INFLUENCE OF CHINESE COLLEGE STUDENTS' PERCEIVED TEACHER AUTONOMY SUPPORT ON ENGAGEMENT: MEDIATING EFFECT OF LEARNING MOTIVATION AND MODERATING EFFECT OF CLASS CLIMATE

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CHEN HAN

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Researcher Chen HAN

Program Doctor of Philosophy (Education Management)

Principle Supervisor Dr. Jian-Hao Huang

Co-Supervisor

Has been approved by

..... Chairman of the Committee

(Dr. Poschanan Niramitchainont)

..... Committee Examiner

(Asst. Prof. Dr. Peng-Fei Chen)

..... Committee Examiner

(Asst. Prof. Dr. Yuan-Cheng Chang)

..... Committee Examiner

(Dr. Kuan-Chun Tsai)

..... Principal Supervisor

(Dr. Jian-Hao Huang)

Approved by the DPU China-ASEAN International College

..... Dean of China-ASEAN International College

(Assist. Prof. Dr. Chun-Shuo Chen)

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Influence of Chinese College Students' Perceived Teacher Autonomy Support on Engagement: Mediating Effect of Learning Motivation and Moderating Effect of Class Climate

Author: *Chen HAN*

Dissertation Principal Supervisor: *Dr. Jian-Hao HUANG*

Dissertation Supervisor: *N/A*

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ABSTRACT

The purpose of this study was to determine the impact of college students' perceived teacher autonomy support (PAS), learning motivation (LM) and class climate (CC) on their engagement, as well as the mediating effect of LM and the moderating effect of the CC by means of a questionnaire survey. Convenience sampling was used to select 1517 college students in Chinese universities as a valid sample. The results show that PAS has a significant positive impact on students engagement (SE; $B = 0.956$); LM has a partial mediating effect between college students' PAS and SE (mediation effect is 0.072); CC has a moderating effect on college students' PAS and LM ($B = 1.919$). Specifically, the CC will enhance the impact of PAS on college students' LM.

The results of present study are expected to expose valuable comprehension into the mechanism of PAS on the engagement of Chinese college students, and it is suggest that higher education institutions should pay attention to training teaching methods based on teacher's autonomous support, encourage teachers to implement humanised teaching, maintain a harmonious relationship between college teachers and their students, as well as culturing fairness in the classroom, and also increase the psychological related training and number of related lectures on college students' LM. In other words, this study's findings suggested that college teachers should provide their students with more autonomous support, cultivate their self-determination motivation, and create a cohesive, fair CC with good teacher-student relationships and student-student relationships in order to improve engagement among college student.

Keywords: Perceived Teacher Autonomy; Learning Motivation; Class climate; Student Engagement

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Dhurakij Pundit University

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CHAPTER 1

INTRODUCTION

This study aims to introduce the relationship and importance of perceived teacher autonomy support (PAS), learning motivation (LM), class climate (CC), student engagement (SE). Therefore, this chapter will gradually introduce the research background, research significance, research purpose, research questions and definition of terms in order.

1.1 Research Background

SE is regarded as a key factor of learning and academic success (Fredricks et al., 2016). Students' internal construction of knowledge requires an external performance of great ability and engagement. It is only when students are involved in their own learning that they can produce a good performance and achieve the desired outcome (Einolander et al., 2021; Yin, 2018). The United States uses the National Survey of SE (NSSE) to demonstrate the level of College Students' SE and evaluate the quality of University Teaching (Kuh, 2009). SE has been the focus of academia in China since the end of the 20th century (Wang & Wang, 2021), For example, Shi et al. (2011) undertook a China's NSSE in 2007 and improved its localisation to Tsinghua University based on China's national conditions by launching the "NSSE-China" project. Shi and Wang (2015) began to investigate the learning situation of Chinese college students in

2011, and pointed out that there were small differences in colleges, majors and grades, and found that the college characteristics, students' individual

characteristics and the family background have a significant impact on their learning status. Wang (2013) further pointed out that the overall status of SE is good among college students, while Ma and Wang (2020) showed that the current situation of research on SE has excelled the understanding of the behaviour itself, but turned to the use of social and cultural constructivism to study the causes and consequences of the social psychological process of students' engagement. Other scholars have proposed that three factors influence the engagement of students in Chinese colleges, namely, interpersonal communication on campus, the second classroom (participating in school activities), and high school experience (Long & Ni, 2020). Guo et al. (2021) included the environment, self-concept, SE and learning outcomes in a model for an investigation, and discussed the relationship between these variables. In addition, Wang and Wang (2021) also pointed out that research on SE in China is still based on the application of existing concepts and tools to investigate their learning status, while there are theories based on Chinese culture and the school education environment. In short, present study is focused on the process of students' psychological condition and learning process in classroom teaching with an exploration of the complex relationship between Chinese college students' PAS, LM, CC and SE to propose a moderated mediating model as a contribution to empirical research in China.

Furthermore, Fredricks et al. (2004)'s research findings SE is not only a learning behaviour, but also an emotional and cognitive component, which they found

to be an ideal research variable (Fredricks et al., 2004). Several researchers have indicated that students' engagement had a significant positive effect on their outcomes of learning (Bergdahl et al., 2020; Yin, 2018). Hence, it is evident that SE not only reflects students' learning process, but also predicts their learning outcomes, and is also one of the important indicators of the quality of education.

Self-determination theory (SDT) can explain the relationship between variables. Specifically, autonomy is one of the three innate needs proposed by SDT (Ryan & Deci, 2000). It is a psychological need, and its satisfaction is crucial to the best development of all individuals. Because, individuals exhibit varying degrees of motivational behaviour, depending on whether they are autonomous or controlled (Black & Deci, 2000). However, teachers' influence has been found to play a very important role in supporting students' autonomy in the classroom (Reeve & Cheon, 2021; Zhou et al., 2009). Black and Deci (2000) investigated the relationships among college students' PAS, autonomous motivation, and academic achievement. Previous studies have shown that PAS had a significant effect on SE (Fredricks et al., 2019; Reeve & Cheon, 2021). Therefore, college students' PAS may be an important factor in their engagement.

The process of motivation-driven behaviour can be well understood and explained by the SDT (Burkley & Burkley, 2018). Therefore, whether students are sufficiently engaged in the learning process largely depends on their motivation to learn. Guthrie et al. (2013) found that a high degree of LM can promote SE and academic performance, and, since many researchers have shown that the motivation to learn has a significant effect on students' engagement in class (Black & Deci, 2000; Fredricks et

al., 2017; Wang & Eccles, 2013), it is evident that LM could be an important predictor of SE.

In addition, according to the basic concept of SDT, students' level of motivation in learning process can be high when their basic psychological needs were filled with satisfaction in the classroom (Bureau et al., 2022; Deci & Ryan, 2000). Previous studies have shown that PAS has a significant influence on the satisfaction of the need for motivation (Fredricks et al. 2019; Zhou et al., 2009). Other researchers have also shown that college students' PAS has a significant impact on their LM and SE (Patall et al., 2018; Ryan & Patrick, 2001). In short, students' perception of the teacher's support of their autonomy has an important impact on their motivation to learn.

In summary, it is evident from the foregoing discussion that PAS has an important effect on students' LM and engagement, and students' LM has an important impact on their engagement in class. This implies that LM may be an important mediating variable. Burkley and Burkley (2018) propose that intrinsic motivation mediates need satisfaction and positive outcomes. Other researchers have come to the same conclusion that LM plays an impressive mediating role between students' PAS and SE (Benita et al., 2021; Yoo, 2015; Zhu & Burrow, 2022). In short, LM may have a mediating effect between PAS and SE.

A class is a small-scale social group composed of teachers and dozens of students with an ordered and organisational structure. Its unique characteristics can be called a CC, which affects the class members' attitude and behaviour (James & Jones, 1974). Researchers have shown that the classroom climate is positively correlated with

social competence, motivation and participation, and academic achievement (Escalante et al., 2020; Gutiérrez, & Tomás, 2018; Patrick et al., 2011; Wang, Degol et al., 2020). Suyatno et al. (2019) showed that a positive and significant impact between the classroom climate and student attitude from junior high schools. Jafari and Asgari (2020) found that classroom climate has a impact on College Students' teacher-student interaction, motivation in learning and academic achievements. Fredricks et al. (2019) showed that a positive teacher-student relationship is beneficial for the development of students with a low level of learning engagement. Researchers have shown that a positive CC can enhance the teacher-student relationship and improve students' academic performance (Buyse et al., 2008). Moreover, previous researchers, Buyse et al. (2008) and Gazelle (2006) demonstrated the moderating effect of the CC. Therefore, when college students PAS, the CC may be an important moderating variable, and different CCs will produce students with different levels of LM and engagement.

In summary, college students' PAS, LM, and CC have been shown to have an important impact on SE. Therefore, this study takes college students as the research participant to explore the influence of PAS on their SE, and further explore the mediating effect of LM between college students' PAS and SE, as well as the moderating effect of the CC.

1.2 Research Significance

1.2.1 Theoretical Significance

Although the relationship between two variables has currently been widely studied in terms of college students' PAS, SE, LM, and CC. but, it is relatively rare to

combine these four factors. In recent years, some researchers have shown that teacher's autonomy support improves SE (Black & Deci, 2000; Ma, 2021; Zhao & Qin, 2021), while others have demonstrated that college students' PAS is related to a higher level of LM (Black & Deci, 2000; Maldonado et al., 2019; Vansteenkiste, 2012). According to Fredricks et al. (2017), both teachers' support and LM have a significant impact on SE. When investigating the effect of LM, Yoo (2015) found that it mediated PAS and SE. In addition, some researchers have shown that the CC has an impact on students' LM and follow-up behaviour (Wang, Degol et al., 2020; Wang, Lee et al., 2020) Hence, it is meaningful to integrate the above four variables into one research model. Most of the existing studies have been focused on adolescents and children, but few have involved college students (Alansari & Rubie-Davies, 2020). Therefore, college students are taken as the research participants in this empirical study to fill the gap the gap in the literature. In short, the path analysis of SE and related factors can support the theoretical development of students' self-determination and act as a reference for subsequent scholars to study college students' engagement. In addition, explore the relationship between relevant variables and verify their influence mechanism, which effectively makes up for the lack of clear influencing factors and uncertain influencing path in the current research.

1.2.2 Practical Significance

Students' achievement, ability, satisfaction and school development are closely related to SE (Einolander, 2021; Ryan & Deci, 2020). Therefore, SE is a key factor. present study is focuses on the in classroom learning process of college students,

which will be beneficial to students, teachers, universities and society (Maldonado et al., 2019; Reeve & Cheon, 2021). We hope to improve the quality of education through the reform of classroom teaching process and methods and the improvement of learning psychology. Therefore, the research results can provide theoretical support for colleges in teaching and management; It can also put forward useful suggestions for teachers' classroom teaching practice, especially for the improvement of teachers' teaching methods and the effective maintenance of CC (Fredricks et al., 2019; Reeve & Cheon, 2021; Escalante et al., 2020; Yin, 2018); On the other hand, it also guides managers and teachers to pay attention to college students' LM, so as to enhance college students' engagement (Ryan & Deci, 2020); Finally, according to the research results, we can put forward suggestions to improve college students' engagement and guide students to better in learning and motivation. Therefore, this study will be conducive to the improvement of school teaching quality, the development of teachers and the SE and mental health of college students.

1.3 Research Purpose

This study is based on the basic principles of SDT, and involves a discussion of the current situation and characteristics of Chinese college students' PAS, LM, CC, and students' engagement in classroom. In studying the relationship between PAS and college students' SE, the mechanism of various variables was explored by using LM as an intermediary variable and CC as a moderating one, which enabled some suggestions to be made to improve students' engagement. Therefore, the main research objectives were as follows:

A. To explore the different impacts of background variables (gender, grade, major, family location, class representative and university category) on college students' PAS, LM, CC, and SE.

B. To explore the effect of college students' PAS on SE.

C. To explore the mediating effect of LM on college students' PAS and SE.

D. To explore the moderating effect of CC on college students' PAS and LM.

1.4 Research Questions

Based on the above background and purpose, current research's aim is to reveal the relationship between Chinese college students' PAS, LM, CC and SE. Therefore, the main questions of present research are as follows:

A. What are the different effects of background variables (gender, grade, major, family location, class representative and university category) on Chinese college students' PAS, LM, CC, and SE?

