | 16.948 | 0.000 | 0.766 |
| CYD | CYD4 | 0.746 | 0.067 | 11.189 | 0.000 | 0.545 |

From Table 4.39, it can be seen that the absolute value of the standardized load coefficient is between 0.545 and 0.862, not less than 0.4, and it is significant, which means that there is a good measurement relationship between the index and the latent variable engagement (CYD).

Table 4.40 Engagement Measurement Model AVE and CR Indicator Results

| Factor | Average Variance Extracted AVE Value | Combined Reliability CR Value |
|---|---|---|
| CYD | 0.580 | 0.843 |

It can be seen from Table 4.40 above that the AVE value corresponding to the engagement factor is 0.580, which is greater than 0.5, and the CR value is 0.843, which is greater than 0.7, which means that the data has good convergent validity. As a result, all measurement items of the engagement dimension will be retained for the next step of analysis.

6) Confirmatory factor analysis of student development

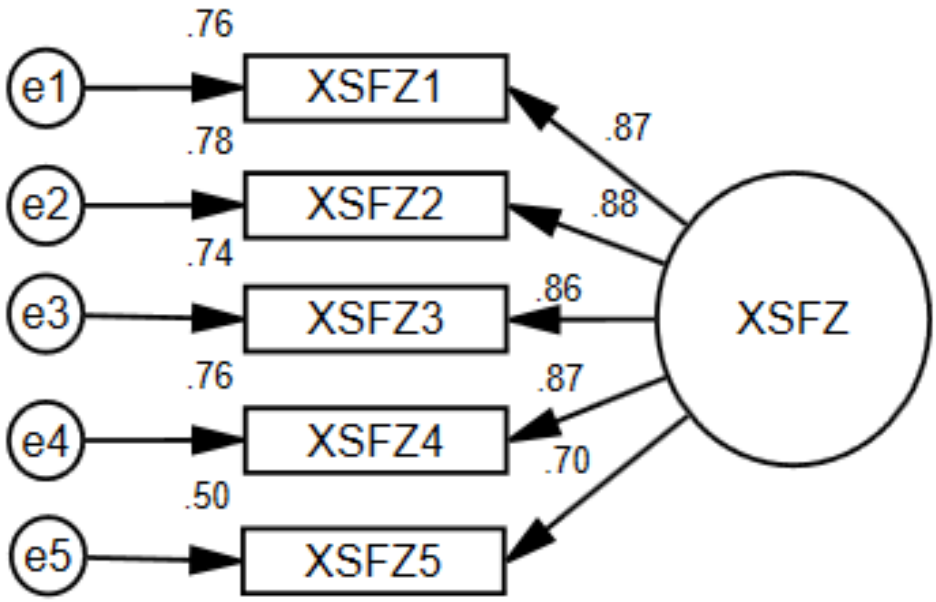


Figure 4.6 Student Development Confirmatory Factor Analysis Model Diagram

Table 4.41 Student Development Validates the Fit of the Factor Analysis Model

| **Model Fit Metrics** | **Common Indicators** | **Judgment Standard** | **Value** |
|---|---|---|---|
| | $\chi^2$ | - | 10.118 |
| | *df* | - | 5 |
| | *p* | >0.05 | 0.072 |
| | $\chi^2$/df | <3 | 2.024 |
| | GFI | >0.9 | 0.99 |
| | RMSEA | <0.10 | 0.05 |
| | RMR | <0.05 | 0.005 |
| | CFI | >0.9 | 0.997 |
| | NFI | >0.9 | 0.993 |
| | NNFI | >0.9 | 0.996 |

It can be seen from Table 4.41 that $\chi$2/df = 2.024<3, RMSEA = 0.05<0.08, RMR = 0.005<0.05, and the values of GFI, CFI, NFI and NNFI are all above 0.9, indicating that the student development (XSFZ) dimension measurement model have a good fit.

Table 4.42 Student Development Dimension Factor Loading Factor

| **Factor (latent variable)** | **Measurement item (explicit variable)** | **Non-standard load factor (Coef.)** | **Std. Error** | ***z (CR value)*** | ***p*** | **Standard Load Factor (Std. Estimate)** |
|---|---|---|---|---|---|---|
| XSFZ | XSFZ1 | 1.000 | - | - | - | 0.874 |
| XSFZ | XSFZ2 | 0.952 | 0.039 | 24.633 | 0.000 | 0.882 |
| XSFZ | XSFZ3 | 1.000 | 0.043 | 23.488 | 0.000 | 0.860 |
| XSFZ | XSFZ4 | 0.953 | 0.040 | 24.002 | 0.000 | 0.870 |
| XSFZ | XSFZ5 | 0.719 | 0.043 | 16.829 | 0.000 | 0.704 |

It can be seen from Table 4.42 that the absolute value of the standardized load factor is between 0.704 and 0.882, not lower than 0.4, and it is significant, which means that there is a very good measurement relationship between the index and the latent variable student development (XSFZ).

Table 4.43 Student Development Measurement Model AVE and CR Indicator Results

| **Factor** | **Average Variance Extracted AVE Value** | **Combined Reliability CR Value** |
|---|---|---|
| XSFZ | 0.707 | 0.923 |

It can be seen from Table 4.43 above that the AVE value corresponding to the student development factor is 0.707, which is greater than 0.5, and the CR value is 0.923, which is greater than 0.7, which means that the data has good convergent validity. As a result, all measurement items of the student development dimension will be retained for further analysis.

7) Global validation factor analysis

In the global validation factor analysis, convergence validity and differentiation validity will be tested. Convergence validity has been previously elaborated. Distinguishing validity is a measure of the degree to which a distinction is made between potential variables. Distinguishing validity implies that potential variables are able to account for more variance in the observations they relate to, rather than measurement errors or external, unmeasured impacts, and other structures within the conceptual framework. The test for differential validity is to compare the absolute Pearson correlation coefficient between the root value of the Ave for each variable and the other variables. If the root value of the Ave is greater than these values, it indicates a good differential validity (Farrell & Rudd, 2009).

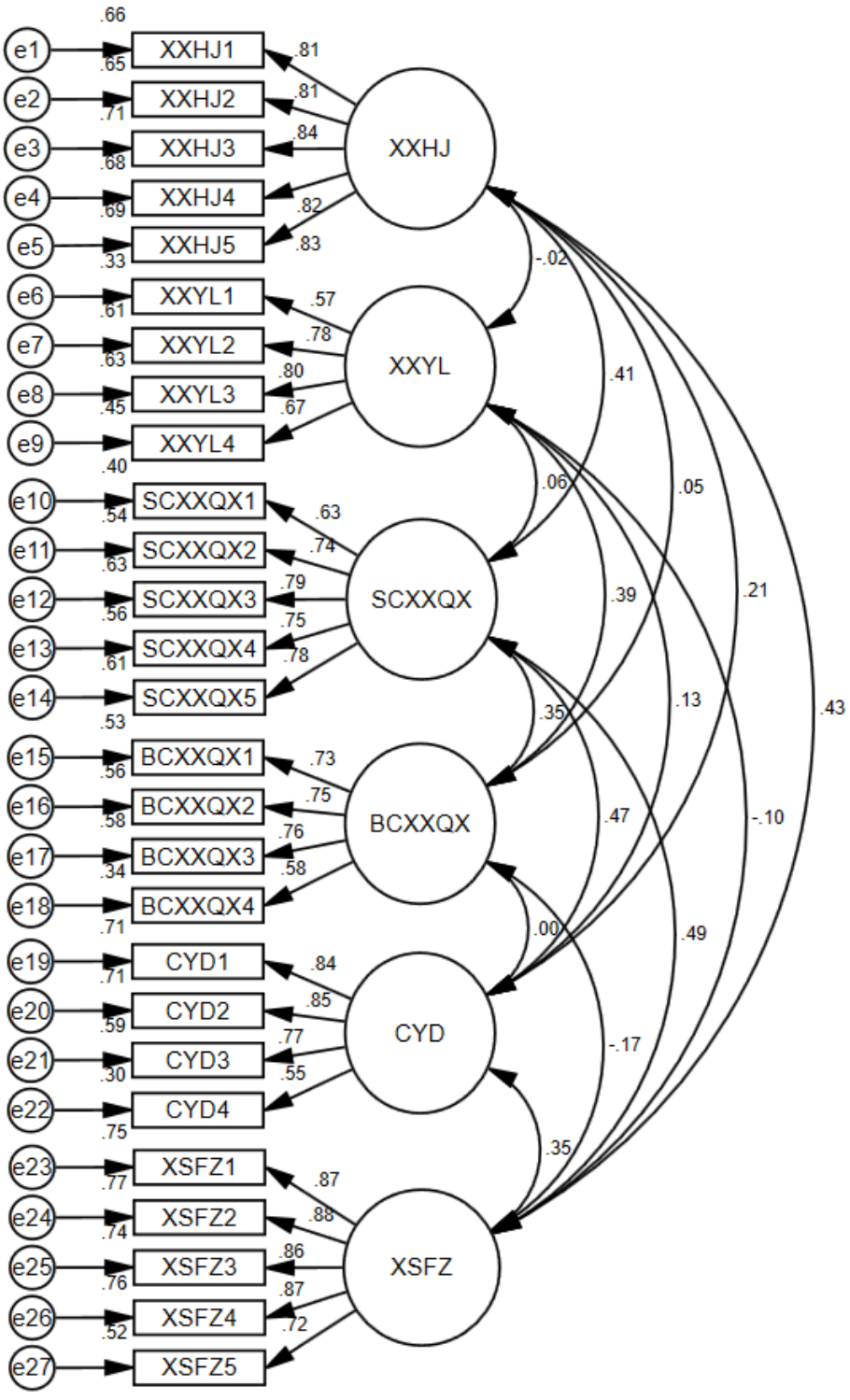


Figure 4.7 Holistic Confirmatory Factor Analysis Model Diagram

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

Table 4.44 Holistic Confirmatory Factor Analysis Fit

| **Model Fit Metrics** | **Common Indicators** | **Judgment Standard** | **Value** |
|---|---|---|---|
| | $\chi^2$ | - | 711.917 |
| | *df* | - | 309 |
| | *p* | >0.05 | 0 |
| | $\chi^2$/df | <3 | 2.304 |
| | GFI | >0.9 | 0.909 |
| | RMSEA | <0.08 | 0.056 |
| | RMR | <0.05 | 0.03 |
| | CFI | >0.9 | 0.935 |
| | NFI | >0.9 | 0.901 |
| | NNFI | >0.9 | 0.926 |

It can be seen from Table 4.44 that $\chi$2/df = 2.304<3, RMSEA = 0.056<0.08, RMR = 0.005<0.05, and the values of GFI, CFI, NFI and NNFI are all above 0.9, indicating that the overall dimension measurement model has good fit.