B. Does college students' PAS have an impact on SE?

C. Does LM play a mediating role on college students' PAS and SE?

D. Does the CC play a moderating role on college students' PAS and LM?

1.5 Definition of Terms

Teachers' autonomous support means that teachers promote the classroom

teaching process by supporting students' autonomous motivation rather than controlling behavior (Jang et al., 2010; Ryan & Deci, 2020). PAS refers to students' evaluation of their perceived degree of autonomy support from their teachers for the perspective of independent individuals (Jang et al., 2010). This means that teachers' autonomous support in the classroom is to promote students' personal autonomy from the perspective of students, respond to students' psychological needs, interests and preferences, provide student the best opportunities for challenge, and make students focus on meaningful learning goals, as well as students can show interesting and closely related classroom activities (Ryan & Deci, 2020). This study use PAS to measure college students' perception of their teachers' classroom behaviour. The Autonomy Enhancement Scale (AES) developed by Assor et al. (2002) was applied to measure the degree of PAS by college students in the process of classroom learning. The AES scale can measure the three aspects shown in the autonomous supporting classroom (Assor et al., 2002): First, provide students with opportunities to choose, pay attention to students' interest needs, and be able to conduct in-depth teaching and learning according to the knowledge points that students are interested in; Second, establish the connection between knowledge points and real life, focus on students' understanding, and explain the reasons for students to learn some knowledge; Third, allow students to put forward different views and encourage independent thinking, so that students have enough time to actively think in classroom, rather than passively accept knowledge. The higher the score, the higher level of PAS is considered to be.

SE refers to the quality of students' own effort and engagement in the learning environment and activities (Fredricks et al., 2004). Current scholars conduct research from the following three aspects (Zeng, 2015): First, take the length of

effective learning as the research. It focuses on the length of time students participate in various learning activities, including the time allocated in the curriculum plan, the time teachers teaching, and the time students complete after-school homework. Second, social psychological research of multidimensional characteristics. It conducts quantitative research on the characteristics of behavior, emotion and cognitive dimensions from the perspective of psychology, and takes the classroom environment, LM, engagement, outcome and other elements as the research framework to explore the relationship and influence effect between these elements. Third, the study of social ecology from the perspective of system interaction. It extends the application scope of learning input from classroom situation and school environment to family environment or other institutions outside school, especially emphasizes the core position of social and cultural elements and discusses the dynamic interaction of various elements in the system (Zeng, 2015). This study is measured by students' engagement during learning activities scale compiled by Reeve and Tseng (2011), which is composed of behavioural engagement, emotional engagement, cognitive engagement (Fredricks et al., 2004), and agentic engagement (Reeve and Tseng, 2011; Wang et al., 2016). It can measure the degree of participation of college students from their real experience in the classroom (Reeve & Tseng, 2011).

According to proponents of the SDT, there is a motivational continuum based on the degree of person's self-determination, and divides the motivation into three types that from intrinsic to amotivation (Ryan & Deci, 2000a). This study measure the quality of college students' LM, and define it as the proportion of intrinsic motivation components in all motivation components, which is expressed by self-determination Index (SDI; Black & Deci 2000; Vallerand & Blssonnette, 1992). The Academic

Motivation Scale (AMS) developed by Vallerand et al. (1992) for college students was applied to measure the college students' LM. The scale measures three types motivation of intrinsic, extrinsic motivation, and amotivation, and its total score can be recorded as SDI (Ryan & Deci, 2020), which the higher the score, the more intrinsic the participant's motivation is considered to be (Black & Deci 2000; Vallerand & Blssonnette, 1992; Vallerand, 1997).

The CC reflects the collective psychological environment and atmosphere shared by class members. It is formed by class members of a common age, with common activities, interests, time and friendship through frequent interaction, which has an impact on PAS and LM (Vallerand et al., 1997), and then affects students' growth and development (Reeve & Cheon, 2021). In this study, the College and University Classroom Environment Inventory (CUCEI) developed by Fraser and Treagus (1986) and Modified by Nair and Fisher (1999, 2001) was applied to measure the CC of the Chinese college students. The Modified CUCEI could assesses college students' perception of seven psychosocial dimensions of the actual classroom environment, such as Personalisation, Cooperation, Student Cohesiveness, Equity, Task Orientation, Innovation, Individualisation (Nair & Fisher, 1999, 2001), which the higher the score, the better CC is considered to be.

CHAPTER 2

LITERATURE REVIEW

2.1 Self-Determination Theory (SDT)

The term "self-determination" refers to those who are driven by their intrinsic motivation (Burkley & Burkley, 2018) and Ryan and Deci (2000a) led to the proposal of the SDT. According to the SDT, human beings are essentially curious, self-motivated and full of vitality. At their best, people are full of energy and inspiration. They tend to study hard to improve themselves, master new skills, and use their talents in a trustworthy way (Ryan & Deci, 2000a).

Ryan and Deci (2020) initially focused on the kind of environment and conditions that can stimulate (or damage) people's intrinsic motivation. The basic physiological needs for human survival are air to breath, food to eat, water to drink, and sleep for the renewal of energy, which the state has the duty to provide for its citizens (Burkley & Burkley, 2018). On the other hand, humans have abundant unique psychological needs, which, although not necessary for survival, are extremely important for mental health, personal growth, an enriching life and happiness (Burkley & Burkley, 2018). However, the basic psychological needs include three components, namely by Ryan and Deci (2000a), autonomy, competence and relatedness. In the classroom context, behaviour that satisfies students' need for autonomy is mainly recognised as teachers' autonomy support. The term ‘college students' perceived

teacher's autonomy support' is employed in current study to

measure Chinese college students' perception of their teachers' classroom behaviour, such as teacher providing appropriate choices to student, fostering students' understanding and their interesting, teacher allow student to criticism and encouraging their independent thinking in the classroom.

Proponents of the SDT point out that if students' basic psychological needs is the satisfied, so that can drives their behaviour (Ryan & Deci, 2000b). Specifically in the classroom context, the satisfaction of the need for autonomy depends on college students' PAS, and students' engagement in class is their corresponding behaviour. Some researchers have shown that college students' PAS has a significant influence on SE (Jang et al., 2010; Ma, 2021; Zhao & Qin, 2021).

Ryan and Deci (2000b) claim that the behaviour exhibited by individuals is usually regulated by psychological processes. In other words, students with a high level of LM will engage more positively in activities (Ryan & Deci, 2000a). LM is the key to successful education. According to Deci and Ryan (2000)'s SDT, students will have a high level of LM when their basic psychological needs are satisfied in the learning process of the classroom. In other words, college students' PAS improves students' intrinsic motivation to learn and, since meaningful choices in learning generate learning intention, it encourages students to fully recognise what they are doing and draw them into activities. Therefore, according to the SDT, college students' PAS is beneficial for fostering students' intrinsic motivational resources, which, in turn, drives their learning behaviour (Ryan & Deci, 2000a).

The CC is the embodiment of the social context of a classroom. Ryan & Deci (2000a) observe that a good social environment is one of the key factors to optimise individuals' development, performance and well-being. Therefore, research of the relationship between the social environment (CC) and subsequent factors can help to explain the causes of student's behaviour and optimise their development, which has theoretical and practical significance. As one of the environmental factors, the CC involves the teacher-student relationship, classmates' relationship, students' development, classroom order, and the maintenance of discipline, etc. According to the SDT, the need for relatedness is associated with the teacher-student relationship, classmate relationship, classroom order, and maintenance of discipline in the CC. The need for competence is related to students' development. If the CC supports the satisfaction of basic psychological needs, it will promote students' LM and learning behaviour.

Therefore, the SDT is applied to the learning process in classroom in this study to explore the impact of college students' PAS on their LM, and to further explore the mediating effect of LM between college students' PAS and SE, as well as the moderating effect of the CC between college students' PAS and SE. This is expected to provide theoretical support for students' beneficial learning behaviour.

2.2 Student Engagement

In recent studies, SE is defined by Kuh (2009) as the quality of student effort and their participation in lavished learning activities. The National Survey of Student Engagement (NSSE) in the United States, which aimed to investigate and weigh the

degree of SE in various learning activities to determine the effectiveness of the investigation, self-diagnosis, and the evaluation of US colleges showed that the more of students can forwardly participated in the various learning activities, the greater was their gain (Kuh, 2009). The NSSE was modified and improved for use as the basis of an Australasian Survey of SE (AUSSE), which was focused on students' learning activities, and surveyed students' learning experience at school. It also examined students' activities and the conditions related to participation in learning, including the commitment of time and energy (Coates, 2009).

Some researchers have studied SE from the perspective of a psychological experience (Fredricks et al., 2016; Reeve, 2013; Wang et al., 2016). Schaufeli (2002) proposed that SE referred to a positive and satisfied station of mental that related to learning. Her proposal was including three dimensions for SE, namely, vitality, dedication and concentration. A SE scale based on the Utrecht Work Engagement Scale-Student (UWES-SS) was developed that Netherlands college students as samples (Schaufeli, 2002). Fredricks et al. (2004) propose that SE refers to the participation quality that present by student in the learning environment and learning activities. It is conceptualised as consisting of at least three different, but interrelated, dimensions, namely, behavioural engagement, emotional engagement, and cognitive engagement. Behavioural engagement means the activity that students' participation, and includes psychological investment in leaning activities in classroom or after-school activities. Emotional engagement refers to students' attitudes, interests and values, including their responses to teachers, classmates, studies, and school. Cognitive engagement means the in deep-thinking of investment. It points to motivational goals and active learning, including thought processes, willingness to overcome difficulties, and degree of effort.

In addition, researchers have declared the addition a fourth dimension in the scope of SE, namely agentic (social) engagement (Reeve & Tseng, 2011; Reeve 2013; Wang et al., 2016). This dimension is defined as the quality of social interaction and social participation in classroom tasks, which including students' actively questioning, share opinions and take a communicated action with each other. Reeve & Tseng (2011) describe agentic engagement is a distinctive aspect of SE, which has a better explanation (R2 = .24). And this is an improvement on Fredricks et al. (2004)'s three-dimensional model.

In summary, SE is defined in this study as the degree and quality of college students' learning behaviour, emotion, cognition and social interaction. The four-dimensional concept and questionnaire improved by Reeve & Tseng (2011) is adopted because it is more a comprehensive measure of SE after adding the agentic (social) dimension.

2.3 College Students' PAS

Autonomy is one of the basic human needs, which constitutes the desire for freedom, personal control, and free choice, and it is also one of the three core human needs that promote behaviour (Burkley & Burkley, 2018). Students' perception of teachers' support for their autonomy is often associated with intrinsic motivation, greater interest, cognitive flexibility, a more positive emotion, and greater behavioural expression (Deci & Ryan, 1987). Many studies have shown that PAS has a wide range of positive effects on LM, SE and other factors (Li et al., 2020; Ma, 2021; Maldonado et al., 2019; Reeve & Cheon, 2021).

However, autonomy support in the classroom is mainly provided by teachers and it involves the creation of classroom conditions that enable students to feel free to ask questions, express their opinions, and pursue their interests (Fredricks et al., 2019; Reeve 2013; Wang et al., 2016). Deci and Ryan (1987) define teachers' autonomy support as teachers' show of respect for students, allowing them to express their opinions and actions freely and encouraging them to deal with, accept and value their inner state, affection and expectations. Assor et al. (2002) found that students seem to distinguish between good and bad teachers based on whether they support their need for autonomy in learning activities. They also pointed out that fostering understanding and interest and suppressing criticism of students' need for autonomy has a particularly important impact on SE. Reeve and Cheon (2021) review that there are eight aspects of teacher autonomy support behaviour, namely, listening to students, allowing students to do things their way, supporting students' discussion, praising information feedback, providing encouragement, providing tips, responding to students' questions and delivering statements of opinion adoption.

Therefore, this study is based on measuring the degree of Chinese college students' PAS from the students' perspective. This involves their perception of teachers' classroom behaviour in terms of teacher providing student choices, take student more understanding and culture interest, allowing student express criticism and encouraging their thinking in more independently (Assor et al., 2002). Because the Assor et al. (2002) 's scale is a more comprehensive scale of college students' PAS; therefore, the Autonomy Enhancement Scale (AES) is used to measure the above three dimensions of college students' PAS in this study.

2.4 Learning Motivation

In contrast to controlled motivation, autonomous motivation refers to individuals freely choosing to engage in a certain behaviour (Ryan & Deci, 2000a). The SDT can be used to identify different types of motivation, explain how each type is developed and maintained, and its effect on students' learning process, academic outcomes, experience in classroom and their well-being (Ryan & Deci, 2000a).