Table 4.45 Holistic Factor Loading Coefficient

| **Factor (latent variable)** | **Measurement item (explicit variable)** | **Non-standard load factor (Coef.)** | **Std. Error** | ***z (CR value)*** | ***p*** | **Standard Load Factor (Std. Estimate)** |
|---|---|---|---|---|---|---|
| XXHJ | XXHJ1 | 1.000 | - | - | - | 0.810 |
| XXHJ | XXHJ2 | 1.047 | 0.057 | 18.498 | 0.000 | 0.809 |
| XXHJ | XXHJ3 | 1.153 | 0.059 | 19.513 | 0.000 | 0.841 |
| XXHJ | XXHJ4 | 1.090 | 0.057 | 18.995 | 0.000 | 0.825 |
| XXHJ | XXHJ5 | 1.113 | 0.058 | 19.129 | 0.000 | 0.829 |
| XXYL | XXYL1 | 1.000 | - | - | - | 0.573 |
| XXYL | XXYL2 | 1.150 | 0.107 | 10.711 | 0.000 | 0.779 |
| XXYL | XXYL3 | 1.159 | 0.107 | 10.788 | 0.000 | 0.795 |
| XXYL | XXYL4 | 0.899 | 0.091 | 9.915 | 0.000 | 0.672 |

| **Factor (latent variable)** | **Measurement item (explicit variable)** | **Non-standard load factor (Coef.)** | **Std. Error** | ***z (CR value)*** | ***p*** | **Standard Load Factor (Std. Estimate)** |
|---|---|---|---|---|---|---|
| SCXXQX | SCXXQX1 | 1.000 | - | - | - | 0.633 |
| SCXXQX | SCXXQX2 | 1.176 | 0.096 | 12.247 | 0.000 | 0.738 |
| SCXXQX | SCXXQX3 | 1.329 | 0.103 | 12.892 | 0.000 | 0.793 |
| SCXXQX | SCXXQX4 | 1.157 | 0.093 | 12.408 | 0.000 | 0.751 |
| SCXXQX | SCXXQX5 | 1.289 | 0.101 | 12.764 | 0.000 | 0.782 |
| BCXXQX | BCXXQX1 | 1.000 | - | - | - | 0.730 |
| BCXXQX | BCXXQX2 | 1.027 | 0.078 | 13.169 | 0.000 | 0.747 |
| BCXXQX | BCXXQX3 | 1.142 | 0.086 | 13.318 | 0.000 | 0.759 |
| BCXXQX | BCXXQX4 | 0.734 | 0.069 | 10.596 | 0.000 | 0.584 |
| CYD | CYD1 | 1.000 | - | - | - | 0.844 |
| CYD | CYD2 | 1.072 | 0.057 | 18.776 | 0.000 | 0.846 |
| CYD | CYD3 | 1.030 | 0.061 | 17.014 | 0.000 | 0.770 |
| CYD | CYD4 | 0.768 | 0.068 | 11.263 | 0.000 | 0.549 |
| XSFZ | XSFZ1 | 1.000 | - | - | - | 0.868 |
| XSFZ | XSFZ2 | 0.952 | 0.040 | 24.044 | 0.000 | 0.876 |
| XSFZ | XSFZ3 | 1.010 | 0.043 | 23.381 | 0.000 | 0.863 |
| XSFZ | XSFZ4 | 0.964 | 0.040 | 23.941 | 0.000 | 0.874 |
| XSFZ | XSFZ5 | 0.738 | 0.043 | 17.230 | 0.000 | 0.718 |

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

It can be seen from Table 4.45 that the absolute value of the standardized load coefficient is between 0.549 and 0.876, not less than 0.4, and it is significant, which means that there is a good measurement relationship between the measurement index and each corresponding latent variable.

Table 4.46 Holistic Measurement Model AVE and CR Index Results

| Factor | Average Variance Extracted AVE Value | Combined Reliability CR Value |
|---|---|---|
| XXHJ | 0.677 | 0.913 |
| XXYL | 0.505 | 0.800 |
| SCXXQX | 0.550 | 0.859 |
| BCXXQX | 0.502 | 0.800 |
| CYD | 0.580 | 0.843 |
| XSFZ | 0.708 | 0.924 |

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

It can be seen from Table 4.46 that the AVE values corresponding to the six variables are all greater than 0.5, and the CR values are all higher than 0.7, which means that the questionnaire data has good convergent validity.

Table 4.47 Holistic Measurement Model Discriminant Validity: Pearson Correlation and AVE Square Root Value

| | XXHJ | XXYL | SCXXQX | BCXXQX | CYD | XSFZ |
|---|---|---|---|---|---|---|
| XXHJ | 0.823 | - | - | - | - | - |
| XXYL | -0.020 | 0.710 | - | - | - | - |
| SCXXQX | 0.369 | 0.051 | 0.742 | - | - | - |
| BCXXQX | 0.039 | 0.337 | 0.279 | 0.709 | - | - |
| CYD | 0.200 | 0.093 | 0.402 | 0.007 | 0.762 | - |
| XSFZ | 0.408 | -0.128 | 0.451 | -0.151 | 0.349 | 0.842 |

Note: The diagonal numbers are the square root of AVE

XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

In Table 4.47, the value on the diagonal line is the square root value of AVE corresponding to each variable, and the remaining values are the Pearson correlation coefficient between variables (generally required not to be greater than 0.85, otherwise it indicates that the measurement items measure the same dimension). The table shows:

1) The square root value of AVE corresponding to the learning environment is 0.823, and the absolute value of the Pearson correlation coefficient between this variable and other variables is between 0.020 and 0.408, all less than 0.823.

2) The square root value of AVE corresponding to the learning pressure is 0.710, and the absolute value of the Pearson correlation coefficient between this variable and other variables is between 0.020 and 0.337, all less than 0.710.

3) The square root value of AVE corresponding to the deep learning orientation is 0.742, and the absolute value of the Pearson correlation coefficient between this variable and other variables is between 0.051 and 0.451, all less than 0.0.742.

4) The square root value of AVE corresponding to the surface learning orientation is 0.709, and the absolute value of the Pearson correlation coefficient between this variable and other variables is between 0.007 and 0.337, all less than 0.709.

5) The square root value of AVE corresponding to the degree of engagement is 0.762, and the absolute value of the Pearson correlation coefficient between this variable and other variables is between 0.007 and 0.402, all less than 0.762.

6) The square root value of AVE corresponding to student development is 0.842, and the absolute value of the Pearson correlation coefficient

between this variable and other variables is between 0.128 and 0.451, all less than 0.842.

In conclusion, there is good discriminant validity among the dimensions.

## 4.9 Multicollinearity Test

Multicollinearity refers to the existence of a precise or highly correlated relationship between the explanatory variables in the linear regression model (O'brien, 2007). The presence of multiple co-linearities can make model estimates distorted or difficult to estimate accurately. O'brien (2007) noted that the Variance Expansion Factor (VIF) can understand multiple co-linearity between variables and that there is no multiple co-linearity problem if the test result is VIF < 3. Through multiple co-linearity tests of the learning environment, learning pressure, deep and surface learning orientation, and engagement, the results are as follows:

Table 4.48 Multicollinearity Test

| Coefficients[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Model** | | **Unstandardized Coefficients** | | **Standardized Coefficients** | **t** | **Sig.** | **Collinearity Statistics** | |
| | | **B** | **Std. Error** | **Beta** | | | **Tolerance** | **VIF** |
| 1 | (Constant) | 1.610 | .207 | - | 7.788 | .000 | - | - |
| | XXHJ | .199 | .034 | .249 | 5.853 | .000 | .857 | 1.167 |
| | XXYL | -.072 | .040 | -.077 | -1.813 | .071 | .870 | 1.150 |
| | SCXXQX | .380 | .050 | .364 | 7.601 | .000 | .677 | 1.477 |
| | BCXXQX | -.207 | .039 | -.238 | -5.380 | .000 | .796 | 1.256 |
| | CYD | .173 | .047 | .161 | 3.685 | .000 | .811 | 1.234 |

a. Dependent Variable: XSFZ

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

The results show that all VIF values are less than 3, indicating that there is no multicollinearity problem.

## 4.10 Structural Equation Modeling Analysis

Next, the structural equation model (SEM) of this study will be analyzed, including fit, path analysis, and hypothesis testing.

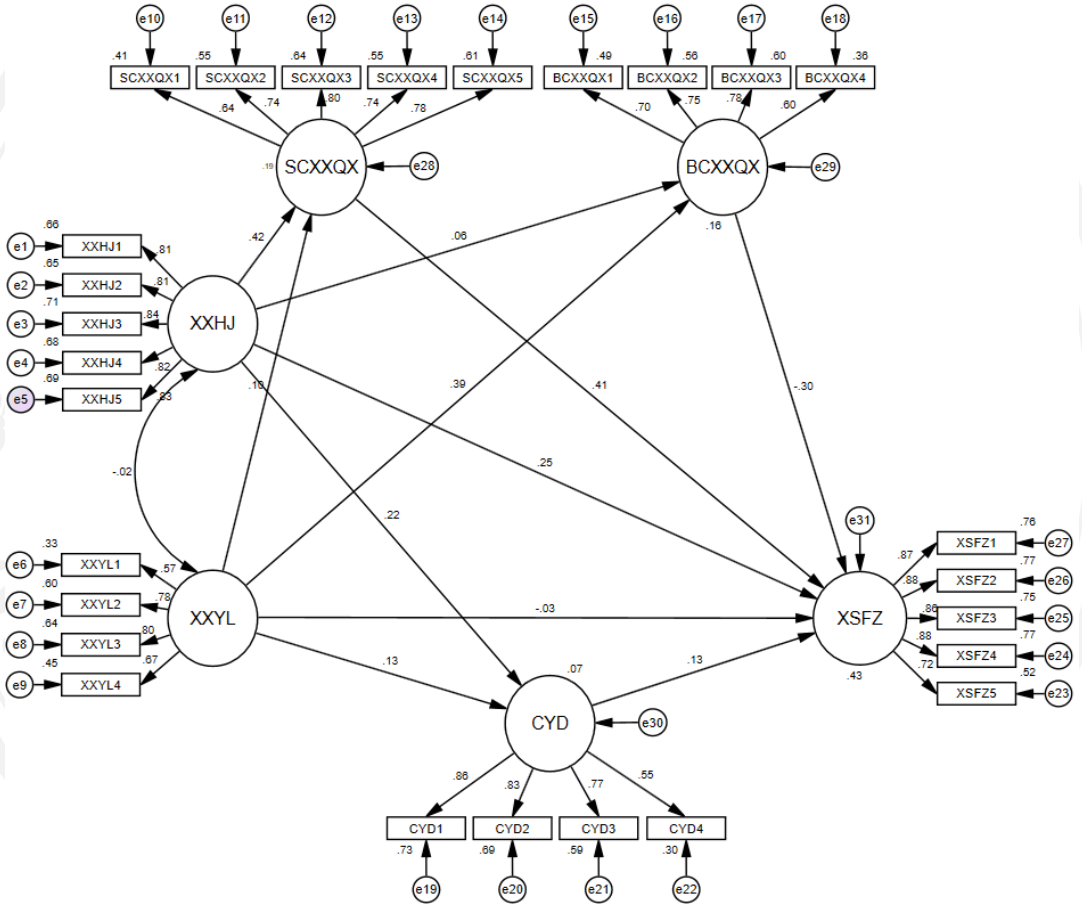


Figure 4.8 Structural Equation Modeling

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

Table 4.49 Structural Equation Model Fit

| Model Fit Metrics | Common Indicators | Judgment Standard | Value |
|---|---|---|---|
| | $\chi^2$ | - | 814.06 |
| | *df* | - | 312 |
| | *p* | >0.05 | 0 |
| | $\chi^2$/df | <3 | 2.609 |
| | GFI | >0.9 | 0.911 |
| | RMSEA | <0.10 | 0.062 |
| | RMR | <0.05 | 0.043 |
| | CFI | >0.9 | 0.948 |
| | NFI | >0.9 | 0.907 |
| | NNFI | >0.9 | 0.919 |

It can be seen from Table 4.49 that $\chi$2/df = 2.609<3, RMSEA = 0.062<0.08, RMR = 0.43<0.05, and the values of GFI, CFI, NFI, and NNFI are all above 0.9, indicating that the model has a good degree of fit.

Table 4.50 Structural Equation Model Regression Coefficient Summary

| X | → | Y | Unstandardized Regression Coefficients | *Se* | *Z (Cr Value)* | *P* | Standardized Regression Coefficients |
|---|---|---|---|---|---|---|---|
| XXHJ | → | SCXXQX | 0.287 | 0.040 | 7.143 | 0.000 | 0.423 |
| XXHJ | → | BCXXQX | 0.055 | 0.050 | 1.100 | 0.271 | 0.060 |
| XXHJ | → | CYD | 0.178 | 0.044 | 4.053 | 0.000 | 0.222 |
| XXHJ | → | XSFZ | 0.231 | 0.048 | 4.795 | 0.000 | 0.247 |
| XXYL | → | SCXXQX | 0.083 | 0.046 | 1.833 | 0.067 | 0.100 |
| XXYL | → | BCXXQX | 0.436 | 0.075 | 5.779 | 0.000 | 0.391 |
| XXYL | → | CYD | 0.131 | 0.057 | 2.313 | 0.021 | 0.133 |
| XXYL | → | XSFZ | -0.030 | 0.060 | -0.507 | 0.612 | -0.026 |
| SCXXQX | → | XSFZ | 0.569 | 0.079 | 7.184 | 0.000 | 0.412 |
| BCXXQX | → | XSFZ | -0.308 | 0.056 | -5.504 | 0.000 | -0.300 |
| CYD | → | XSFZ | 0.156 | 0.054 | 2.897 | 0.004 | 0.134 |

Remarks: → Indicates regression influence relationship or measurement relationship

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

According to the standardized regression coefficients and the significance level P value in Table 4.50 of the regression weights, the learning environment has a significant positive effect on the deep learning orientation ($\beta = 0.423$, $P < 0.001$) at the 0.001 level. This shows that a good learning environment can indeed promote students' deep learning orientation. This supports the conclusion of Biggs (1987) 3P learning process theory that the learning environment has a significant positive effect on deep learning orientation, and is also consistent with the findings of Entwistle and Ramsden (2015). Entwistle and Ramsden (2015) argue that students' perceptions of good teaching will encourage them to adopt deeper learning. The analysis results verified the hypothesis of this study:

$H1_A$: Learning environment is positively correlated with deep learning orientation. Established.

According to the standardized regression coefficients and significance level P values in Table 4.50 of the regression weights, the learning environment had no significant effect on the surface learning orientation at the 0.001 or 0.05 level. This suggests that students' perceptions of the learning environment are not closely related to the surface learning they employ. This is consistent with the previous study by Meyer (1990). Meyer (1990) argued that the negative relationship between learning environment and surface learning orientation could not be detected at the individual and group levels. But more people believe that the learning environment has a negative impact on the surface learning orientation. For example, Wang et al. (2013) found that a more constructive learning environment will guide students to adjust their learning orientation, significantly promoting students to adopt more deep learning orientation and less surface learning orientation in learning . This suggests that more research is indeed needed to explore the relationship between the two. Therefore, this study assumes:

$H1_B$: Learning environment is negatively correlated with surface learning orientation. The result is Invalid.

According to the standardized regression coefficients and significance level P values in Table 4.50 of the regression weights, the learning environment had a significant positive effect on engagement ($\beta = 0.222$, $P < 0.001$) at the 0.001 level. This shows that a good learning environment does promote student engagement. This

supports the conclusion of Pascarella (1985) comprehensive causal theory that the learning environment has a significant positive effect on engagement, and is also consistent with the findings of Tharayil et al. (2018). Tharayil et al. (2018) believe that a good learning environment, especially good teaching practice, can significantly reduce students' resistance to active learning, and is significantly related to student engagement. The analysis results verified the hypothesis of this study:

$H1_D$: Learning environment is positively correlated with engagement. Established.

According to the standardized regression coefficients and the significance level P value in Table 4.50 of the regression weights, the learning environment had a significant positive effect on student development ($\beta = 0.247$, $P < 0.001$) at the 0.001 level. This shows that a good learning environment can indeed promote student development. This result is consistent with the views of many researchers. For example, Lizzio et al. (2002) believe that students' perceptions of the teaching environment directly or indirectly affect learning outcomes, and students' knowledge and skills can be best developed in a good learning environment. The analysis results verified the hypothesis of this study:

$H1_C$: Learning environment is positively correlated with student development. Established.

According to the standardized regression coefficients and significance level P values in Table 4-50 for regression weights, learning pressure had no significant effect on deep learning orientation at the 0.001 and 0.05 levels. This suggests that the learning pressure is not closely related. This echoes some of the previous conclusions. Maria Öhrstedt and Petra Lindfors (2018) argue that the relationship between deep learning orientation and perceived stress seems contradictory and unclear, despite its positive association with expected performance. On the other hand, Trigueros et al. (2020) believe that learning pressure is negatively related to deep learning orientation, critical thinking and academic achievement. The results show divergent views on the effect of learning pressure on deep learning orientation. Therefore, the hypothesis of this study:

$H2_A$: Learning pressure is negatively correlated with deep learning orientation. The result is Invalid.

According to the standardized regression coefficients and the significance level P value in Table 4.50 of the regression weights, learning pressure had a significant effect on the surface learning orientation ($\beta = 0.391$, $P < 0.001$) at the 0.001 level. This suggests that greater learning pressure will bring more surface learning to students. This is consistent with the conclusions of many previous researchers. For example, Biggs (1985) argued that surface learning orientation are most susceptible to stress responses. Yuan et al. (2017) pointed out that the more pressure student's face in learning, the easier it is to adopt the thinking strategy of surface learning. Therefore, the hypothesis of this study:

$H2_B$: Learning pressure is positively correlated with surface learning orientation. Established.

According to the standardized regression coefficients and the significance level P value in Table 4.50 of the regression weights, learning pressure has a positive and significant effect on engagement ($\beta = 0.133$, $P < 0.05$) at the 0.05 level. This suggests that greater learning pressure promotes greater student engagement. This echoes previous mixed results. Previously, it was concluded that learning pressure was not significantly correlated with engagement, either positively or negatively. For example, Molnar et al. (2001) showed no significant correlation between academic effort and stress. However, Uchil (2017) believes that learning tasks with higher pressure can make students more motivated to participate. And Asghar (2014) pointed out that higher learning pressure is related to students' overall mood, negative learning and coping with disengagement. Combined with the conclusions of this study, the effect of learning pressure on engagement may require more evidence. Therefore, the hypothesis of this study:

$H2_D$: Learning pressure is positively correlated with engagement. Established.

According to the standardized regression coefficients and the significance level P value in Table 4.50 of the regression weights, learning pressure had no significant effect on student development at the 0.001 and 0.05 levels. This suggests that there is no obvious direct relationship between learning pressure and student development. This is inconsistent with most previous conclusions, Pascoe et al. (2020) argue that the greater the academic-related stress, the worse the learning

outcomes, and the learning pressure has a detrimental effect on student development. Therefore, the hypothesis of this study:

$H2_C$: Learning pressure is negatively correlated with student development. The result is Invalid.

According to the standardized regression coefficients and significance level P values in Table 4.50 of the regression weights, the deep learning orientation had a significant positive effect on student development ($\beta = 0.412$, $P < 0.001$) at the 0.001 level. This is consistent with the conclusions of previous studies. For example, Kember et al. (2020) deep learning methods have a positive and significant impact on the development of students in all aspects. Therefore, the hypothesis of this study:

H3: Deep learning orientation is positively correlated with student development. Established.

According to the standardized regression coefficients and significance level P values in Table 4.50 of the regression weights, surface learning orientation has a significant negative impact on student development ($\beta = -0.300$, $P < 0.001$) at the 0.001 level. This is consistent with the conclusions of previous studies. For example, Saljo (1984); Biggs (2011) pointed out that surface learning orientation is associated with low-quality learning outcomes. Therefore, the hypothesis of this study:

H4: Surface learning orientation is negatively correlated with student development. Established.

According to the standardized regression coefficients and the significance level P value in Table 4.50 of the regression weights, engagement has a significant positive effect on student development ($\beta = 0.134$, $P < 0.05$) at the 0.05 level. This is consistent with the conclusions of previous studies. For example, Astin (2012) pointed out that in four years of college, engagement is crucial to student development, and the higher the student's engagement, the greater the gain. Therefore, the hypothesis of this study:

H5: Engagement is positively related to student development. Established.

## 4.11 Test of Mediation Effect

The mediation effect means that two related construct variables form a relationship through the intervention of the third variable construct, which is divided into complete mediation and partial mediation (Wu, 2013). Generally, the Bootstrap mediation effect test method (set 5000 iterations) is used (Lu & Qiu, 2020). Evaluating the confidence interval is an important condition for confirming the mediating effect, if the confidence interval (95% BootCI) of the indirect effect does not cross zero, which supports the existence of the mediating effect (Memon et al., 2018). When the mediating effect is significant, not only the size of the mediating effect ab, but also the effect size of ab should be reported (Fang et al., 2012).