The SDT divided motivation into three types based on continuity,that is intrinsic motivation, extrinsic motivation and amotivation. The closer to the end of intrinsic motivation, the more autonomous behaviour is reflected, and the closer to the end of extrinsic motivation, the more non-autonomous behaviour is reflected. While intrinsic motivation only includes intrinsic regulation, extrinsic motivation includes four kinds of regulation, namely, integrated regulation, identified regulation, introjected regulation and external regulation, and amotivation only includes non-regulation (Deci & Ryan, 2000; Ryan & Deci, 2020). Intrinsic motivation means that people undertake an activity on a voluntary basis. In other words, intrinsic motivation behaviour is the prototype behaviour of SDT. On another side, driven by extrinsic motivation, individuals' behaviour is defined as being for an external reason, which is regarded as a means to achieve another purpose (Burkley & Burkley, 2018). Amotivation means that the individuals in question do not know the relationship between their behaviour and its results, has no interest in the behavioural activities undertaken, and have no external or internal driving force to ensure that their activities follow the normal procedure (Ryan & Deci, 2020).

These motivational types are associated with humans' basic need for autonomy, competence and relatedness (Deci & Ryan, 2020). At the context of the classroom, the intrinsic motivation of learning is associated with autonomy, competence, and relatedness, while extrinsic motivation is related to other goals, such as good grades and a good image consistent with those of others (Burkley & Burkley, 2018).

At present, more scholars use the concept of SDI to integrate the above types of motivation factors into a single score (Grouzet et al., 2004; Kusurkar et al., 2013; Ryan & Deci, 2020; Stolk, 2018). SDI can calculate the overall / summary scores of motivation, which can reflect the distribution of automatic and controlled motivation (Ryan & Deci, 2020), and can also better generate profiles of motivation in people-centered research (Wang et al., 2017). The higher SDI can predict changes in key educational outcomes (Ryan & Deci, 2020).

Therefore, the LM in this study refers to the autonomous motivation spontaneously generated by college students themselves in the classroom that points to learning activities. It originates from college students' PAS, including a series of variation from intrinsic to extrinsic motivation (Deci & Ryan, 2000). Vallerand et al. (1992) developed a scale that provided for college students, and the scales total score can be calculated as a self-determination index (SDI). The higher the score of SDI is, the higher is the level of intrinsic motivation (Black & Deci 2000; Vallerand & Blssonnette, 1992; Vallerand, 1997). Therefore, Vallerand et al. (1992)'s AMS is used to measure the LM of the Chinese college students in this study.

2.5 Class Climate

From the beginning, the climate has been used as a general concept to describe the quality of life of an organisation as an ongoing process. An organisational climate is usually defined as "those characteristics that distinguish the organisation from other organisations and that influence the behaviour of people in the organisations". Some researchers believe that the climate is a collective perception of the environmental characteristics of people living and working in a certain environment, and this perception has an impact on people's behaviour, and they emphasise that a climate is a kind of "individuals' common recognition of their collective" (Litwin & Stringer, 1968; James & Jones, 1974). Other researcher emphasise that the CC is the product of individuals' personal perception and the perception of the environment by personal consciousness (Epstein, 2012; Reeve & Cheon, 2021). Walberg and Moos started their research in two respective universities (Fraser, 2012) .The Learning Environment Inventory (LEI) in a research project named Harvard Project physical at Harvard University, while Moos undertook human-environmental research in the social environment laboratory of Stanford University (Fraser, 2012). These two types of research are very close in direction and characteristics. They both regard the classroom environment as the perception of teachers and students, rather than some kind of "objective" description or measurement, and they both attach importance to the psychological influence of the environment on the people in it, such as work efficiency, learning efficiency, etc. (Fraser, 1986, 2012).

Class is a collective whose members share the same age, activities, interests, time and friendship, and the class members interact frequently, receive support from

individuals and groups, and give support to others (Epstein, 2012; Reeve & Cheon, 2021). Since the classroom is the main place for activities when students are growing up, they spend most of their time at school. Therefore, the CC is a special feature that is unique to each class collective. The CC reflects the common collective environment and climate shared by all the students in the class, which has an important impact on their growth and development. The CC is affected by many factors, such as teachers, students, teaching management regulations, etc. (Reeve & Cheon, 2021).

The current concepts similar to the CC are school climate, classroom climate, learning environment, and so on. The environment of student learning contains some physical environment's components, and the CC specifically refers to the social and psychological components of the environment. The study of the classroom climate has two levels, the first of which is the school climate. This is a relatively durable school environmental characteristic experienced by members, which affects members' behaviour and is based on the members' collective behavioural perception. It is a behavioural concept shared by school members, rather than beliefs or values. The school climate can be regarded as the school's personality and a series of its internal characteristics. The school climate has a huge impact on its organisational behaviour, and an important and positive influence on the school itself (Hoy & Miskel, 2005). The second level is the CC or classroom climate. The classroom environment can be divided into a physical environment and a socio-psychological environment. However, the classroom climate refers to the "socio-psychological context" in the classroom (Fraser, 1998). Most scholars perceive that CC, classroom climate, and classroom psychosocial environment are synonyms.

The class is the basic unit of management and teaching activities in China and students spend most of their time there. The class is the most direct environment for them and the school exerts its influence through the class. In addition, the CC is more independent than the school climate. Therefore, in this study, the CC means the common understanding of college students that in the classroom. Since the College and University Classroom Environment Inventory (CUCEI; Fraser et al., 1986) is a scale that was especially developed for college students, it has been integrated in previous studies of CC. The contents of the modified scale by Nair and Fisher (1999, 2001) are quite comprehensive and include seven dimensions: that from Personalisation to Equity (Alansari & Rubie-Davies, 2020; Fraser et al., 1986; Fraser, 1998). Therefore, the modified CUCEI revised by Nair and Fisher's (1999, 2001) is used to measures the perceived CC of Chinese college students in this study.

2.6 Impact of College Students' PAS on SE of College Students

Ryan and Deci (2020) point out that PAS has a significant impact on SE and learning processes. Some scholars have found that the role of PAS is more important than competence and relationship. Therefore, this research focuses on the role of college students' PAS (Assor, 2002; Einolander, 2021; Gutiérrez & Tomás, 2018). The key point of this study is to determine whether the classroom meets the students' basic psychological needs. That is because when students perceive teacher autonomy support and are valued, they are more interested in learning, feel happier in their school life, show more effort and perseverance in learning, and are more engaged in learning (Cheon & Reeve, 2013; Fredricks et al., 2019; Jang et al., 2010; Reyes et al., 2012).

Some researchers have found that PAS has a wide range of positive effects on students' engagement (Gutiérrez & Tomás, 2019; Li et al., 2020; Reeve & Cheon, 2021). Fredricks et al. (2019) research using interview method shows that PAS can improve SE. Further researchers have confirmed that PAS has a significant impact on SE (Einolander, 2021; Jang et al., 2010; Ma, 2021; Wang et al., 2017; Zhao & Qin, 2021). Since college students' PAS is an important factor of their SE, the first hypothesis is proposed as follows;

H1: College students' PAS has a positive impact on SE.

2.7 Influence of College Students' PAS on their LM

SDT indicates if the PAS can meet the BPN of students in the classroom, it will contribute to the internalisation of those students' motivation (Deci & Ryan, 2000). SDT believes that perceived autonomy support is usually related to intrinsic motivation; hence, it stimulates students' greater intrinsic motivation, curiosity and desire to challenge (Jang et al., 2016; Ryan & Deci, 2000b). Black & Deci (2000) finding the relationship between students' PAS, LM, and academic achievement. Many studies found that PAS had a significant effect on students' LM (Domen et al., 2019; Fredricks et al., 2019; Ryan & Patrick, 2001; Stolk et al., 2018; Maldonado et al., 2019). Some studies also have shown that college students' PAS had a significant effect on their LM in learning process and SE (Patall et al., 2018; Ryan & Patrick, 2001). In short, students' PAS may have an important effect on their LM. Therefore, hypothesis 2 is proposed as follows;

H2: College students' PAS has a positive effect on their LM.

2.8 Influence of College Students' LM on SE

The SDT can explain the process of autonomous motivation that can driven behaviour (Burkley & Burkley, 2018); Therefore, whether students are sufficiently engaged in the learning process largely depends on their motivation to learn. Deci and Ryan (2000) suggest that active learning is promoted when classroom conditions meet basic human needs, and autonomous motivation is related to a positive emotional experience and a high-quality performance. Guthrie et al. (2013) found that a high level of LM promotes SE and academic performance. Some researchers have shown that LM can enhance SE (Guay et al., 2016; Ryan & Deci, 2020). Other researchers demonstrate the significant effect of LM on SE (Black & Deci, 2000; Fredricks et al., 2017). Past empirical researchers have also found that students with a high level of motivation have better engagement, and then obtain better grades (Guo, 2018; Yin & Wang, 2015; Yin, 2018; Yoo, 2015). In short, LM is an important predictor of SE. Therefore, hypothesis 3 in present study is proposed as follows;

H3: College students' LM has a positive effect on SE.

2.9 Mediating Effect of LM on College Students' PAS and SE

Motivation has often been an important intermediate variable in past research (Jang, 2008; Jeno et al., 2021; Wang & Eccles, 2013). According to the SDT, all external promotion conditions can be internalised in students' minds to form LM so that they can act (Deci & Ryan, 2000). Burkley & Burkley (2018) believe that intrinsic

motivation plays a mediating role between needs satisfaction and positive outcomes. Vallerand et al. (1997) demonstrated that LM mediates the relationship between high school students' PAS and their behavioural intention. Maldonado et al. (2019) found that LM mediates the association between PAS from high school students samples and concentration, while Jeno et al. (2021) illustrated that college students' LM mediates the correlation between their PAS and vitality. Yoo (2015) reached the same conclusion that LM has a mediating effect on PAS and SE in secondary schools. In conclusion, Deci and Ryan (2000) found that all extrinsic facilitative conditions can only lead to action if they are internalised in the student's mind to form the motivation to learn. In this study, college students' PAS was considered to facilitate an external condition and it was postulated that it may influence SE based on their motivation to learn. Hence, college students' LM may have a mediating impact on their PAS and SE. Therefore, Hypothesis 4 is proposed as follows;

H4: LM has a mediating effect between college students' PAS and SE.

2.10 Moderating Effect of CC on College Students' PAS and LM

The classroom is the main location of students' activities, and the CC reflects the collective psychological environment. Class members share approximating ages, activities, interests, time, and friendships and frequently interact (Reeve & Cheon, 2021). Thus, CC impacts students' perception of autonomy, competence, and LM (Vallerand et al., 1997; Wang & Eccles, 2013), and then affects the growth and development of students (Reeve & Cheon, 2021). Different students find that in the same classroom different individuals can have different motivations and behaviour

(Ryan & Deci, 2000a). Many studies have shown that CC has a significant impact on LM and subsequent behaviour (Cayubit, 2021; Gutiérrez, & Tomás, 2018; Jafari & Asgari, 2020). As Wang, Degol et al., (2020) suggested, a favourable CC produces better educational and psychosocial outcomes because class organization and instructional practices are more effective in a better CC, with interaction and support among students are shared more, and interpersonal relationships are more harmonious, which enables students to experience more enjoyment and grow in competence, and promotes their intrinsic motivation.

Past researchers have found that the CC plays a moderating role in the learning process (Allodi, 2010; Buyse et al., 2008; Gazelle, 2006; Guay, 2017; Trouilloud, 2006). They have revealed that the better CC, the better the students' motivation, academic performance and satisfaction (Reyes et al., 2012; Mucherah, 2014; Wang & Eccles, 2013). Wang, Lee et al. (2020) claimed that students in the better CC showed higher LM levels, while students exhibited lower motivation levels in the worse CC. Therefore, the CC may be an important moderating variable. In summary, it was speculated in current study that the association between students' PAS and LM was stronger in a better CC than in worse one. Therefore, Hypothesis 5 is proposed as follows;

H5: The CC has a moderating effect on college students' PAS and LM.

2.11 Research on background variables in SE, PAS, LM, CC variables

In the study of many background variables (gender, grade, major, place of origin, class representative or not, university category), Li et al., (2021) studied the SE

of college students in Shanghai, and found that the average score of female college students' SE was higher than that of male students; The overall situation of SE of students from cities is better than that of rural students; Senior students scored the highest, while freshmen scored the lowest; The cognitive engagement of students majoring in liberal arts and engineering is higher than behavioral and emotional engagement. At the same time, Bu (2021) found that the SE of college students in research universities in China is higher than that of college students in teaching universities. In addition, Wang (2013) also found that the SE of seniors and freshmen was significantly higher than that of sophomores and juniors. Chen and Zhang (2013) found that Chinese college students' PAS has significant differences in grades and majors, but there is no significant difference in gender. Zhang et al. (2021) found that among Chinese college students, female students' LM is significantly higher than male students; Freshmen and seniors have higher LM than sophomores; Liberal arts students are higher than science students, but there is no significant difference in family location and university category. Li et al. (2020)'s research on college students in Wuhan city found that CC of research university students is significantly higher than that of teaching university students, and the CC of college students from cities is significantly higher than these from rural. Therefore, this study will explore whether these background variables are different in each research variable, and the specific situation of their differences.