1) Learning Environment-Deep Guided Learning Orientation-Student Development Mediating Effect Test

Table 4.51 XXHJ=>SCXXQX=>XSFZ Mediation Test Results

| **Summary of Mediation Test Results** | | |
|---|---|---|
| **Item** | | **XXHJ=>SCXXQX=>XSFZ** |
| c | total effect | 0.324** |
| a | value | 0.283** |
| b | value | 0.380** |
| a*b | Mediating effect size | 0.108 |
| a*b | (Boot SE) | 0.032 |
| a*b | (z-value) | 3.417 |
| a*b | (p-value) | 0.001 |
| a*b | (95% BootCI) | 0.075 ~ 0.200 |
| c’ | direct effect | 0.199** |
| * p<0.05 ** p<0.01 | | |

Note: XXHJ: learning environment; SCXXQX: deep learning orientation; XSFZ: student development

Table 4.52 XXHJ=>SCXXQX=>XSFZ Mediating Effect Size Results Summary

| Item | Test Results | C Total Effect | A*B Mediation Effect | C' Direct Effect | Effect Ratio Calculation Formula | Effect Ratio |
|---|---|---|---|---|---|---|
| XXHJ=>SCXXQX =>XSFZ | Partial intermediary | 0.324 | 0.108 | 0.199 | a * b / c | 33.229% |

The results show that the 95% confidence interval (95%BootCI) corresponding to the mediating effect value a*b is 0.075 ~ 0.200, excluding 0, and the corresponding a, b, c' are significant, a*b and c' have the same sign, so Deep learning orientation (SCXXQX) plays a partial mediating role between learning environment (XXHJ) and student development (XSFZ), with a mediating effect of 33.229%, which is consistent with the conclusions of many researchers such as Biggs (2011). The research hypothesis is supported by H6, i.e.

H6: Deep learning orientation mediates the relationship between learning environment and student development. Established.

2) The mediating effect test of learning environment-surface learning orientation-student development

Table 4.53 XXYL=>BCXXQX=>XSFZ Mediation Test Results

| Summary of Mediation Test Results | | |
|---|---|---|
| **Item** | | **XXHJ=>BCXXQX=>XSFZ** |
| c | total effect | 0.324** |
| a | value | 0.042 |
| b | value | -0.207** |
| a*b | Mediating effect size | -0.009 |
| a*b | (Boot SE) | 0.013 |
| a*b | (z-value) | -0.688 |
| a*b | (p-value) | 0.492 |
| a*b | (95% BootCI) | -0.036 ~ 0.015 |
| c' | direct effect | 0.199** |

* p<0.05 ** p<0.01

| Summary of Mediation Test Results | |
|---|---|
| **Item** | **XXHJ=>BCXXQX=>XSFZ** |
| Note: XXHJ: learning environment; BCXXQX: surface learning orientation; XSFZ: student development | |

Table 4.54 XXHJ=>BCXXQX=>XSFZ Mediation Effect Size Results Summary

| Item | Test Results | C Total Effect | A*B Mediation Effect | C' Direct Effect | Effect Ratio Calculation Formula | Effect Ratio |
|---|---|---|---|---|---|---|
| XXHJ=>BCXXQX=>XSFZ | Mediating effect is not significant | 0.324 | -0.009 | 0.199 | - | 0% |

The results show that the 95% confidence interval (95%BootCI) corresponding to the mediating effect value a*b is -0.036 ~ 0.015, which includes 0, so the surface learning method (BCXXQX) is in the learning environment (XXHJ) and student development (XSFZ) The mediating effect between the two groups is not significant, the proportion of the mediating effect is 0%, the research hypothesis H8 is not supported, which is inconsistent with the research conclusions of most researchers ,such as Biggs (1987) and Biggs (2011), which indicates that the Chinese university learning environment under the students have different learning behaviors and outcomes. Although the learning environment is a significant factor affecting student development, surface learning is not a mediating factor that affects learning outcomes. Which is

H8: Surface learning orientation mediates the relationship between learning environment and student development. The result is Invalid.

3) The mediating effect test of learning environment-engagement-student development

Table 4.55 XXHJ=>CYD=>XSFZ Mediation Test Results

| Summary of Mediation Test Results | | |
|---|---|---|
| **Item** | | **XXHJ=>CYD=>XSFZ** |
| c | total effect | 0.324** |
| a | value | 0.150** |
| b | value | 0.173** |
| a*b | Mediating effect size | 0.026 |
| a*b | (Boot SE) | 0.016 |
| a*b | (z-value) | 1.662 |
| a*b | (p-value) | 0.096 |
| a*b | (95% BootCI) | 0.008 ~ 0.069 |
| c’ | direct effect | 0.199** |

* p<0.05 ** p<0.01

Note: XXHJ: learning environment; CYD: engagement; XSFZ: student development

Table 4.56 XXHJ=>CYD=>XSFZ Mediation Effect Size Results Summary

| **Item** | **Test Results** | **C Total Effect** | **A*B Mediation Effect** | **C’ Direct Effect** | **Effect Ratio Calculation Formula** | **Effect Ratio** |
|---|---|---|---|---|---|---|
| XXHJ=>CYD=>XSFZ | Partial intermediary | 0.324 | 0.026 | 0.199 | a * b / c | 8.022% |

The results show that the 95% confidence interval (95%BootCI) corresponding to the mediating effect value a*b is 0.008 ~ 0.069, excluding 0, and the corresponding a, b, c' are significant, a*b and c' have the same sign, so Engagement (CYD) plays a partial mediating role between school environment (XXHJ) and student development (XSFZ), with a mediating effect of 8.022%, which further confirms the mediation effect of engagement by Astin (1984) and others. 's discussion. It is also consistent with the conclusions of many researchers such as Zhu

et al. (2019). Zhu et al. (2019) pointed out that the learning environment not only has a direct impact on learning outcomes, but also has an indirect impact on students' own development through learning engagement. The research hypothesis is that H10 is supported, i.e.

H10: Engagement mediates the relationship between learning environment and student development. Established.

4) The mediating effect test of learning pressure-deep learning orientation-student development

Table 4.57 XXYL=>SCXXQX=>XSFZ Mediation Test Results

| **Summary of Mediation Test Results** | | |
|---|---|---|
| **Item** | | **XXYL=>SCXXQX=>XSFZ** |
| c | total effect | -0.113** |
| a | value | 0.053 |
| b | value | 0.380** |
| a*b | Mediating effect size | 0.02 |
| a*b | (Boot SE) | 0.025 |
| a*b | (z-value) | 0.811 |
| a*b | (p-value) | 0.417 |
| a*b | (95% BootCI) | -0.025 ~ 0.072 |
| c’ | direct effect | -0.072 |

* p<0.05 ** p<0.01

Note: XXYL: learning pressure; SCXXQX: deep learning orientation XSFZ: student development

Table 4.58 XXYL=>SCXXQX=>XSFZ Mediating Effect Size Results Summary

| **Item** | **Test Results** | **C Total Effect** | **A*B Mediation Effect** | **C' Direct Effect** | **Effect Ratio Calculation Formula** | **Effect Ratio** |
|---|---|---|---|---|---|---|
| XXYL=>SCXXQX=>XSFZ | Mediating effect is not significant | -0.120 | 0.022 | -0.142 | - | 0% |

The results show that the 95% confidence interval (95%BootCI) corresponding to the mediating effect value a*b is -0.025 ~ 0.072, which includes 0, so the deep learning orientation (SCXXQX) is the difference between learning pressure (XXYL) and student development (XSFZ). The mediating effect between the two groups was not significant, and the proportion of the mediating effect was 0%. The research hypothesis H7 was not supported, which was consistent with the study of Maria Öhrstedt and Petra Lindfors (2018). Maria Öhrstedt and Petra Lindfors (2018) found that the relationship between deep learning orientation and perceived stress was not clear, although deep learning orientation was positively associated with expected performance. This suggests that deep learning orientation is not a mediator of learning pressure affecting learning development. Which is

H7: Deep learning orientation mediates the relationship between learning pressure and student development. The result is Invalid.

5) The mediating effect test of learning pressure-surface learning orientation-student development

Table 4.59 XXYL=>BCXXQX=>XSFZ Mediation Test Results

| Summary of Mediation Test Results | | |
|---|---|---|
| **Item** | | **XXYL=>BCXXQX=>XSFZ** |
| c | total effect | -0.113** |
| a | value | 0.363** |
| b | value | -0.207** |
| a*b | Mediating effect size | -0.075 |
| a*b | (Boot SE) | 0.024 |
| a*b | (z-value) | -3.098 |
| a*b | (p-value) | 0.002 |
| a*b | (95% BootCI) | -0.133 ~ -0.038 |
| c’ | direct effect | -0.072 |

* p<0.05 ** p<0.01

Note: XXYL: learning pressure; BCXXQX: surface learning orientation; XSFZ: student development

Table 4.60 XXYL=>BCXXQX=>XSFZ Mediation Effect Size Results Summary

| **Item** | **Test Results** | **C Total Effect** | **A*B Mediation Effect** | **C’ Direct Effect** | **Effect Ratio Calculation Formula** | **Effect Ratio** |
|---|---|---|---|---|---|---|
| XXYL=>BCXXQX=>XSFZ | fully mediated | -0.113 | -0.075 | -0.072 | - | 100% |

The results show that a and b are significant, but c' is not. Therefore, it is not necessary to judge whether the 95% confidence interval (95% BootCI) corresponding to the mediating effect value a*b contains 0. It can be considered that the surface learning orientation (BCXXQX) is in the learning pressure. (XXYL) and student development (XSFZ) play a complete mediating role, the mediating effect value is negative, and the effect ratio is 100%. This shows that learning pressure does not directly affect student development, but affects surface learning orientation. , and

ultimately negatively affect student development. Maria Öhrstedt and Petra Lindfors (2018) found that surface learning orientation was positively associated with higher levels of perceived stress, which in turn reflected lower levels of expected learning outcomes. Therefore, the research hypothesis is supported by H9, i.e.

H9: Surface learning orientation mediates the relationship between learning pressure and student development

6) The mediating effect test of learning pressure-engagement-student development

Table 4.61 XXYL=>CYD=>XSFZ Mediation Test Results

| **Summary of Mediation Test Results** | | |
|---|---|---|
| **Item** | | **XXYL=>CYD=>XSFZ** |
| c | total effect | -0.113** |
| a | value | 0.085* |
| b | value | 0.173** |
| a*b | Mediating effect size | 0.015 |
| a*b | (Boot SE) | 0.012 |
| a*b | (z-value) | 1.208 |
| a*b | (p-value) | 0.227 |
| a*b | (95% BootCI) | -0.007 ~ 0.041 |
| c’ | direct effect | -0.072 |
| * p<0.05 ** p<0.01 | | |

Note: XXYL: learning pressure; CYD: engagement; XSFZ: student development

Table 4.62 XXYL=>CYD=>XSFZ Mediation Effect Size Results Summary

| **Item** | **Test Results** | **C Total Effect** | **A*B Mediation Effect** | **C' Direct Effect** | **Effect Ratio Calculation Formula** | **Effect Ratio** |
|---|---|---|---|---|---|---|
| XXYL=>CYD=>XSFZ | fully mediated | -0.113 | 0.015 | -0.072 | - | 100% |

The results show that a and b are significant, but c' is not. Therefore, it is not necessary to judge whether the 95% confidence interval (95% BootCI) corresponding to the mediating effect value a*b contains 0. XXYL) and student development (XSFZ) play a complete mediating role, the mediation effect value is positive, and the effect ratio is 100%. This shows that learning pressure does not directly affect student development, but by affecting engagement, ultimately positive impact on student development. Previously, there was little literature discussing the mediating role of engagement in learning pressure and student development. Mehmet A. Karaman et al. (2017); Smejkalová (2018) pointed out that learning pressure is not helpful for directly predicting learning benefits, but as university student' learning pressure increases, there should be other potential mediators related to stress affecting students' academic performance . . Clearly, this study found one such mediating factor, engagement. Therefore, the research hypothesis is supported by H11, i.e.

H11: Engagement mediates the relationship between learning pressure and student development

The following is a summary of the results of all the mediation tests:

Table 4.63 Summary of Mediation Test Results

| Item | Test Results | Assumption | Does It Exist |
|---|---|---|---|
| XXHJ=>SCXXQX=>XSFZ | Partial intermediary | H6: Deep learning orientation mediates the relationship between learning environment and student development | Established |
| XXHJ=>BCXXQX=>XSFZ | Mediating effect is not significant | H8: Surface learning orientation mediates the relationship between learning environment and student development | Not obvious |
| XXHJ=>CYD=>XSFZ | Partial intermediary | H10: Engagement mediates the relationship between learning environment and student development | Established |
| XXYL=>SCXXQX=>XSFZ | Mediating effect is not significant | H7: Deep learning orientation mediates the relationship between learning pressure and student development | Not obvious |
| XXYL=>BCXXQX=>XSFZ | fully mediated | H9: Surface learning orientation mediates the relationship between learning pressure and student development | Established |
| XXYL=>CYD=>XSFZ | fully mediated | H11: Engagement mediates the relationship between learning | Established |

| Item | Test Results | Assumption | Does It Exist |
|---|---|---|---|
| | | pressure and student development | |

Note: XXHJ: learning environment; XXYL: learning pressure; SCXXQX: deep learning orientation; BCXXQX: surface learning orientation; CYD: engagement; XSFZ: student development

## 4.12 Summary of Research Hypothesis Testing Results

In the above path analysis and mediation analysis of the structural equation model, all the hypotheses of this study were tested and summarized as follows:

Table 4.64 Summary Table of Results for Hypothesis Testing

| Research Hypothesis | Test Result |
|---|---|
| $H1_A$: Learning environment is positively correlated with deep learning orientation. | established |
| $H1_B$: Learning environment is negatively correlated with surface learning orientation. | Invalid |
| $H1_C$: Learning environment is positively correlated with student development. | established |
| $H1_D$: Learning environment is positively correlated with engagement. | established |
| $H2_A$: Learning pressure is negatively correlated with deep learning orientation. | Invalid |
| $H2_B$: Learning pressure is positively correlated with surface learning orientation. | established |
| $H2_C$: Learning pressure is negatively correlated with student development. | Invalid |

| Research Hypothesis | Test Result |
|---|---|
| $H2_D$: Learning pressure is positively correlated with engagement. | established |
| H3: Deep learning orientation is positively correlated with student development. | established |
| H4: Surface learning orientation is negatively correlated with student development. | established |
| H5: Engagement is positively correlated with student development. | established |
| H6: Deep learning orientation mediates the relationship between learning environment and student development. | established |
| H7: Deep learning orientation mediates the relationship between learning pressure and student development. | Invalid |
| H8: Surface learning orientation mediates the relationship between learning environment and student development. | Invalid |
| H9: Surface learning orientation mediates the relationship between learning pressure and student development. | established |
| H10: Engagement mediates the relationship between learning environment and student development. | established |
| H11: Engagement mediates the relationship between learning pressure and student development. | established |

## 4.13 Discussion

As mentioned above, this study establishes a structural equation model that takes the learning environment and learning pressure as independent variables, the deep learning orientation, the surface learning orientation and engagement as intermediate variables, and the student development as dependent variables. The hypothesis of this study focuses on two aspects: one is that a better learning environment can reduce students' superficial learning, increase students' deep learning and engagement, and ultimately directly or indirectly affect their personal development. Second, it is assumed that higher learning pressure leads to less deep

learning by students, more surface learning occurs and more engagement is generated, ultimately directly or indirectly affecting their personal development.

The previous analysis of the structural equation model mainly achieved two goals: first, it analyzed the direct influence of the learning environment and learning pressure on the deep and surface learning orientation, engagement and personal development of Chinese university students. The second is to explore the indirect impact of the learning environment and learning pressure on student development through the mediation of deep and surface learning orientation and engagement. The prognosis or consequences of these variables are discussed below in conjunction with the results of previous SEM analyses.

#### 4.13.1 Discuss the Direct Relationship between the Learning Environment and other Variables

Regarding the relationship between the learning environment and other variables, the previous assumption is that the learning environment has a direct positive impact on the deep learning orientation, engagement and student development, and has a negative impact on the surface learning orientation. The results show that:

1) Supporting the positive correlation between the learning environment and deep learning orientation

The results show that better learning environments can facilitate students to adopt more deep learning. This result is consistent with previous research, for example, Biggs (2011) believed that the learning environment has a significant positive effect on deep learning orientation. and provide further evidence of the findings of the et al. Entwistle and Ramsden (2015) and Gozalo et al. (2020) believed that students' perception of a good learning environment will encourage them to adopt deeper learning. The conclusions of others are also supported. Wang et al. (2013) noted that a more constructive learning environment would lead students to reorient their learning and promote the adoption of a deeper learning orientation in their learning.

2) Negative correlation that does not support the relationship between learning environment and student development

The results show that the relationship between the learning environment and surface learning orientation is not significant. This is consistent with the findings of some previous investigators. Specifically, a negative relationship between the learning environment and the surface learning orientation cannot be detected at the individual and population level (Meyer, 1990). Additional support was also provided for the findings of the study Postareff et al. (2018). In fact, the impact on surface learning in the learning environment occurs only at the individual level (Postareff et al., 2018). On the contrary, however, other studies have found that the learning environment has a negative impact on surface learning orientation. For example, Wang et al. (2013) pointed out that a more constructive learning environment will guide students to reorient their learning and significantly promote students to adopt less superficial learning in their learning. In the practice of higher education in China, the main learning method usually displayed by students is the hard back of the memory related to surface learning. This method has been developed for a long time and is less affected by the new environment. This explains from one side that the findings of this study should be reproduced in reality.

3) Positive correlation that supports the relationship between learning environment and engagement

The results show that high-quality learning environments promote greater student engagement. This finding is consistent with previous research that the characteristics of the learning environment do have a significant impact on student engagement in learning (Pascarella, 1985). Specifically, the findings of this study support Furrer and Skinner (2003), Helgeson and Lopez (2010), Kyriakides et al. (2013) and Skaalvik and Federici (2016) previous findings. These researchers found that in learning environments with high-quality learning support and pedagogical practices, students exhibit greater behavioral engagement in academic tasks.

4) Positive correlation that supports the relationship between learning environment and student development

The results show that high-quality learning environments can better influence all aspects of students' development. This finding is consistent with previous research that various characteristics of the learning environment influence students' learning outcomes (Henderson et al., 2000; Nugraemi & Usman, 2019; Tian,

1993). Specifically, this finding supports previous research by Roberts et al. (2008); Wubbels et al. (2014) et al. An important variable that determines student learning outcomes is the learning environment (Roberts et al., 2008; Wubbels et al., 2014). The results are also provided additional support to the research by Prentice and Robinson (2010). By providing high-quality curriculum content and service support for students' learning, the school can promote the development of more knowledge, skills and abilities (Prentice & Robinson, 2010).

### 4.13.2 Discuss the Direct Relationship between Learning Pressure and other Variables

With regard to the direct relationship between learning pressure and other variables, the previous assumption was that learning pressure had a positive impact on surface learning orientation and engagement, and a negative impact on deep learning orientation and student development. The results show that:

1) Negative correlation that does not support the relationship between learning pressure and deep learning orientation

The results suggest that higher levels of learning pressure do not significantly affect students' ability to perform less deep learning. Previously, the relationship between learning pressure and deep learning orientation was controversial. This finding is therefore consistent with some of the previous findings. That is, the relationship between deep learning orientation and perceived stress appears to be contradictory and unclear, although it is positively linked to expected accomplishments (Maria Öhrstedt & Petra Lindfors, 2018). The results also support the research by Lizzio et al. (2002). Lizzio et al. (2002) found that the perceived stress of learning tasks is not systematically related to students' use of deep learning methods. However, Trigueros et al. (2020) recent studies have shown a negative correlation between learning pressure and deep learning orientation. The results show that the influence of learning pressure on deep learning orientation is different.

2) Positive correlation that supports the relationship between learning pressure and surface learning orientation

The results show that higher levels of learning pressure lead students to adopt more superficial learning. This finding is consistent with previous research that

students who experience high levels of stress tend to use more superficial learning in an attempt to accomplish more learning tasks (Roussis & Wells, 2008). Specifically, the results support the study of Biggs (1985); Yuan et al. (2017). Biggs (1985) believed that surface learning orientation is most susceptible to stress reactions. Yuan et al. (2017) pointed out that the greater the learning pressure on students, the easier it is to adopt the thinking strategy of superficial learning. The Lindblom-Ylänne et al. (2019) findings are also supported by evidence. The superficial approach to learning is always closely related to the stress of heavy learning workloads (Lindblom-Ylänne et al., 2019).

3) Positive correlation that supports the relationship between learning pressure and engagement

The results show that higher levels of learning pressure promote greater student engagement. Previous studies have shown that the relationship between the two is either not significantly related, positively related or negatively related. Therefore, the findings of this study respond to the different results previously presented and are consistent with those of some investigators. That is, the more stressful the learning task, the more motivation for students to participate (Uchil, 2017). It also provides support for the research results of Bedard, Lison, Dalle, Cote, and Boutin (2012). Specifically, students need to be under some degree of pressure, and the balance between stress and available resources creates effective energy that motivates students to become more involved in learning (Bédard et al., 2012). In contrast, Molnar et al. (2001) noted that there was no significant correlation between academic effort and stress. Asghar (2014) found that higher learning pressure is related to students' overall mood, passive learning, and non-participatory coping. Combined with the conclusions of this study, the impact of learning pressure on engagement may require more evidence.

4) Negative correlation that supports the relationship between learning pressure and student development

The results show that learning pressure is not a direct factor affecting students' academic performance. Previous studies have shown that the relationship between the two is either not significantly related, positively related or negatively related. Therefore, the findings of this study respond to the different results previously

presented and are consistent with those of some investigators. That is, there is no predictor (perceived pressure and confusion) useful for predicting academic achievement (Smejkalová, 2018). In particular, it supports the conclusions of previous studies conducted by Stoliker and Lafreniere (2015). Learning pressures may actually have an impact on academic achievement, but the impact is manifested differently in different students, resulting in higher or lower academic achievement, with different outcomes (Stoliker & Lafreniere, 2015). Additional support was also provided for the study by Azila-Gbettor et al. (2015). Regardless of the pressure of learning, students can still achieve excellent academic results (Azila-Gbettor et al., 2015). In contrast, Pascoe et al. (2020) believed that the greater the study-related stress, the poorer the learning outcomes, and that the study stress has a negative impact on student development. On the contrary, students with high levels of stress perform better in learning outcomes (Keeley et al., 2008). Combined with the conclusions of this study, the impact of learning pressure on student development may require more evidence.