CHAPTER 3

RESEARCH METHODS

The research design and research framework of this study were formed from the aforementioned research purpose, research motivation and the literature review. This study used questionnaires to collect data, and subsequent analysis content to understand the association between college students' PAS, LM, CC and SE in 6 universities in China. This chapter is composed of six sections. The first section contains a discussion of the research methods and research framework. The relationship between the variables is also clarified in order to propose the research hypotheses. The second section contains detailed information of the study participants, and the research tool is introduced in the third section as a scale with specific details. The fourth section is devoted to the data analysis technology used in the study, and the test procedure is item analysis, reliability and validity test for the pilot test data, and this are presented in the fifth section, while the summarised in the sixth section.

3.1 Research Framework and Research Hypotheses

The research samples in this study were college students from six universities in China. The questionnaire survey was conducted using four research scales, namely, AES, students' engagement during learning activities scale, AMS and CUCEI. The collected data was then processed and analysed. After discarding the

ineffective data, this study use SPSS 25 to process the data and undertake a statistical analysis.

3.1.1 Research Framework

This study was aimed to following the SDT to explore the influence of college students' PAS, LM, and CC on SE, and further to understand the mediating effect of LM on college students' PAS and SE, as well as the moderating effect of CC on college students' PAS and LM. The research framework in current study is shown in figure 3.1:

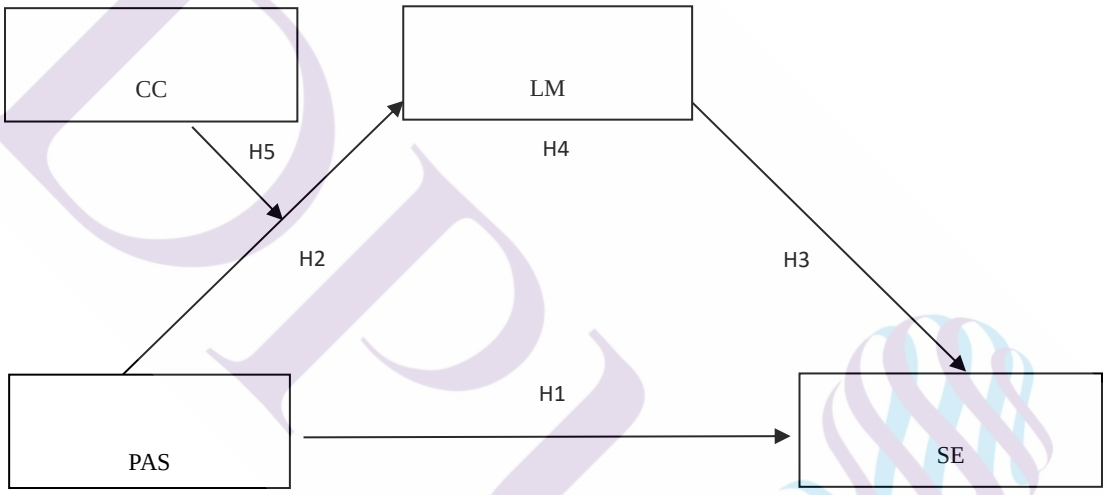

Figure 3.1 *The Research Framework*

3.1.2 Research Hypotheses

H1: College students' PAS has a positive impact on students engagement.

H2: College students' PAS has a positive effect on their LM.

H3: College students' LM has a positive effect on SE.

H4: LM has a mediating effect between college students' PAS and SE.

H5: The CC has a moderating effect on college students' PAS and LM.

3.2 Research Participants

Shaanxi Province, located in the northwest of China, is a large province of education. Among them, in 2019, the total scale of higher education in Shaanxi Province ranked 10th among 32 provinces in China. And the college students average number was 3812 in higher education per 100000 population in Shaanxi Province, which was higher than the national average of 2857, only lagging behind Beijing and Tianjin, ranking third in China (CNR, 2021).

This study conducted a sampling survey among students in six undergraduate universities in Shaanxi Province, including. Among them, university X is located in Xi'an city, Shaanxi Province. It is the oldest research university in Northwest China, and is listed in the national "double first-class" university. University C is also located in Xi'an city, and is also a research university focusing on engineering. It directly belongs to the Ministry of education, and is the national researching university of the "project 985 and Project 211", and the national "double first-class" construction university. University Q is also located in Xi'an city. This is a provincial teaching university with the characteristics of normal, regional and application-orientation. University W is located in a small city around Xi'an. It is a multi-disciplinary teaching university characterised by training teachers. University L is located in another small city around Xi'an and is a regional teaching university. It is an application-orientated university for the integration of industry and education. University Y is located in another city around Xi'an and is also a provincial teaching

university characterised by teacher education. In a short, research universities are different from teaching universities in policy support, capital investment, infrastructure, teachers and student qualifications. So, university X and C are national research universities that can train Master's and Doctoral students; Q, W, L and Y are provincial teaching universities that can only train undergraduates. Therefore, The six universities selected in this study covered different administrative regions and different university categories in Shaanxi Province of China, so they are highly representative.

In this study, a questionnaire survey was conducted among undergraduate students from 6 universities in China. All questionnaires and the collection of original data are completed using the network platform wjx (www.wjx.cn). The teachers of students share the questionnaire with the class WeChat group of students for testing. During the test, the online questionnaire was used after informing the respondents of the purpose of the questionnaire and obtaining the consent of the research participant. At the same time, the principles of voluntary filling, termination at any time, confidentiality and anonymity were emphasised.

According to Tinsley and Tinsley (1987), the number of samples for a pilot test is five times the scale with the largest number of items. In present study, the largest number of items was CUCEI, with 49 items in total, so at least 250 students should be selected as pilot test samples. According to Bentler and Chou (1987), the number of samples for the formal test should be 10 times the number of items. Since this study contains 117 items, at least 1200 samples needs to be collected; therefore, the research samples were taken in two periods. The first was the pilot test questionnaire survey in October 2021, and the second was the formal questionnaire survey undertaken

from November to December 2021. With the help of teachers, online questionnaires were distributed to the college students in selected institutions through WeChat. In the pilot test, 458 questionnaires were collected for an item analysis, exploratory factor analysis and reliability of the scales, and 1856 questionnaires were collected in the formal test to verify the research hypotheses.

3.3 Research Tools

3.3.1 Student Engagement Scale

The Students' Engagement During Learning Activities Scale developed by Reeve and Tseng (2011) was applied to measure SE, which consisted of 22 items (See table 3.1) on a 7-point Likert scale, with well-validated self-reporting scales of engagement representing students' behavioural, emotional, cognitive, and social engagement in the learning process of classroom (Reeve & Tseng, 2011). The overall score was compute by averaging the scores of the four aspects (Cheon & Reeve, 2013). Cronbach's alpha of the four aspects was 0.78-0.94 (Reeve & Tseng, 2011).

Table 3.1

Questionnaire Items to Assess the Aspects of SE

Aspects	Item code	Item content
Behavioural engagement	Y1-1	1. I am careful and meticulous in class.
	Y1-2	2. I am very focused in class.
	Y1-3	3. When I find that the teacher begins to explain new content, I always listen carefully.
	Y1-4	4. I work very hard at school.
	Y1-5	5. I try to learn new knowledge in classroom.

Agentic engagement	Y2-1	6. I can express my preferences and opinions in classroom.
	Y2-2	7. In classroom, I will ask questions.
	Y2-3	8. I will tell my teacher my preferences in classroom.
	Y2-4	9. I let the teacher know my interests.
	Y2-5	10. I can make suggestions to make the classroom better.
Cognitive engagement	Y3-1	11. I try to organically connect new knowledge with old knowledge in the classroom.
	Y3-2	12. When I study, I try to connect the principles I have learned now with my past experience.
	Y3-3	13. In my study, I try to integrate all kinds of views, and I like to do so.

Table 3.1 (Continued)

Aspects	Item code	Item content
Cognitive engagement	Y3-4	14. I use my own examples to understand important concepts.
	Y3-5	15. When the learning materials are difficult to understand, I will change my learning methods.
	Y3-6	16. When I do my homework, I occasionally take time to reflect on what I am doing.
	Y3-7	17. When I study, I will try to think and understand the principle, rather than just get the answer.
	Y3-8	18. Before I begin to study, I will predict my mastery.
Emotional engagement	Y4-1	19. I'm curious about what I'm learning in class.
	Y4-2	20. I am very interested in the activities in classroom..
	Y4-3	21. I like learning things that is new in classroom.
	Y4-4	22. The classroom is happy and interesting.

3.3.2 PAS Scale

The Autonomy Enhancement Scale (AES) developed by Assor et al. (2002) applied in this study to measure the students' PAS. Several researchers have used this scale to survey the level of students' PAS (Adams et al., 2017; Kaplan, 2017; Patall et

al., 2018; Wang et al., 2017). The scale was consists of 18 items (See table 3.2), and scored on a 5-point scale, that score ranging from 1 (not at all true) to 5 (very true). Three aspects of PAS were measured, namely, teacher providing student choices, take student more understanding and culture interest, allowing student express criticism and encouraging their thinking in more independently. The Cronbach's alpha for these aspects was 0.58-0.81 (Assor et al., 2002).

Table 3.2

Questionnaire Items to Assess the Aspects of PAS

Aspects	Item code	Item content
Providing choice	X1-1	1. The teacher will give me enough time to finish what I am interested in.
	X1-2	2. In class, the teacher allowed me to choose my best way of learning.
	X1-3	3. The teacher will ask us: what knowledge points do we want to learn in detail or roughly.
	X1-4	4. The teacher will ask us what we don't understand in our study.
	X1-5	5. The teacher allowed me to: choose the knowledge points that I am interested in, from the main research.

Table 3.2 (Continued)

Aspects	Item code	Item content
Providing choice	X1-6	6. The teacher allows us to choose some content from the homework list to complete.
	X1-7	7. The teacher encouraged me to use my own way to complete the learning task.
Fostering understanding and interest	X2-1	8. Teachers pay attention to the organic connection between theory and reality.
	X2-2	9. The teacher attaches importance to and cultivates my interests.
	X2-3	10. The teacher can explain the importance of the learning content to help us better understand.

	X2-4	11. The teacher will talk with us about our knowledge and understanding.
Allowing criticism and encouraging independent thinking	X3-1	12. The teacher will listen to my opinion.
	X3-2	13. When there are differences between teachers and students, the teacher encourages everyone to express different views.
	X3-3	14. Teachers are willing to listen to students' complaints (or negative emotions) about teachers themselves.
	X3-4	15. For students who say what they really think, the teacher respects the students, not fooling them on the surface.
	X3-5	16. The teacher allowed me that to decide things by myself.
	X3-6	17. The teacher allows us to talk about unreasonable and unfair things.
	X3-7	18. The teacher taught me to think and solve problems independently.

3.3.3 Learning Motivation Scale

The AMS developed by Vallerand et al. (1992) for college students was applied to measure the students' LM. This scale has also been widely used by several researchers (Chen & Jang, 2010; Giesbers et al., 2013; Hu & Luo, 2021). The AMS consists of 28 items (See table 3.3), and sort on a 7-point Likert scale, which was designed to measure the quality of the students' LM, that as described by the SDT. The scale measures intrinsic motivation to amotivation, and its total score can be recorded as the SDI (Ryan & Deci, 2020). It was calculated by using the following formula: 2× ((know + achievement + stimulation) / 3) + identified - (introjected + external) / 2 - 2 ×amotivation (Grouzet et al. 2004; Stolk, 2018). The range of the SDI is from -18 (that means very little self-determination) to +18 (that means extreme self-determination), and the higher the score, the more intrinsic the participant's motivation is considered to be (Black & Deci 2000; Vallerand & Blssonnette, 1992; Vallerand, 1997). The Cronbach alpha of the seven aspects ranged from 0.73 to 0.85 (Vallerand et al., 1992).

Table 3.3

Questionnaire Items to Assess the Aspects of Academic Motivation Scale

Aspects	Item code	Item content
Intrinsic motivation - to know and learn	M1-1	1. I learn new knowledge in order to experience happiness and satisfaction.
	M1-2	2. The joy of pursuing new knowledge and new things.
	M1-3	3. To broaden my knowledge in interesting subjects and make me happy.
	M1-4	4. Because study can expose me to many new things that attract me.
Intrinsic motivation - toward achievement and accomplishment	M2-1	5. I study in order to improve myself.
	M2-2	6. In order to pursue the sense of comfort when personal achievements have made a breakthrough.
	M2-3	7. Because after overcoming difficulties, I get satisfaction.
	M2-4	8. In order to find the satisfaction in the process of pursuing excellence in the university.
Intrinsic motivation - to experience stimulation	M3-1	9. When I tell others my opinions, I will have a wonderful experience.
	M3-2	10. When I read about a popular writer, I felt my heart pounding.
	M3-3	11. When I am completely attracted by famous works, I experience beauty.
	M3-4	12. When I read something very interesting, I feel excited.
Extrinsic motivation - identified	M4-1	13. In order to increase my vocational skills, I went to university to study.
	M4-2	14. Because I have a college degree, it can help me find some jobs.
	M4-3	15. College education will make me clear my employment direction.
	M4-4	16. I believe that after these years of study, I will improve my working ability.
Extrinsic motivation	M5-1	17. To prove to myself that I am capable of obtaining a university degree.

- introjected regulation	M5-2	18. Because I think it is very important to succeed in college.
	M5-3	19. To show myself: I am a smart man.
	M5-4	20. Because I want to prove to myself that I can do it and succeed in my studies.
Extrinsic motivation	M6-1	21. Because I only have a high school degree, I may not find any good jobs in the future.
- external regulation	M6-2	22. Going to college is to get a better job in the future.

Table 3.3 (Continued)

Aspects	Item code	Item content
Extrinsic motivation	M6-3	23. Because I hope to have a "good life" in the future.
- external regulation	M6-4	24. In order to get a higher salary in the future.
Amotivation	M7-1	25. To be honest: I don't know what learning is for; I really think: I'm a waste of time in college.
	M7-2	26. I'm confused now; I don't know whether to continue reading.
	M7-3	27. I don't understand why I want to go to college. Frankly, it doesn't matter.
	M7-4	28. I don't know what I do in college.

3.3.4 Class Climate Scales

The CUCEI developed by Fraser and Treagus (1986) and Modified by Nair and Fisher (1999, 2001) was applied to calculate the CC of the college students. This questionnaire used in several previous CC studies (Alansari & Rubie-Davies, 2020; Fraser, 1998; Nair & Fisher, 1999, 2001). The Modified CUCEI assesses college students' perception of seven dimensions of the classroom psychological environment: from Personalisation to Individualisation. The 5-point scale consisted of 49 items (See table 3.4), and the Cronbach α of the seven dimensions ranged from 0.84 to 0.97 (Nair

& Fisher, 1999, 2001).

Table 3.4

Questionnaire Items to Assess the Aspects of CUCEI

Aspects	Item code	Item content
Personalisation	W1-1	1. Teachers can take into account the feelings of students.
	W1-2	2. Teachers can talk with students heart to heart.
	W1-3	3. Teachers try their best to help students.
	W1-4	4. Teachers can help every student who meets difficulties in his studies.
	W1-5	5. When talking with students in class, the teacher will take the initiative to approach the students.
	W1-6	6. The teacher ignored the students' questions. (R)
	W1-7	7. Teachers attach importance to students and are friendly to students.

Table 3.4 (Continued)

Aspects	Item code	Item content
Cooperation	W2-1	8. I finished my homework with cooperate my classmates.
	W2-2	9. When doing my homework, I shared my books and materials with my classmates.
	W2-3	10. I have a team spirit when I work in groups in class.
	W2-4	11. When there is research content in class, I cooperate with my classmates.
	W2-5	12.In class, I learned something useful from other students.
	W2-6	13. I can cooperate with others in class activities.
	W2-7	14. I cooperated with my classmates and achieved the classroom goals.
Student cohesiveness	W3-1	15. The students in the class are relatively strange to each other. (R)
	W3-2	16. Every student knows the names of others in the class.

	W3-3	17. Friendship was established among the students in the class.
	W3-4	18. There is a lack of opportunities for students in the class to know each other. (R)
	W3-5	19. In the class, it won't be long before everyone can call each other's names.
	W3-6	20. The students in the class are familiar with each other.
	W3-7	21. All the students in the class are willing to know each other.
Equity	W4-1	22. The teacher pays equal attention to my questions and those of other students.
	W4-2	23. The teacher gave me as much help as other students.
	W4-3	24. In class, the teacher treated me and other students fairly.
	W4-4	25. Like other students, I received the same encouragement from my teachers.
	W4-5	26. I have as many opportunities to answer questions as other students.
	W4-6	27. The teacher treats me equally with others.
	W4-7	28. I have as much say in class as other students.
Task orientation	W5-1	29. Students are very clear about what should be done in class.
	W5-2	30. I think it is very important for teachers to assign clear learning tasks in class, and the students all know what to do.
	W5-3	31. The classroom content closely focuses on the teaching objectives, rather than endless nonsense.
	W5-4	32. There are clear plans for activities in the classroom.
	W5-5	33. The classroom task is very clear, so everyone knows what to do.
	W5-6	34. The course has no plan and the content is chaotic (R)
	W5-7	35. The content of classroom activities is clear and well arranged.
Innovation	W6-1	36. In class, teachers can try new teaching ideas.

Table 3.4 (Continued)

Aspects	Item code	Item content
Innovation	W6-2	37. In class, teachers can adopt new and distinctive teaching

		methods.
	W6-3	38. Teachers can design new classroom activities.
	W6-4	39. Teachers' classroom teaching methods are innovative and diverse.
	W6-5	40. The seating arrangement in class is rigid.(R)
	W6-6	41. Teachers will come up with unique classroom activities.
	W6-7	42. Basically, the class is full, and the class activities are relatively simple. (R)
Individualisation	W7-1	43. All students are expected to have rigid and consistent classroom activities. (R)
	W7-2	44. According to students' learning level, teachers allow students to learn at their own pace.
	W7-3	45. According to the students' mastery, the teacher allows students to allocate more classroom activity time independently.
	W7-4	46. The teacher allows students to choose the type and mode of classroom activities.
	W7-5	47. Allow students to control their progress according to their abilities.
	W7-6	48. In class, when students see interesting content, the teacher will speak more accordingly.
	W7-7	49. The teacher has rigid control of everything in the classroom.

3.4 Data Analysis Procedure

After using the online questionnaire platform to collect the questionnaire data, SPSS software is used to sort out and analyse the data. For the pilot test data, SPSS software is used for item analysis, factor analysis and reliability analysis to test the structure and reliability of data of the questionnaire. For the formal test data, firstly, SPSS is used for sample descriptive statistics, variance analysis, Pearson's correlation analysis, scale reliability test and common method variance (CMV) test, and Amos is used for confirmatory factor analysis (CFA). Secondly, model 4 of the PROCESS macro is used to test the mediating effect, then model 7 is used to test the moderated

mediating effect, and finally use bootstrap confidence interval is used to confirm the significance of mediating effect and moderated mediating effect (Hayes, 2013).

3.4.1 Item Analysis

In this section, the item analysis' main purpose was to test the reliability of each item in the scale. In the pilot test of this study, the six criteria of the item analysis were taken as the basis of deleted items, specifically including a comparison of the extreme group-critical ratio, items-total correlation, corrected item-total correlation, and Cronbach's alpha if items were deleted. Communalities and factor loading were used as the basis for judging whether an item should be deleted.

The comparison of the extreme group-critical ratio was to arrange the total scores of each scale in high and low order, take 27% before and after each scale to group high and low, and then conduct a t-test on the difference to obtain the critical ratio (CR). Items should be deleted that were not significant at 0.05.

3.4.2 Correlation Tests

3.4.2.1 The Items-Total Correlation

This study calculate the correlation coefficient from the score of each item by the total score of the scale. The Items should be deleted, when the correlation was not significant or the *R* value was less than 0.4. In addition, when the correlation between the any items was too high, it means that the overlap between them was high, and the item should be deleted.

3.4.2.2 The Corrected Item-Total Correlation

The Corrected Item-Total correlation method was to calculate the correlation coefficient between the score with an item that the score without present item. The standard for selecting items in this study was that the correlation coefficient should be greater than 0.4 and reach a significant level of 0.05.

3.4.3 Test of Homogeneity

3.4.3.1 The Cronbach α Coefficient after Deleted Items

Cronbach α coefficient was used to measure each item's internal consistency in the scale. This has often been used to calculate the reliability and stability of the whole scale. After an item was deleted, the Cronbach α coefficient was used to test the change of the Cronbach α coefficient of the overall scale. A much higher Cronbach α coefficient after an item was deleted than the original Cronbach α coefficient indicates that the measured attributes of this item may be different from those of other items; hence, it could be deleted.

3.4.3.2 Communalities and Factor Loadings

Commonalities are the proportion of each variable's variance that can be explained by the factors. A higher value of commonalities means that more common traits can be measured, whereas items with low commonality show less homogeneity with the scale, so they can be deleted. The first largest principal component of the whole scale was extracted by a principal component analysis. If the value of the items was less than 0.2, they should be deleted. The factor loading was in accordance with the

standard of Wu (2008), and the factor load of the item should reach 0.5, otherwise it should be deleted.

3.4.4 Factor Analysis

A factor analysis can be used to verify the items' construct validity from the pilot test data. The exploratory factor analysis (EFA) in this study was used to obtain each item's factor loading, variance explained and cumulative total variance explained of the scale in order to test the pilot test questionnaire's validity, and judge its quality.

In the formal data, this study use a confirmatory factor analysis (CFA) to verify the adaptation from the data to the model. The absolute fit test index and incremental fit test index were tested respectively in order to judge the fit between the data and the model and to verify the reliability and validity of the formal questionnaire.

3.4.5 The Reliability Analysis

The pilot test data and the formal data were all have a reliability analysis, and scales' Cronbach's α was used to measure the internal consistency. If the Cronbach's α coefficient was above 0.70, that means the data was considered to be reliable and the scale was indicated to have good internal consistency.

3.4.6 Common Method Variance

This study use Common Method Variance (CMV) to measure such bias. For the formal data, the single factor test method of Harman was used to extract the

characteristic factor value with eigenvalues is higher than 1 from the original data. If the first factor explains a variation less than the critical value of 50%, it indicates that there was no common method variance problem.

3.4.7 Descriptive Statistics

The background data of the research participants, such as gender, family location, college, grade and major, was subjected to frequency statistics and percentage statistics and the average, standard deviation and frequency of the research variables (college students' perceived teacher's autonomy support, LM, CC and SE) were calculated in order to understand the current status of each variable of the college students.

3.4.8 Variance Analysis

The background data of the research participants in terms of gender was divided into female and male, the family location was divided into rural and urban, class representatives were divided into yes and no, and university categories were divided into ordinary universities and key universities, for respective independent sample t-tests. The majors were divided into liberal arts, science, engineering and art, and the grades were divided into freshmen, sophomores, juniors and seniors, and an ANOVA analysis was used to estimate the differences of these background variables.

3.4.9 Pearson's Correlation Analysis

The data was analysed by Pearson's relevant standards to obtain the relevant values of PAS, LM, CC and SE, and then the correlation between two variables was analysed and tested for collinearity.

3.4.10 Process Model Analysis

In this study, Model 4 and Model 7 of process macro to verify the association between the variables. The PROCESS macro in SPSS can be used to test the regression coefficient, mediating and moderating effects among the variables, as well as to complete the goal of the study that to test the mediating effect of LM and the moderating effect of the CC.

3.5 Descriptive Statistics of Pilot Test Samples

Although 458 questionnaires were collected during the pilot test, 91 of them were found to be invalid (lack of information, continuous multiple filling in the same number, etc.). These were eliminated, leaving 367 valid questionnaires, with a recovery rate of 80.1%. 235 were from university W, accounting for 64.0% of the sample, 70 were from university L, accounting for 19.1% of the sample, and 62 were from university Q, accounting for 16.8% of the sample. Therefore, the effective pilot test sample of this study was 367.

Subsequently, all the items in the questionnaire were subjected to a normality test and the results showed that the skew was between -1.093 and 0.421, and the

absolute values were less than the standard value of 3 (Kline, 1998). Kurtosis ranged from -0.960 to 1.755, and the absolute values were less than the value of 10 (Huang, 2002), which indicated that the sample data was conformed in a normal distribution.

3.6 The Test of Reliability and Validity

The items that were analysed next were perceived teacher's autonomy support, LM, CC and SE. The analytical standard was used for this item analysis, which was used three categories and six criteria to assessment. Items that had more than two criteria that failed to meet the standard were deleted.