### 4.13.3 Discuss Deep Learning Orientation

The previous assumptions were deep learning orientation and learning environment, learning pressure, direct relevance to student development, and mediation. As mentioned earlier, the positive correlation between deep learning orientation and the learning environment is supported, and learning pressure is not a predictive variable of deep learning orientation. The following discussion discusses the relationship between deep-seated academic orientation and student development, as well as the role of intermediaries.

1) Positive correlation that supports the relationship between deep learning orientation and student development.

The results show that the more students adopt deep learning, the more they develop in all aspects. This is consistent with the conclusion of previous studies that deep learning has a positive and significant impact on all aspects of student development (Kember et al., 2020). Specifically, it supports the conclusions of Saljo (1984); Hall et al. (2004). These researchers found that students' deep learning improves their exposure to the subject material, improves their analytical and conceptual thinking skills, and has a positive impact on all aspects of students'

development. Additional evidence was provided for the study by Chan and Yeung (2019). Chan and Yeung (2019) found that the degree of deep learning significantly affects the development of students' abilities.

2) Intermediary role that supports the deep learning orientation in the learning environment and student development

The results show that students who perceive a good learning environment will conduct more deep learning, and then deep learning will bring more learning outcomes to students and achieve their own development in all aspects. The results also indicate that the reasons why the learning environment promotes student development should be partly explained by the fact that the learning environment promotes deep learning. The mediating role of the deep learning orientation is consistent with previous research, that is, high-quality learning outcomes are related to the school's establishment of a learning environment that encourages deep learning (Trigwell, 1991). The results further support the study by Lizzio et al. (2002). Lizzio et al. (2002) pointed out that the perception of a good teaching environment affects students' deep learning, and that students use deep learning as a strong predictor of learning quality.

3) Intermediary role that does not support the deep learning orientation in learning pressure and student development

The results show that the deep learning orientation is not an intermediary factor in the development of students under learning pressure. The important reason is that for Chinese university students, study pressure is not a predictor of deep learning orientation. This is consistent with previous research by Maria Öhrstedt and Petra Lindfors (2018) that the relationship between deep learning orientation and perceived stress is unclear, although deep learning orientation is positively correlated with expected accomplishments (Maria Öhrstedt & Petra Lindfors, 2018). On the contrary, Trigueros et al. (2020) pointed out that learning pressure reduces students' deep learning, which in turn negatively affects academic outcomes. This suggests that there is a debate and that the results of this study may inform subsequent studies.

### 4.13.4 Discuss Surface Learning Orientation

Previous assumptions were surface learning orientation and learning environment, learning pressure, direct relevance to student development, and mediation. As mentioned earlier, the positive correlation between surface learning orientation and learning pressure is supported, and the learning environment is not a predictive variable of surface learning orientation. The following discussion discusses the relationship between superficial orientation and student development, as well as the role of intermediaries.

1) Negative correlation that supports the relationship between surface learning orientation and student development

The results show that the introduction of more superficial learning affects the students' own development. This is consistent with previous studies that surface methods are associated with poor-quality learning outcomes (Saljo, 1984; Watkins, 1983). Specifically, it provides support for the findings of Trigwell (1991), Trigwell (1991); Chan and Yeung (2019), These researchers found that surface learning methods prevented students from gaining a deeper understanding of the subject material and from developing their analytical and thinking skills adequately. Postareff et al. (2018) findings are also supported by evidence. Postareff et al. (2018) noted that students who adopt more superficial learning often do not receive higher learning scores and are not able to remember, integrate and communicate various knowledge messages more quickly.

2) Intermediary role that does not support the surface learning orientation in the learning environment and learning development

The results show that surface learning orientation is not an intermediary factor that affects the development of students in the learning environment. The important reason is that the learning environment is not a predictor of surface learning orientation. This is inconsistent with the findings of previous studies, which point out that low-quality learning environments can lead students to adopt more superficial learning, which in turn can negatively affect their own development. Biggs (2011) The same viewpoint is shared by Patrick et al. (2011); Postareff et al. (2018) et al. This suggests that students in Chinese university learning environments have different motivations, strategies, and outcomes. Although the

learning environment is a significant factor influencing student development, superficial learning is not a mediating factor in its impact on learning outcomes.

3) Intermediary role that supports the surface learning orientation in learning pressure and student development

The results show that students who perceive higher learning pressure will adopt more superficial learning, and superficial learning will then affect students' own development. The results of the mediating role suggest that the reasons why learning pressure hinders students' development should be fully explained by the fact that learning pressure causes students to adopt more superficial learning. This is in line with previous research that has shown that stressful perceptions associated with learning tasks can affect students' ability to adopt superficial approaches and reap low-quality learning outcomes (Fransson, 1988). Specifically, it is consistent with the research results of Diseth and Martinsen (2003); Minbashian et al. (2004). In fact, academic pressure does not directly affect learning outcomes, but when academic pressure is high, students are more likely to adopt superficial learning methods, and students using superficial learning methods obtain lower learning outcomes (Diseth & Martinsen, 2003; Minbashian et al., 2004).

### 4.13.5 Discuss Engagement

The previous assumptions were engagement and learning environment, learning pressure, direct relevance to student development, and mediation. As noted earlier, the positive correlation between engagement and the learning environment and learning pressure is supported. The following discussion discusses the relationship between engagement and student development, and the role of intermediaries.

1) Positive correlation that supports the relationship between engagement and student development

The results show that students with higher engagement are more likely to achieve better self-development. This is consistent with previous research that the more students are involved, the more successful they will be at university. The active engagement of students in learning is essential for their own development (Pace, 1984b; Pascarella, 1985). Specifically, it supports the research results of Bowden and

Marton (1998), Sirin and Rogers-Sirin (2004); Karima (2016). The researchers found that active engagement had a significant impact on students' own development, with hard-working students doing better in analyzing thinking, reflection skills, critical thinking and new ideas, while improving their cognitive abilities and reaping emotions. The results also provide evidence for the study by Precourt and Gainor (2019). Precourt and Gainor (2019) pointed out that there is a significant difference in the performance of low-engagement students compared to high-engagement students.

2) Intermediary role that supports the engagement between the learning environment and student development

The results show that students who perceive a good learning environment will have more engagement, and then more engagement will bring more learning outcomes to students and achieve their own development in all aspects. The results also indicate that the reasons why the learning environment promotes student development should be partly explained by the fact that the learning environment promotes student engagement. The mediating role of engagement is consistent with previous research that the characteristics of the learning environment do have a significant impact on the degree of student engagement and ultimately on their personal development (Pascarella, 1985; Pascarella & Terenzini, 2005). Specifically, the results further support the research of (Hyde & Ruth, 2002), (Furrer & Skinner, 2003) and (Helgeson & Lopez, 2010) et al. These studies found that creating good learning support and pedagogical practices can significantly increase student engagement and thus improve student learning. The results also provide evidence for research by Zhang (2021). Zhang (2021) pointed out that a good classroom learning environment promotes the active engagement of students and directly or indirectly affects their learning outcomes.

3) Intermediary role that supports the engagement between learning pressures and student development

The results show that perceived high learning pressure can promote students' greater engagement, and subsequent engagement will bring more learning outcomes to students and achieve their own development in all aspects. The mediating role of engagement suggests that the reason why learning pressure promotes student development should be fully explained as that learning pressure promotes student

engagement. The mediating role of engagement is consistent with previous research that when students face more stressful learning tasks, they will respond with more engagement to overcome difficulties and achieve academic success (Ames & Archer, 1988). The conclusions support the study by Zhang (2018) as well. They found that stress increases an individual's motivation for learning, increases an individual's involvement, and ultimately contributes to the learner's learning achievement. The results also provide additional evidence for the study by Reddy et al. (2018). Reddy et al. (2018) noted that low levels of learning pressure do not necessarily ensure that students will perform better, and that appropriate or higher levels of learning pressure promote greater student engagement and optimal performance.

# CHAPTER 5

# RESEARCH CONCLUSIONS

## 5.1 Summary

In retrospect, the research question of this study is to explore how the personal development of university students in China is affected by the learning environment and study pressure. At the same time, under the influence of these two factors, the engagement and study orientation of university students and how these factors further affect the personal development of students. Specifically, this study aims to explore two aspects: 1. Whether the learning environment is a direct or indirect factor that helps to increase students' deep learning and engagement, as well as reduce superficial learning and enhance students' own development; 2. Whether learning pressure is a direct or indirect factor that causes more surface learning and less deep learning, and promotes greater engagement, and ultimately affects student development.

In order to achieve the research goal, this study established a structural equation model (SEM) with learning environment and learning pressure as independent variables, learning orientation (including deep and surface layers) and engagement as mediating variables, and student development as dependent variables, and proposed research hypotheses. Based on the analysis of the SEM model, it was found that the learning environment, learning pressure, learning orientation, engagement, and student development are variables that interact with each other. Specifically, the study found that the learning environment is an important positive factor that promotes students' deep learning and engagement, and allows students to achieve better personal development. Relatively speaking, learning pressure is not a completely negative factor, it positively increases superficial learning and engagement, but for the development of students, superficial learning is generally a negative factor, and engagement is a positive factor. This study further confirms that

deep learning orientation and engagement are important intermediary factors, which can transmit the beneficial influence of the learning environment on student development. At the same time, engagement plays a full intermediary role, transforming (transmitting) learning pressure into a beneficial effect on student development. Finally, surface learning orientation was also found to be an entirely mediating factor, shifting the negative impact of learning pressure on student development.

Based on the findings of the study, management recommendations will be provided in Section 5.3 below. For the education management department, the school and the teacher level, put forward methods and strategies to promote students' deep learning and increase engagement. At the same time, we will put forward constructive opinions on the top-level design of reform of education and teaching in Chinese universities and measures to increase the burden.

## 5.2 Academic Contributions

This study provides additional evidence for previous student development studies. This study uses the Astin (1984) engagement theory, combined with the Pascarella (1985) comprehensive causal model and Biggs (1987) the"3P" learning process model, to further understand the mechanism of Chinese university students exhibiting a high degree of engagement and more deep learning when perceiving a higher quality learning environment, and obtaining better personal development. This study also found that although surface learning orientation is a negative predictor of student development, it is not an intermediary between the learning environment and student development. It reminds researchers that they need to give more consideration to the precursor of publishing the surface learning orientation. In fact, this study expands and enriches the comprehensive causal model of Pascarella (1985) and the "3P" learning process model of Biggs (1987). The comprehensive causal model of Pascarella (1985) and the "3P" learning process model of Biggs (1987) were originally models with engagement and learning orientation as single mediators respectively. This study not only combines the two mediating factors, but also demonstrates that the learning environment, learning orientation (especially deep

learning orientation) and engagement, as well as the path relationship of student development are effective through the analysis of structural equation model, forming a new student development theory model with two parallel mediating factors.