3.6.1 The Item Analysis of SE

The item of SE was analysed using the SPSS 25 software, and the calculate results of the analysis are shown in table 3.5. And the first 27% and the last 27% of the total scores were selected as high and low groups for a t-test. The *CR* value was between 12.873 and 21.679 (p <0.001), and the value of absolute was greater than 3. This indicated that each item had significant differences in high and low groups, and the scale had good discrimination; Each item of SE was significantly correlated by the total score. And in this study the correlation value was between 0.678 and 0.816, which was greater than the reference value of 0.4; The corrected item-total correlation between the items and the total score was between 0.647 and 0.796, which was greater than the reference value of 0.4; The Cronbach α coefficient after deleting an item ranged from 0.963 to 0.964, which was less than the overall scale of Cronbach α Coefficient 0.965;

The communalities were between 0.465 and 0.678, which was greater than the reference value of 0.2; The factor loadings were between 0.682 and 0.824, which was greater than the reference value of 0.40. Based on the above criteria, in the item analysis, the 6 criteria of all the items of the scale met the reference value. Since all 22 items of SE were retained, there was no need to delete any of them.

Table 3.5

Item Analysis of SE

Item number	Extreme group	Correlation detection			Homogeneity test		Number of substandard indexes	Notes
	CR value	Items-Total Correlation	Corrected Item-Total correlation	Cronbach α after Deleted Item	Communality	Factor Loadings		
Criteria	≧3.0	≧.400	≧.400	<.965	≧.20	≧.40		
Y1-1	18.438***	0.765	0.739	0.963	0.588	0.767	0	R
Y1-2	17.915***	0.764	0.737	0.963	0.584	0.764	0	R
Y1-3	17.247***	0.757	0.730	0.963	0.582	0.763	0	R
Y1-4	19.524***	0.799	0.777	0.963	0.643	0.802	0	R
Y1-5	20.001***	0.816	0.796	0.963	0.678	0.824	0	R
Y2-1	21.679***	0.814	0.789	0.963	0.646	0.804	0	R

Table 3.5 (Continued)

Item number	Extreme group	Correlation detection			Homogeneity test		Number of substandard indexes	Notes
	CR value	Items-Total Correlation	Corrected Item-Total correlation	Cronbach α after Deleted Item	Communality	Factor Loadings		
Y2-2	20.800***	0.782	0.751	0.963	0.584	0.764	0	R
Y2-3	19.074***	0.752	0.719	0.963	0.533	0.730	0	R

Y2-4	20.228***	0.780	0.749	0.963	0.578	0.761	0	R
Y2-5	18.322***	0.785	0.756	0.963	0.589	0.767	0	R
Y3-1	16.615***	0.788	0.764	0.963	0.630	0.794	0	R
Y3-2	15.503***	0.764	0.741	0.963	0.600	0.775	0	R
Y3-3	18.452***	0.803	0.781	0.963	0.656	0.810	0	R
Y3-4	15.230***	0.711	0.680	0.964	0.516	0.718	0	R
Y3-5	15.216***	0.747	0.721	0.963	0.570	0.755	0	R
Y3-6	12.873***	0.678	0.647	0.964	0.465	0.682	0	R
Y3-7	15.701***	0.745	0.719	0.963	0.566	0.753	0	R
Y3-8	13.931***	0.687	0.654	0.964	0.472	0.687	0	R
Y4-1	15.917***	0.770	0.747	0.963	0.607	0.779	0	R
Y4-2	18.133***	0.754	0.729	0.963	0.579	0.761	0	R
Y4-3	15.009***	0.743	0.718	0.963	0.571	0.756	0	R
Y4-4	15.596***	0.750	0.724	0.963	0.567	0.753	0	R

Note. * * * refers to p <. 001; R = Retained

3.6.2 The Item Analysis of PAS

The items of PAS were calculated using SPSS 25 software, and the results of analysis are shown in table 3.6. Because the first 27% and last 27% of the total score were selected as high and low groups for a t-test. So,the result of the *CR* value was between 13.088 and 18.804 (p <0. 001), and it is shown that absolute value was greater than 3, indicating that each item had significant differences in high and low groups, and the scale had good discrimination; Each item of the PAS was significantly correlated with the total score, and the correlation was between 0.657 and 0.837, which was greater than the reference value of 0.4; The corrected item-total correlation between the items and the total score was between 0.607 and 0.812, which was greater than the reference value of 0.4; After deleting items except X3-6 items (0.958), the Cronbach

α coefficient of the remaining items ranged from 0.955 to 0.956, which was less than the overall scale of Cronbach α Coefficient 0.958; The communalities were between 0.416 and 0.699, which was greater than the reference value of 0.2; The factor loadings were between 0.645 and 0.836, which was greater than the reference value of 0.40. Based on the above criteria, in the item analysis, the 6 criteria of all items of the scale met the reference value, so that all 18 items of the PAS were retained, and there was no need to delete any of them.

Table 3.6

Item Analysis of PAS

Item number	Extreme group	Correlation detection			Homogeneity test		Number of substandard indexes	Notes
	CR value	Items-Total Correlation	Corrected Item-Total correlation	Cronbach α after Deleted Item	Communality	Factor Loadings		
Criteria	≧3.0	≧.400	≧.400	<.958	≧.20	≧.40		
X1-1	15.805***	0.750	0.714	0.956	0.553	0.744	0	R
X1-2	16.996***	0.769	0.735	0.956	0.582	0.763	0	R
X1-3	15.025***	0.758	0.721	0.956	0.564	0.751	0	R
X1-4	16.199***	0.767	0.735	0.956	0.590	0.768	0	R
X1-5	16.023***	0.765	0.732	0.956	0.585	0.765	0	R
X1-6	14.210***	0.748	0.709	0.956	0.547	0.739	0	R
X1-7	16.206***	0.793	0.764	0.955	0.629	0.793	0	R
X2-1	15.344***	0.749	0.719	0.956	0.573	0.757	0	R
X2-2	18.804***	0.837	0.812	0.955	0.699	0.836	0	R
X2-3	16.378***	0.748	0.718	0.956	0.573	0.757	0	R

X2-4	16.931***	0.796	0.768	0.955	0.643	0.802	0	R
X3-1	18.307***	0.803	0.774	0.955	0.652	0.807	0	R
X3-2	16.449***	0.745	0.714	0.956	0.568	0.754	0	R
X3-3	17.777***	0.807	0.779	0.955	0.652	0.808	0	R
X3-4	17.011***	0.801	0.774	0.955	0.650	0.806	0	R
X3-5	17.145***	0.769	0.737	0.956	0.588	0.767	0	R
X3-6	13.088***	0.657	0.607	0.958	0.416	0.645	1	R
X3-7	16.018***	0.746	0.714	0.956	0.560	0.748	0	R

Note. * * * refers to p <. 001; R = Retained

3.6.3 The Item Analysis of LM

The items of LM were analysed using SPSS and the results are shown in table 3.7. The first 27% and last 27% of the total score were selected as high and low groups for a *t*-test. The *CR* value was between 9.878 and 21.829 (p <0. 001), and its absolute value was greater than 3, indicating that each item had significant differences in high and low groups, and the scale had good discrimination; Each item of LM was significantly correlated with the total score, and the correlation was between 0.425 and 0.793 (except M6-1, 0.286), which was greater than the reference value of 0.4; The corrected item-total correlation between the items and the total score, except for M5-3 (0.376), M6-1 (0.217) and M6-4 (0.380) , was between 0.490 and 0.776, which was greater than the reference value of 0.4; According to Wu (2010), if the factor constructs contained in the total scale have more than two different aspects, the aggregate scores of those aspects have no substantive meaning. The Cronbach α coefficient of the whole scale is 0.945. Therefore, the Cronbach α coefficient after deleting items was between 0.942 and 0.945, which was smaller than the reference value of 0.945, except for M5-3 (0.946) and M6-1 (0.949). The communalities of items, except for M5-

3(148), M6-1 (0.045) and M6-4 (0.160), were between 0.239 and 0.700, which were greater than the reference value of 0.2; The factor loadings of items, except for M6-1(0.212) and M5-3 (0.385), were between 0.400 and 0.836, which were greater than the reference value of 0.40. Based on the above criteria, 26 of the 28 items of LM were retained and only tow item (M5-3 and M6-1) was deleted.

Table 3.7

Item Analysis of LM

Item number	Extreme group	Correlation detection			Homogeneity test		Number of substandard indexes	Notes
	CR value	Items-Total Correlation	Corrected Item-Total correlation	Cronbach α after Deleted Item	Communality	Factor Loadings		
Criteria	≧3.0	≧.400	≧.400	≦0.945	≧.20	≧.40		
M1-1	11.740***	0.574	0.534	0.944	0.353	0.594	1	R
M1-2	15.155***	0.741	0.719	0.942	0.607	0.779	0	R
M1-3	18.423***	0.782	0.763	0.942	0.671	0.819	0	R
M1-4	17.944***	0.784	0.765	0.942	0.671	0.819	0	R
M2-1	18.354***	0.793	0.775	0.942	0.691	0.831	0	R
M2-2	16.993***	0.759	0.739	0.942	0.646	0.804	0	R
M2-3	18.840***	0.778	0.760	0.942	0.678	0.823	0	R
M2-4	18.317***	0.771	0.749	0.942	0.643	0.802	0	R
M3-1	19.449***	0.769	0.750	0.942	0.651	0.807	0	R
M3-2	17.570***	0.758	0.737	0.942	0.638	0.798	0	R
M3-3	18.558***	0.772	0.752	0.942	0.659	0.812	0	R

M3-4	20.629***	0.793	0.776	0.942	0.700	0.836	0	R
M4-1	18.379***	0.719	0.691	0.942	0.529	0.727	0	R
M4-2	14.777***	0.631	0.593	0.943	0.395	0.629	0	R
M4-3	17.261***	0.698	0.667	0.942	0.495	0.704	0	R
M4-4	19.937***	0.750	0.726	0.942	0.559	0.747	0	R
M5-1	15.518***	0.662	0.631	0.943	0.439	0.663	0	R
M5-2	16.780***	0.689	0.660	0.942	0.468	0.684	0	R
M5-3	8.834***	0.430	0.376	0.946	0.148	0.385	4	D
M5-4	17.199***	0.648	0.611	0.943	0.389	0.624	0	R
M6-1	5.534***	0.286	0.217	0.949	0.045	0.212	5	D
M6-2	10.759***	0.529	0.490	0.944	0.251	0.501	0	R
M6-3	14.917***	0.668	0.641	0.943	0.444	0.667	0	R
M6-4	7.983***	0.425	0.380	0.945	0.160	0.400	2	R
M7-1	15.569***	0.611	0.560	0.944	0.309	0.556	0	R
M7-2	14.318***	0.562	0.503	0.945	0.239	0.489	0	R
M7-3	17.125***	0.626	0.581	0.943	0.318	0.564	0	R
M7-4	15.994***	0.586	0.529	0.945	0.265	0.515	0	R

Note. * * * refers to p <. 001; R = Retained; D = Deleted

3.6.4 The Item Analysis of CC

The CC items were analysed using SPSS and the results are shown in table 3.8. The first 27% and last 27% of the total score were selected as high and low groups for a *t*-test. The *CR* value was between 3.935 and 21.829 (p <0. 001), and its absolute value was greater than 3, indicating that each item had significant differences in high and low groups, and the scale had good discrimination; Each item in the CC was significantly correlated with the total score, and the correlation was between 0.414 and 0.811, except for W1-6 (0.385), W3-4 (0.383), W7-1 (0.252), W7-6 (0.390), which were greater than the reference value of 0.4; The corrected item-total correlation

between all the items and the total score, except for W3-2 (0.379), W3-4 (0.348), W3-6 (0.399), W7-1 (0.217)and W7-6 (0.361), which was greater than the reference value of 0.4; After deleting items, the Cronbach α coefficient of the remaining items ranged from 0.963 to 0.965, which was less than the overall scale of Cronbach α Coefficient 0.965; The communalities were between 0.214 and 0.685, except for W1-6 (0.144), W3-1 (0.157), W3-2 (0.139), W3-4 (0.329),W3-5 (0.162), W3-6(0.151), W6-5(0.184), W7-1(0.049) and W7-6(0.129), which were greater than the reference value of 0.2; The factor loadings were between 0.462 and 0.923, except for W1-6 (0.380), W3-1 (0.396), W3-2 (0.373), W3-4 (0.329), W3-6(0.388), W7-1 (0.222) and W7-6 (0.359), which were greater than the reference value of 0.40. Based on the above criteria, 45 of the 49 items in the CC were retained and 4 items were deleted (i.e. W1-6, W3-4, W7-1 and W7-6 were deleted).

3.6.5 The Testing of Reliability and Validity

After completing the item analysis, an EFA was applied to test the construct validity of the scale to measure the degree of theoretical concepts or traits. The factor analysis' purpose was to identify the potential structure of the scale, delete inappropriate items, and make the variables in the scale more relevant.

Table 3.8

Item Analysis of CUCEI

Item number	Extreme group	Correlation detection	Homogeneity test	Number of substandard	Notes

	CR value	Items-Total Correlation	Corrected Item-Total correlation	Cronbach α after Deleted Item	Communality	Factor Loadings	indexes	
Criteria	≧3.0	≧.400	≧.400	≦0.965	≧.20	≧.40		
W1-1	15.254***	0.699	0.682	0.964	0.502	0.709	0	R
W1-2	16.828***	0.724	0.707	0.963	0.539	0.734	0	R
W1-3	20.746***	0.778	0.764	0.963	0.619	0.787	0	R
W1-4	19.644***	0.750	0.734	0.963	0.580	0.761	0	R
W1-5	15.212***	0.647	0.627	0.964	0.425	0.652	0	R
W1-6	8.400***	0.385	0.352	0.965	0.144	0.380	4	Deleted
W1-7	14.421***	0.638	0.619	0.964	0.429	0.655	0	R
W2-1	8.992***	0.528	0.504	0.964	0.294	0.543	1	R
W2-2	12.137***	0.643	0.624	0.964	0.437	0.661	0	R
W2-3	14.273***	0.688	0.673	0.964	0.504	0.710	0	R
W2-4	14.091***	0.693	0.678	0.964	0.514	0.717	0	R
W2-5	15.676***	0.734	0.720	0.964	0.575	0.759	0	R
W2-6	14.884***	0.725	0.711	0.964	0.559	0.747	0	R
W2-7	14.503***	0.698	0.684	0.964	0.525	0.725	0	R
W3-1	7.579***	0.437	0.405	0.965	0.157	0.396	2	R
W3-2	6.579***	0.414	0.379	0.965	0.139	0.373	3	R
W3-3	11.488***	0.590	0.567	0.964	0.322	0.568	0	R
W3-4	6.180***	0.383	0.348	0.965	0.108	0.329	4	Deleted
W3-5	6.994***	0.453	0.419	0.965	0.162	0.403	1	R
W3-6	5.819***	0.430	0.399	0.965	0.151	0.388	3	R
W3-7	9.981***	0.551	0.524	0.964	0.264	0.514	0	R
W4-1	16.852***	0.723	0.708	0.964	0.558	0.747	0	R
W4-2	17.174***	0.742	0.727	0.963	0.575	0.759	0	R
W4-3	19.258***	0.762	0.750	0.963	0.617	0.785	0	R
W4-4	21.829***	0.811	0.800	0.963	0.685	0.828	0	R
W4-5	15.096***	0.677	0.660	0.964	0.494	0.703	0	R
W4-6	19.276***	0.759	0.746	0.963	0.617	0.785	0	R
W4-7	17.363***	0.718	0.703	0.964	0.549	0.741	0	R

W5-1	15.164***	0.693	0.676	0.964	0.493	0.702	0	R
W5-2	15.299***	0.710	0.696	0.964	0.541	0.736	0	R
W5-3	14.965***	0.685	0.667	0.964	0.470	0.686	0	R
W5-4	14.731***	0.666	0.648	0.964	0.451	0.671	0	R
W5-5	12.030***	0.642	0.621	0.964	0.407	0.638	0	R

Table 3.8 (Continued)

Item number	Extreme group	Correlation detection			Homogeneity test		Number of substandard indexes	Notes
	CR value	Items-Total Correlation	Corrected Item-Total correlation	Cronbach α after Deleted Item	Communality	Factor Loadings		
W5-6	8.881***	0.463	0.435	0.965	0.214	0.463	1	R
W5-7	16.904***	0.756	0.743	0.963	0.602	0.776	0	R
W6-1	18.717***	0.760	0.746	0.963	0.578	0.760	0	R
W6-2	16.922***	0.740	0.723	0.963	0.543	0.737	0	R
W6-3	19.839***	0.792	0.780	0.963	0.635	0.797	0	R
W6-4	17.183***	0.763	0.749	0.963	0.591	0.769	0	R
W6-5	7.180***	0.430	0.401	0.965	0.184	0.428	1	R
W6-6	12.657***	0.648	0.627	0.964	0.404	0.635	0	R
W6-7	8.314***	0.501	0.473	0.964	0.217	0.466	1	R
W7-1	3.935***	0.252	0.217	0.966	0.049	0.222	5	Deleted
W7-2	9.882***	0.510	0.484	0.964	0.253	0.503	0	R
W7-3	9.983***	0.541	0.515	0.964	0.273	0.523	0	R
W7-4	13.632***	0.627	0.605	0.964	0.375	0.612	0	R
W7-5	11.241***	0.599	0.576	0.964	0.335	0.579	0	R
W7-6	5.761***	0.390	0.361	0.965	0.129	0.359	4	Deleted
W7-7	12.948***	0.571	0.545	0.964	0.299	0.547	0	R

Note. * * * refers to p <. 001; R = Retained

3.6.5.1 Analyse the reliability and validity of students' engagement during the learning activities scale

3.6.5.1.1 Analyse the validity of students' engagement during the learning activities scale

The SPSS software was used to test the validity of the scale based on a factor analysis. The specific methods were as follows: a PCA was selected for the extraction, and a maximum variation method was used for the rotating shaft. According to the results of the factor analysis, the KMO of the scale was 0.955 (reference value was 0.8), and the Bartlett spherical test chi-square was 7771.485 ($p < 0.001$). This indicated that there were common factors among the items, making them suitable for a factor analysis (Kaiser, 1974).

The results show that the commonality value of 22 items in the scale was between 0.547 and 0.892, indicating that each item was very important to the common factors.

Four common factors about these dimensions were extracted using a method that limits extraction to four common factors, and the items' factor loading were between 0.684-0.818, 0.660-0.878, 0.571-0.795 and 0.607-0.745, which was greater than the reference value of 0.45.

After the rotation axis, the eigenvalue of each factor was 4.240, 4.319, 5.454 and 2.849, and the explanatory variation was 19.274%, 19.630%, 24.789% and 12.952%. The cumulative total explanatory variation was 76.645% (50% higher than the reference value). Therefore, according to the factor analysis, the pilot test scale had good validity and the same structure as the original scale (Tabachnick et al., 2007).

3.6.5.1.2 Reliability analysis of students' engagement during learning activities scale

Cronbach α was used for this analysis and the results show that the Cronbach α coefficients of four factors, were 0.940, 0.946, 0.931 and 0.898, and the Cronbach's α of the whole scale was 0.965. These results indicate that the pilot test scale had good internal consistency (Nunnally, 1978), as shown in the table 3.9.

The results of the reliability and validity analysis show that all 22 items of the SE scale in the pilot test questionnaire were retained, and there was no need to delete any of them.

Table 3.9

Factor Analysis and Reliability Analysis of SE Scale

Aspects	Item number	Communality	Factor loading	Square Load after Axis Conversion		Cronbach 's α
				Eigenvalue	Explanatory variation (%)	
Behavioural engagement	Y1-1	0.847	0.817	4.240	19.274	0.940
	Y1-2	0.852	0.818			
	Y1-3	0.813	0.792			
	Y1-4	0.751	0.684			
	Y1-5	0.810	0.721			
Agentic engagement	Y2-1	0.752	0.660	4.319	19.630	0.946
	Y2-2	0.816	0.789			
	Y2-3	0.892	0.878			

	Y2-4	0.866	0.840			
	Y2-5	0.836	0.808			
	Y3-1	0.772	0.757			
	Y3-2	0.748	0.760			
	Y3-3	0.779	0.759			
Cognitive engagement	Y3-4	0.731	0.795	5.454	24.789	0.931
	Y3-5	0.726	0.739			
	Y3-6	0.575	0.658			
	Y3-7	0.644	0.630			
	Y3-8	0.547	0.571			
	Y4-1	0.804	0.714			
Emotional engagement	Y4-2	0.817	0.745	2.849	12.952	0.898
	Y4-3	0.783	0.669			
	Y4-4	0.700	0.607			
CTEV: 76.645%						
Overall reliability: 0.965						

Note. CTEV = Cumulative total explanatory variation

3.6.5.2 Reliability and validity analysis of autonomy enhancement scales(AES)

3.6.5.2.1 Validity analysis of autonomy enhancement scales (AES)

SPSS software was used to test the validity of the scale using a factor analysis. The specific methods were as follows: a principal component analysis was selected for the extraction, and the maximum variation method was used for the rotating shaft. According to the results of the factor analysis, the KMO of the scale was 0.952 (reference value was 0.8), and the Bartlett spherical test chi-square was 4437.930 ($p <$

0.001), indicating that there were common factors among the items, making them suitable for a factor analysis (Kaiser, 1974).

The results show that the commonality value of 16 items in the scale was between 0.646 and 0.771, indicating that each item was very important to the common factors.

Three common factors: teacher providing student choices, take student more understanding and culture interest, allowing student express criticism and encouraging their thinking in more independently, were extracted using a method to limit the extraction of common factors to three. The factor loadings of the items of three factors were between 0.525 and 0.791, 0.609 and 0.755 and 0.582 and 0.727, and the factor load was greater than the reference value of 0.45.

After the rotation axis, the eigenvalue of each factor was 4.099, 3.565 and 3.782, and the explanatory variation was 25.617%, 22.280% and 23.639% The cumulative total explanatory variation was 71.537% (50% higher than the reference value). Therefore, the results of the factor analysis show that the pilot test scale had good validity and the same structure as the original scale (Tabachnick et al., 2007).

3.6.5.2.2 Reliability analysis of autonomy enhancement scales (AES)

Cronbach α was used in this study. The analysis results shown that the Cronbach α coefficients were 0.940, 0.946, 0.931 and 0.898 for three factors: teacher providing student choices, take student more understanding and culture interest,

allowing student express criticism and encouraging their thinking in more independently, and the Cronbach's α of the whole scale was 0.954. These results indicate that the pilot test scale had good internal consistency (Nunnally, 1978), as shown in the table 3.10.

The reliability and validity of the 18 items in the PAS scale were analysed. After a factor analysis, two items (X2-2 and X3-6) with poor validity and cross factors were deleted, and 16 items were retained.

Table 3.10

Factor Analysis and Reliability Analysis of AES Scale

Aspects	Item number	Communality	Factor loading	Square Load after Axis Conversion		Cronbach's α
				Eigenvalue	Explanatory variation (%)	
Providing choice	X1-1	0.706	0.744	4.099	25.617	0.916
	X1-2	0.771	0.791			
	X1-3	0.696	0.736			
	X1-4	0.646	0.525			
	X1-5	0.681	0.604			
	X1-6	0.685	0.735			
	X1-7	0.711	0.582			
Fostering understanding and interest	X2-1	0.735	0.747	3.565	22.280	0.850
	X2-3	0.741	0.755			
	X2-4	0.705	0.609			
Allowing criticism and encouraging independent	X3-1	0.711	0.643	3.782	23.639	0.913
	X3-2	0.750	0.582			
	X3-3	0.755	0.713			

thinking	X3-4	0.766	0.724
	X3-5	0.722	0.727
	X3-7	0.665	0.700
CTEV: 71.537%			
Overall reliability: 0.954			

Note. CTEV = Cumulative total explanatory variation

3.6.5.3 Reliability and validity analysis of academic motivation scale(AMS)

3.6.5.3.1 Validity analysis of academic motivation scale (AMS)

SPSS software was used to test the validity of the scale using a factor analysis. The specific methods were as follows: a principal component analysis was selected for the extraction, and the maximum variation method was used for the rotating shaft. According to the results of the factor analysis, the KMO of the scale was 0.931 (reference value was 0.8), and the Bartlett spherical test chi-square was 6477.440 ($p < 0.001$). These results indicate that there were common factors among the items, which was suitable for the factor analysis (Kaiser, 1974).

The results show that the commonality value of the 21 items in the scale was between 0.709 - 0.897, indicating that each item was very important to the common factors.

Using a method that limited the extraction to seven common factors, the seven common factor in this scale were extracted. The factor load of the items among these six factors was between 0.771-0.834, 0.457-0.656, 0.723-0.742, 0.778-0.888, 0.740-0.790, 0.762-0.866, 0.825-0.867, and the factor load was greater than the

reference value of 0.40.

After the rotation axis, the eigenvalue of each factor was 3.045, 1.658, 1.686, 3.637, 1.561, 2.527 and 3.436, and the explanatory variation was14.498%, 7.897%, 8.029%, 17.319%, 7.435%, 12.034% and 16.360%. The cumulative total explanatory variation was 83.571% (50% higher than the reference value). Therefore, the results of the factor analysis show that the structure of the pilot test scale had good validity and was consistent with that of the original scale (Tabachnick et al., 2007).

3.6.5.3.2 Reliability analysis of academic motivation scale (AMS)

Cronbach α was used in this study. The analytical results show that Cronbach α coefficients were 0.932, 0.888, 0.898, 0.927, 0.749, 0.839 and 0.911 for seven factors, and the Cronbach α of the whole scale was 0.936. These results indicate that the pilot test scale had good internal consistency (Nunnally, 1978), as shown in the table 3.11.