Similarly, current research provides additional evidence of the impact of learning pressure on student development. This study found both beneficial and unfavorable learning pressures for Chinese university students. Specifically, this study also found that surface learning orientation and engagement are the complete intermediaries between learning pressure and student development, which fills a gap in the research on Chinese university students. These two pathways clearly explain why study pressure has a multifaceted effect on the individual development of Chinese university students. Compared to low-stress students, high-stress students learn more superficially and exhibit lower learning returns, which is an adverse effect of learning pressure. Compared with low-stress learning, students with high learning pressure will show more engagement and high learning returns, which is a beneficial aspect of learning pressure. The study also revealed that learning pressure is not a direct factor influencing student development, which reminds us of the need to explore additional intermediaries between the two to understand how learning pressure affects student returns. Therefore, the results of this study enriched the theory of learning pressure, and this study further confirmed the multifaceted nature of the impact of learning pressure on the development of students. Meanwhile, few previous studies have used learning orientation and engagement as mediating factors to explore the influence of learning pressure on student development. This study explored these two mediating factors and confirmed through mediating analysis that learning pressure, learning orientation (especially surface learning orientation) and engagement, and the path relationship of student development are effective, forming a model about the relationship between learning pressure and student development.

In conclusion, this study, combined with the theory of learning pressure, expands the theoretical model of learning environment-student development of Pascarella (1985); Biggs (1987), and forms a new two-factor theoretical model of "learning environment and learning pressure-student development". Through this model, we can explore the learning environment and perceived learning pressures of Chinese university students, which provides a unique perspective for research

focusing on the cultivation and development of Chinese university students. Especially in the current reality of China's learning environment reform and " increase the burden " causing learning pressure, this study fills the research gap in this regard. Through the modeling and analysis of this study, it can be explained in depth how the effectiveness of the learning environment and learning pressure is shifted to outcomes related to student development, including increased deep learning and engagement, and decreased surface learning.

## 5.3 Practical Contributions

As mentioned above, the reform of the educational and teaching environment of universities and colleges and universities has become the main theme of the daily work of Chinese universities and colleges in order to improve the quality of student training and promote the development of students. This study found that the reform of the educational teaching environment and the creation of a new learning environment and the resulting learning pressure directly or indirectly affect the individual development of students through learning orientation and engagement. Therefore, the findings of this study can make many useful contributions to university management practices. Next, the study discusses relevant contributions in relation to the learning environment and the impact of learning pressure on the outcomes of other variables.

### 5.3.1 Practical Contribution 1: About the Learning Environment

The results of the study show that a good learning environment is, on the whole, a beneficial factor in promoting students' deep learning and engagement, as well as individual development. These findings contribute to university management practices and student self-learning management in several ways:

1) Research has shown that a good learning environment is essential for student development. This finding contributes to the need for educational and teaching reform. Clearly, this finding reflects the importance of a good learning environment. Therefore, in order to create a good learning environment, education and teaching reform should be firmly implemented. Meanwhile, in the top-level design of reform, in addition to putting forward the reform outline requirements, it is

also necessary to design detailed achievement indicators to avoid blind grasping and excessive demands at the university level, so as to achieve the reform goals as soon as possible and achieve a better learning environment.

2) Research has shown that good learning environments, including pedagogical practices, promote deeper learning and engagement among students and ultimately influence their development. This discovery has contributed to the implementation of teaching practices. College administrators are reminded that in the top-level design of university teaching environment reform, as well as in the daily management of the university, the teacher retraining plan should be included in the reform focus, to effectively improve the level of teaching practice of teachers, to change the traditional teacher-centered teaching concept, and to create a learning environment centered on the active engagement of students and autonomous deep learning.

3) Research shows that deep learning orientation has a significant positive effect on student development, while surface learning orientation has a negative impact. This finding has also contributed to the implementation of teaching practices. Remind teachers that in the process of learning, they should provide more self-exploration of learning content and subjective topics. Students need to draw conclusions based on understanding materials to promote students' deep understanding of the content and reduce simple reproduction of ready-made materials and answers.

4) Studies have shown that engagement has a significant positive effect on student development, and therefore the learning environment should encourage greater student engagement. This finding also contributes to the implementation of pedagogical practice, reminding schools or teachers that in the course of pedagogical practice, students' learning engagement should be enhanced through various means. Now a millennial or digital generation, college students have a strong interest in electronic technology and new media information. Therefore, in order to increase student engagement, universities can increase the investment in advanced educational technology equipment such as the majority of media, which should be preceded by the upgrading of teachers' modern educational technology capabilities. At the same time, there is a large number of other studies confirming that

in the learning environment, the way tasks requiring group cooperation are completed can maximize student engagement, which is also a good way to increase student engagement.

5) Studies have shown that deep learning orientation and engagement are generally beneficial factors for students' individual development, while superficial learning is a disadvantage. This brings practical coaching contributions in terms of methods and behaviors to students' self-learning management. Remind students that deep learning should be used as a daily learning method, consciously abandoning superficial learning, and avoiding excessive memorization. At the same time, more energy and effort need to be devoted to integrated learning, including the integration of all aspects of disciplinary knowledge in the learning process, as well as learning to reflect, and more collaborative learning with other students, which will benefit their own development in all its aspects.

### 5.3.2 Practice Contribution 2: About Learning Pressure

In reality, the requirement of "increase the burden" has inevitably caused learning pressure. According to the conclusion of this study, learning pressure has a beneficial and unfavorable side, which mainly brings three aspects of contribution to university management practice:

1) The results of the study show that learning pressure negatively affects the development of students through the full mediation of surface learning. The contribution of this finding is to remind university administrators and teachers of the importance of promoting less superficial learning in teaching practice. In order to reduce the surface learning of students, on the one hand, teachers can provide more self-exploration of learning content and subjective topics, and promote students to draw conclusions based on understanding the materials and learning task requirements, so as to reduce the surface learning of simple reproduction of ready-made materials and answers. On the other hand, students can also be guided to reduce superficial learning through learning assessments. Specifically, students are required to demonstrate learning outcomes in phases or throughout the semester through hands-on exercises, experimental results, live presentations, works and thesis writing.

These requirements can avoid simple plagiarism of superficial learning in advance, as the above assessment methods require students to internalize their knowledge in order to obtain high scores.

2) The research results show that the full intermediary effect of learning pressure through engagement affects the development of students positively.

This discovery mainly contributes to the implementation method of university administrators and teachers in teaching practice. College administrators and teachers should be aware that, while students do not like learning pressures as much, appropriate or high learning pressures can actually be beneficial in promoting their investment in learning. Teachers can increase the complexity and challenge of learning tasks, increase the amount of learning tasks appropriately, and increase the pressure of learning appropriately to promote engagement. Managers can also encourage students to increase their engagement in extracurricular activities such as sports, social services. These activities are also the process of students learning collaborative learning, which can not only modulate the psychological harm that higher learning pressure can cause to students, but also enhance the other benefits of students.

3) Research has shown that two aspects of learning pressure that are detrimental to students' individual development are transmitted mainly by the mediating effect of surface learning orientation and engagement. This makes a guiding contribution to students' self-learning management. Students should understand that in the face of pressure, if they adopt superficial learning as a response, they can only memorize the hard back learning content, which does not allow them to achieve good learning results. Superficial learning can allow them to memorize some content temporarily, but in practice, meaningful understanding of learning materials can obtain long-term memory and generate more knowledge association. At the same time, under pressure from learning tasks, students should first understand that this is the purposeful behaviors and requirements of school administrators and teachers. These behaviors and requirements are to a large extent rationally thought out and supported by educational theories, and should not be handled negatively. For learning tasks, it is beneficial to devote more time and effort to learning by synthesizing knowledge from various disciplines, actively reflecting on the links between

knowledge points, actively collaborating with peers, and assisting each other in understanding learning materials, all of which benefit the development of their own knowledge and abilities.

## 5.4 Research Deficiencies and Future Research Prospects

In addition to the contribution of the study, some deficiencies in the study are then described, while future research prospects are presented based on the deficiencies.

First of all, the data collected in this study are from various universities and do not distinguish between different levels of schooling. However, in fact, the university is divided into the following levels: "985 Project" College, "211 Project" College, Central Ministry College, Provincial College. At these different levels of university, students' learning processes may have different impacts and outcomes. Therefore, caution should be exercised in extending the findings to specific levels of universities. At the same time, the research data does not distinguish between regions. In fact, the development level of higher education in various provinces in China is evenly balanced. College students in different provinces are in different learning environments and learning requirements, and the interaction of various factors in the learning process may differ. As a result, future studies can be conducted on specific levels or universities in different provinces to achieve adaptability of results.

Secondly, the study collected data from university students, including those in grades 1 to 4. The reason for this is based on the following considerations: Chinese universities generally assess university students' learning outcomes on a semester-by-semester basis, with two semesters being a single academic year, which actually indicates a consensus among university administrators that the university's learning environment or other factors affect students' attainment or large or small personal development, whether a student enters the university for a semester, a year, or longer. Therefore, it is appropriate for this study to collect these data. However, considering that students' adaptation to the learning environment may take some time, and that there may be differences in learning pressure for each academic year, in future studies, grades may be considered as a control variable when time is sufficient and the

sample size is large enough to further understand the differences in outcomes between students in different grades.

In addition, all questionnaire data in the study are self-reported by the respondents, which may have a bias in social expectations, which in turn may cause some bias in the study. Social expectation bias refers to the tendency of those who participate in the questionnaire to give answers to social expectations rather than to choose responses that feel real (Grimm, 2010). The learning environment and engagement involved in this study may be sensitive for university students, who may express a more positive response to their own school and an unrealistic expression of their own engagement in learning. Although studies of social expectation biases suggest that such biases may not be as common as previously thought (Krosnick, 1999). However, in future studies, it is recommended, if time permits, to use a social will scale designed to detect and measure deviations in social will. At the same time, mandatory selection programs, interviewer selection and the use of proxy themes, as well as the use of multi-source data, were used to reduce the impact of social expectation bias on the study.

Finally, this study explores the relationship between learning pressure, learning orientation, engagement and student development. In fact, students still have widespread interpersonal and life stress, and these variables need to be further explored in the future. In addition, the study found that learning pressure does not directly affect the development of students. Although this study explored the mediating role of surface learning orientation and engagement, it is clearly not enough. Such as burnout, negative emotions, etc., may find the mediating role of these factors in future studies.

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# APPENDICES

# Appendix A

## Pre-test Questionnaire

## University student' Learning Process Questionnaire

Dear students: Thank you for participating in this survey! The purpose of this questionnaire is to understand your experience in a university in the past year and the factors that influence the learning process. Your answers will help the research to be successfully completed, and the results will help your university understand your real needs, which will further improve your study and living environment. The researcher will strictly abide by the "Statistical Law of the People's Republic of China" and keep the information you fill in confidential. Thanks!

1. Background information

1.1 Gender

A. Male B. Female

1.2 Your subject category

A Philosophy B Economics C Law D Education

E Literature F History G Science H Engineering

I Agriculture J Medicine K Management

L Art M Military

1.3. Grade

A one B two C three D four

2. Learning Environment (two parts, 8 questions in total)

2.1 Learning Support. To what extent is your school doing the following? A total of 3 questions:

(1) Focus on providing support to help you succeed academically

A Very little B Very little C Somewhat

D Very much E Very much

(2) Provide you with learning support (such as tutoring services)

A Very little B Very little C Somewhat

D Very much E Very much

(3) Encourage students from different backgrounds (social background, ethnic background, etc.) to contact each other

A Very little B Very little C Somewhat

D Very much E Very much

2.2 Teaching practice. To what extent does your teacher do the following, total of 5 questions:

(1) Clearly state the learning objectives and learning requirements of the course

A Not at all B Rarely C A little

D A full E do it completely

(2) Reasonable organization and arrangement of teaching content

A Not at all B Rarely C A little

D A full E do it completely

(3) Use cases or diagrams to explain difficulties

A Not at all B Rarely C A little

D A full E do it completely

(4) Provide guidance and feedback as you complete course assignments (such as essays, designs, etc.)

A Not at all B Rarely C A little

D A full E do it completely

(5) Provide immediate feedback on the status of assignments or quizzes

A Not at all B Rarely C A little

D A full E do it completely

3. Learning pressure. Find out about your pressure situation in study, a total of 7 questions:

(1) My teacher is too demanding of my academic performance

A strongly disagree B disagree C generally

D agree E strongly agree

(2) I'm worried about failing the course exams this year

A strongly disagree B disagree C generally

D agree E strongly agree

(3) The teacher has unrealistic expectations of me

A strongly disagree B disagree C generally

D agree E strongly agree

(4) There are too many courses to learn

A strongly disagree B disagree C generally

D agree E strongly agree

(5) I think the amount of homework is too much

A strongly disagree B disagree C generally

D agree E strongly agree

(6) My classmates and I compete fiercely in terms of grades

A strongly disagree B disagree C generally

D agree E strongly agree

(7) Exam questions are often difficult

A strongly disagree B disagree C generally

D agree E strongly agree

4. Learning orientation. Including learning motivation and strategies, to understand your motivation and strategies used in the learning process, a total of 12 questions. During the learning process, your situation is:

(1) I find that sometimes learning gives me a deep sense of personal satisfaction

A Not at all B Very often not C Half of it

D Very often E Exactly

(2) I found that I have to work hard on a learning content, and I will not form my own conclusions until I am satisfied.

A Not at all B Very often not C Half of it

D Very often E Exactly

(3) My goal: to pass the course with as little effort as possible

A Not at all B Very often not C Half of it

D Very often E Exactly

(4) I only seriously study what is taught in class or on the syllabus

A Not at all B Very often not C Half of it

D Very often E Exactly

(5) Almost any learning content, once I get into learning it will be very interesting

A Not at all B Very often not C Half of it

D Very often E Exactly

(6) I find most new learning content to be interesting and often take the extra time to find out more about it

A Not at all B Very often not C Half of it

D Very often E Exactly

(7) I don't find my classes interesting, so I try to do as little homework as possible

A Not at all B Very often not C Half of it

D Very often E Exactly

(8) I learn things by rote, reciting them over and over even if I don’t understand them until I remember them

A Not at all B Very often not C Half of it

D Very often E Exactly

(9) I find that learning content and academic topics can sometimes be as exciting as a good novel or movie

A Not at all B Very often not C Half of it

D Very often E Exactly

(10) I always test myself on important learning content until I fully understand them

A Not at all B Very often not C Half of it

D Very often E Exactly

(11) I can pass most exams by memorizing key sections rather than by understanding the learning content.

A Not at all B Very often not C Half of it

D Very often E Exactly

(12) I usually limit my studies to a specific range because I don’t think it’s necessary to do anything extra

A Not at all B Very often not C Half of it

D Very often E Exactly

5. Engagement. This part understands your Engagement in the learning process, 2 parts, a total of 7 questions.

5.1 Reflection and comprehensive learning (4 questions in total). In your daily study, you will:

(1) When completing assignments, combine different curriculum knowledge and ideas

A Never B Often C Usually D Often E Always

(2) Link your learning to social issues

A Never B Often C Usually D Often E Always

(3) Can comprehensively consider problems from different perspectives in course discussions or assignments

A Never B Often C Usually D Often E Always

(4) Reflect or examine the strengths and weaknesses of your point of view

A Never B Often C Usually D Often E Always

5.2 Collaborative learning (3 questions in total). In your daily study, how often do you study with your peers:

(1) Invite another student to help you understand the course material

A very little B very little C average D a lot

E very much

(2) Explain the course study material to another student or students

A very little B very little C average D a lot

E very much

(3) Collaborate with other students on coursework or assignments

A very little B very little C average D a lot

E very much

6. Student development. Find out how much your college experience has helped you in your personal development in terms of knowledge, skills, emotions, etc. 8 questions in total:

(1) How much did your university study experience help you improve your ability to write well?

A very small B very small C somewhat D very large

E very large

(2) How much did your university study experience help you improve your good oral expression skills?

A very small B very small C somewhat D very large

E very large

(3) How much has your university experience helped you improve your critical and analytical thinking? (Critical and analytical thinking refers to: in-depth analysis and evaluation of the logic and evidence of knowledge or ideas)

A very small B very small C somewhat D very large

E very large

(4) How much did your university study experience help you improve your professional knowledge and skills?

A very small B very small C somewhat D very large

E very large

(5) How much did your university study experience help you improve your ability to work effectively with others?

A very small B very small C somewhat D very large

E very large

(6) How helpful has your university study experience helped you to establish a clear outlook on life and values?

A very small B very small C somewhat D very large

E very large

(7) How much did your university study experience help you to improve your ability to solve complex problems in reality?

A very small B very small C somewhat D very large

E very large

(8) How much did your university study experience help you improve your curiosity and imagination?

A very small B very small C somewhat D very large

E very large

# Appendix B

# Formal Questionnaire

## University student' Learning Process Questionnaire

Dear students: Thank you for participating in this survey! The purpose of this questionnaire is to understand your experience in a university in the past year and the factors that influence the learning process. Your answers will help the research to be successfully completed, and the results will help your university understand your real needs, which will further improve your study and living environment. The researcher will strictly abide by the "Statistical Law of the People's Republic of China" and keep the information you fill in confidential. Thanks!

1. Background information

1.1 Gender

A. Male B. Female

1.2 Your subject category

A Philosophy B Economics C Law D Education

E Literature F History G Science H Engineering I AgricultureJ Medicine K Management L Art M Military

1.3. Grade

A one B two C three D four

2. Learning environment, understand the university learning environment you are in, a total of 5 questions

2.1 Focus on providing support to help you succeed academically

A Very little B Very little C Somewhat D Very much E Very much

2.2 Clearly state the learning objectives and learning requirements of the course

A Not at all B Rarely C Somewhat D Do E Not at all

2.3 Reasonable organization and arrangement of teaching content

A Not at all B Rarely C Somewhat D Do E Not at all

2.4 Use cases or diagrams to explain difficulties

A Not at all B Rarely C Somewhat D Do

E Not at all

2.5 Provide guidance and feedback as you complete course assignments (such as essays, designs, etc.)

A Not at all B Rarely C Somewhat D Do

E Not at all

3. Learning pressure, understand your learning pressure in the process of university study, a total of 4 questions:

3.1 My teacher is too demanding of my academic performance

A strongly disagree B disagree C generally D agree

E strongly agree

3.2 I'm worried about failing this year's course exams

A strongly disagree B disagree C generally D agree

E strongly agree

3.3 The teacher has unrealistic expectations of me

A strongly disagree B disagree C generally D agree

E strongly agree

3.4 There are too many courses to learn

A strongly disagree B disagree C generally D agree

E strongly agree

4. Learning orientation. Find out about your deep or superficial motivations and strategies in the learning process, a total of 9 questions. During the learning process, your situation is:

4.1 I find that sometimes learning gives me a deep sense of personal satisfaction

A Not at all B Very often not C Half of it D Very often

E Exactly

4.2 I found that I have to work hard on a learning content, and I will not form my own conclusions until I am satisfied.

A Not at all B Very often not C Half of it D Very often

E Exactly

4.3 Almost any learning content, once I get into learning it will be very interesting

A Not at all B Very often not C Half of it D Very often

E Exactly

4.4 I find most new learning content to be interesting and often take extra time to find out more about it

A Not at all B Very often not C Half of it D Very often

E Exactly

4.5 For important learning content, I always test myself until I fully understand it

A Not at all B Very often not C Half of it D Very often

E Exactly

4.6 My goal: to pass the course with as little effort as possible

A Not at all B Very often not C Half of it D Very often

E Exactly

4.7 I only seriously study what is taught in class or on the syllabus

A Not at all B Very often not C Half of it D Very often

E Exactly

4.8 I don't find my classes interesting, so I try to do as little homework as possible

A Not at all B Very often not C Half of it D Very often

E Exactly

4.9 I learn something by rote, even if I don't understand it, recite it over and over again until I remember it.

A Not at all B Very often not C Half of it D Very often

E Exactly

5. Participation. This section understands your engagement in the learning process and consists of 4 questions.

5.1 When completing assignments, combine different curriculum knowledge and ideas

A Never B Often C Usually D Often

E Always

5.2 Be able to comprehensively consider problems from different perspectives in course discussions or assignments

A Never B Often C Usually D Often

E Always

5.3 Reflect or examine the strengths and weaknesses of your point of view

A Never B Often C Usually D Often

E Always

5.4 Collaborate with other students on coursework or assignments

A very little B very little C average D a lot

E very much

6. Student development. Find out about your personal gains from your university studies, with 5 questions:

6.1 How much did your university study experience help you improve your ability to write well?

A very small B very small C somewhat D very large

E very large

6.2 How much did your university study experience help you to improve your good oral expression skills?

A very small B very small C somewhat D very large

E very large

6.3 How much has your university experience helped you improve your critical and analytical thinking? (Critical and analytical thinking refers to: in-depth analysis and evaluation of the logic and evidence of knowledge or ideas)

A very small B very small C somewhat D very large

E very large

6.4 How much did your university study experience help you improve your professional knowledge and skills?

A very small B very small C somewhat D very large

E very large

6.5 How much did your university study experience help you improve your ability to work effectively with others?

A very small B very small C somewhat D very large E very large

# BIOGRAPHY

| | |
|---|---|
| **Name-Surname** | Mr.Jianye Su |
| **Academic Background** | Obtained a bachelor's degree,<br>Guangxi Normal University in 1999<br>Obtained a master's degree,<br>Capital Normal University of China in 2007 |
| **Experience** | 2003 - present, Work in Yulin Normal University, Guangxi, China.<br><br>Support or participate in 5 scientific research projects.<br>Published 6 papers in the journals above provincial level. |