26 items were subjected to a factor analysis after the item analysis (M5-3 and M6-1 item had been deleted). After the factor analysis, five items with poor validity and cross factors (M1-1, M2-1, M3-1, M3-4 and M5-2) were deleted and 21 items were retained.

Table 3.11

Factor Analysis and Reliability Analysis of AMS Scale

Aspects	Item number	Communality	Factor loading	Square Load after Axis Conversion	Cronbach's α

				Eigenvalue	Explanatory variation (%)	
Intrinsic motivation - to know and learn	M1-2	0.895	0.834	3.045	14.498	0.932
	M1-3	0.879	0.783			
	M1-4	0.857	0.771			
Intrinsic motivation - towards achievement and accomplishment	M2-2	0.859	0.655	1.658	7.897	0.888
	M2-3	0.883	0.656			
	M2-4	0.709	0.457			
Intrinsic motivation - to experience stimulation	M3-2	0.897	0.742	1.686	8.029	0.898
	M3-3	0.895	0.723			
Extrinsic motivation - identified	M4-1	0.788	0.778	3.637	17.319	0.927
	M4-2	0.869	0.888			
	M4-3	0.893	0.880			
	M4-4	0.834	0.781			
Extrinsic motivation - Introjected regulation	M5-1	0.808	0.740	1.561	7.435	0.749
	M5-4	0.838	0.790			

Table 3.11 (Continued)

Aspects	Item number	Communality	Factor loading	Square Load after Axis Conversion		Cronbach's α
				Eigenvalue	Explanatory variation (%)	
Extrinsic motivation - external regulation	M6-2	0.781	0.831	2.527	12.034	0.839
	M6-3	0.823	0.762			
	M6-4	0.799	0.866			

Amotivation	M7-1	0.787	0.825	3.436	16.360	0.911
	M7-2	0.805	0.867			
	M7-3	0.842	0.862			
	M7-4	0.810	0.854			
CTEV: 83.571 %						
Overall reliability: 0.936						

Note. CTEV = Cumulative total explanatory variation

3.6.5.4 Reliability and validity analysis of CUCEI

3.6.5.4.1 Validity analysis of CUCEI

SPSS software was used to test the validity of the scale using a factor analysis. The specific methods were as follows: a principal component analysis was selected for the extraction, and the maximum variation method was used for the rotating shaft. According to the results of the factor analysis, the *KMO* of the scale was 0.952 (reference value was 0.8), and the Bartlett spherical test chi-square was 11693.260 ($p < 0.001$). This indicates that there were common factors among the items, making them suitable for a factor analysis (Kaiser, 1974).

The results show that the commonality value of 37 items in the scale was between 0.422 and 0.853, indicating that each item was very important to the common factors.

Using a method that limits the extraction of common factors, seven common factors were extracted: personalisation, cooperation, student cohesiveness, equity, task orientation, innovation, individualisation. Among them, the factor loadings of the items were 0.472-0.692, 0.679-0.844, 0.572-0.834, 0.706-0.817, 0.362-0.752, 0.569-0.713

and 0.712-0.840, and the factor loadings of most items were greater than the reference value of 0.4.

After rotating the shaft, the eigenvalue of each factor was 2.755, 5.98, 3.228, 5.724, 2.200, 3.887 and 3.408, and the explanatory variation was 7.447%, 16.161%, 8.725%, 15.470%, 5.946%, 10.505% and 9.209%. The cumulative total explanatory variation was 73.464% (50% higher than the reference value). Therefore, the results of the factor analysis show that the structure of the pilot test scale was consistent with that of the original scale and had good validity (Tabachnick et al., 2007).

3.6.5.4.2 Reliability analysis of CUCEI

Cronbach α was used in this study. The analytical results show that the Cronbach α coefficients were 0.904, 0.947, 0.827, 0.947, 0.810, 0.887 and 0.863, for seven factors, and the Cronbach α of the whole scale was 0.963. These results indicate that the pilot test scale had good internal consistency (Nunnally, 1978), and the result was shown in the table 3.12.

45 items were subjected to a factor analysis after the item analysis (W1-6, W3-4, W7-1 and W7-6 had been deleted). After the factor analysis, 8 items with poor validity and cross factors (W1-5, W3-1, W5-1, W5-2, W5-6, W5-7, W6-5 and W7-7) were deleted, and 37 items were retained.

3.7 The Summary of This Chapter

This chapter contained the details of the structure of this study, including the main variables presented in Chapter 1, and the existing literature about the relationship

between PAS, SE, LM and CC reviewed in Chapter 2.

Table 3.12

Factor Analysis and Reliability Analysis of CUCEI Scale

Aspects	Item number	Communality	Factor loading	Square Load after Axis Conversion		Cronbach's α
				Eigenvalue	Explanatory variation (%)	
Personalisation	W1-1	0.781	0.692	2.755	7.447	0.904
	W1-2	0.792	0.668			
	W1-3	0.822	0.666			
	W1-4	0.751	0.611			
	W1-7	0.734	0.472			
Cooperation	W2-1	0.550	0.679	5.98	16.161	0.947
	W2-2	0.742	0.790			
	W2-3	0.836	0.842			
	W2-4	0.852	0.844			
	W2-5	0.787	0.755			
	W2-6	0.845	0.822			
	W2-7	0.853	0.839			
Student cohesiveness	W3-2	0.661	0.766	3.228	8.725	0.827
	W3-3	0.598	0.600			
	W3-5	0.697	0.770			
	W3-6	0.771	0.834			
	W3-7	0.559	0.572			
Equity	W4-1	0.722	0.710	5.724	15.470	0.947
	W4-2	0.755	0.715			
	W4-3	0.817	0.774			

	W4-4	0.799	0.706			
	W4-5	0.746	0.774			
	W4-6	0.850	0.817			
	W4-7	0.743	0.745			
Task orientation	W5-3	0.805	0.725	2.200	5.946	0.810
	W5-4	0.832	0.752			
	W5-5	0.527	0.362			
Innovation	W6-1	0.781	0.713	3.887	10.505	0.887
	W6-2	0.741	0.688			
	W6-3	0.767	0.629			
	W6-4	0.739	0.632			
	W6-6	0.623	0.606			
	W6-7	0.422	0.569			

Table 3.12 (Continued)

Aspects	Item number	Communality	Factor loading	Square Load after Axis Conversion		Cronbach's α
				Eigenvalue	Explanatory variation (%)	
Individualisation	W7-2	0.615	0.712	3.408	9.209	0.863
	W7-3	0.793	0.840			
	W7-4	0.764	0.766			
	W7-5	0.709	0.731			
CTEV: 73.464%						
Overall reliability: 0.963						

Note. CTEV = Cumulative total explanatory variation

Then, having adopted the four pilot test scales of AES, SEDLAS, AMS, and CUCEI, used SPSS 25 software to operate for an item analysis and reliability analysis,

and an EFA was used to verify the reliability and validity of the pilot test questionnaire so that it could be used as the formal questionnaire in the study.

22 items were found in the Students' Engagement During Learning Activities Scale, which met the requirements of item analysis, reliability and validity, and there was no need to delete any item.

As for the Autonomy Enhancement scales (AES), there were originally 18 items but, after deleting 2 with poor validity (X2-2 and X3-6), 16 items were retained in the subtotal.

There were originally 28 items in the Academic Motivation Scale (AMS), but 7 (M1-1, M2-1, M3-1, M3-4, M5-2, M5-3 and M6-1) were deleted after an item analysis and reliability and validity analysis, leaving 21 items to be retained in the subtotal.

49 items were initially found in the CUCEI, but an item analysis showed that 4 of them (W1-6, W3-4, W7-1 and W7-6) had a low factor loading, causing them to be deleted. At the same time, 8 items that were found to have poor reliability and validity (W1-5, W3-1, W5-1, W5-2, W5-6, W5-7, W6-5 and W7-7) were also deleted. After deleting a total of 12 items, 37 items remained.

Since the 96 remaining items in the pilot test questionnaire had good reliability and validity, they were compiled into the formal questionnaire.

CHAPTER 4

RESEARCH FINDINGS

This chapter have seven parts to present the research findings derived from using various instruments, including a descriptive analysis and reliability and validity test of the formal questionnaire data, a common method variance test, difference analysis, correlation analysis, mediation effect test, moderated mediation effect test and a test of the research hypotheses. In the first part, frequency was mainly used in a descriptive analysis of the demographic background variables to illustrate the status of each variable and test their reliability and validity. The results of the common method variance test are presented in the second part and the results of a difference analysis of PAS, SE, LM and CC in different background variables are presented in the third part. The fourth part is devoted to a correlation analysis, which was conducted to understand the relevant status of these variables. The mediating effect test of process (Model 4), which was aimed to test the regression relationship of various variables and the mediating role of LM between PAS and SE is addressed in the fifth part, while the process's moderated mediating effect test (Model 7), to test the moderating effect of CC between PAS and LM is shown in the sixth part. Finally, the research hypotheses are verified and the results presented in the seventh part.

4.1 The Reliability and Validity Test of Formal Questionnaire

4.1.1 The Descriptive Analysis

4.1.1.1 Descriptive Analysis of Background Variables

When the formal questionnaire was issued, the sample who had participated in the pilot test was excluded, and the questionnaire was issued to the students of six undergraduate colleges in Shaanxi Province. The questionnaire star network platform was used to collect the data and other measured procedures were consistent with those of the pilot test questionnaire. After answering some questions, students could click the submit button to obtain the questionnaire data. A total of 1856 samples were collected for this study but, after deleting unqualified samples (such as too short a response time, continuous samples with the same option and inconsistent samples), 1517 samples were analysed (recovery rate is 81.73%). The normality test of the data showed that the skew coefficient of the samples was between: -0.959 ~ -0.128, and its absolute values were less than the standard value of 3 (Kline, 1998). The kurtosis coefficient was between -1.263 ~ 1.332, and its absolute values were less than the standard value of 3, indicating that the sample data conformed to the normal distribution.

The results show that, in terms of gender, 342 male accounted for 22.5% of the sample and 1175 female accounted for 77.5%. As for their grades, 691 (45.6%) were freshmen, 431 (28.4%) were sophomores, 307 (20.2%) were juniors, and 73 (4.8%) were seniors. 592 (39.0%) of them had majored in science, 558 (36.8%) in liberal arts, 195 (12.9%) in engineering, 125 (8.2%) in art and 47 (3.1%) in other specialist subjects. In terms of family location, 891 (58.7%) of the sample came from rural areas, while 626 (41.3%) came from urban areas. As for their university category,

1283 (84.6%) of them had attended ordinary universities, and 210 (13.8%) had attended key universities. 296 (19.5%) of the sample were members of the class committee, while the majority of 1221 (80.5%) were not. Among them, 143 (9.4%) were from university X, 47 (3.1%) from university C, 98 (6.5%)were from university Q, 928 (61.2%) samples from university W, 159 (10.5%)were from university L, 65 (4.3%) from university Y, 77 (5.1%)samples did not fill in the name of the university. In summary, this sample contained 833 more female than male, more freshmen, sophomores and juniors, and fewer seniors. A large number of them had majored in science and liberal arts whereas a small number had majored in art and engineering. There were fewer students from key universities and more students from rural areas, table 4.1 shown the result.

In this study, category of higher education institutes is divided into teaching university and research university. Since the basic information of Chinese universities is filed with the ministry of education of China, thereby the teaching university and research university can be distinguished by the name of the university in the questionnaire data.

Table 4.1

The Formal Sample's Demographic Variables

Background	Variable	People No.	Percentage (%)
Gender	Female	1175	77.5
	Male	342	22.5
Grade	Freshman	691	45.6
	Sophomore	431	28.4

	Junior	307	20.2
	Senior	73	4.8
Major	Science	592	39.0
	Liberal arts	558	36.8
	Engineering	195	12.9

Table 4.1 (Continued)

Background	Variable	People No.	Percentage (%)
	Art	125	8.2
	Other	47	3.1
Family location	Rural	891	58.7
	Urban	626	41.3
Whether to serve as a class representative	Yes	296	19.5
	Not	1221	80.5
Category of higher education institutes	Teaching university	1283	84.6
	Research university	210	13.8

4.1.1.2 Descriptive Analysis of the SE Variable

The students' engagement during learning activities scale in this study was a 7-point scale with 4 dimensions and 22 items. The mean score of (M = 5.093, SD = 0.970) indicated that these Chinese college students' engagement was at the upper middle level, as shown in table 4.2.

Table 4.2

Descriptive Statistical Table of SE Variable (n＝1517)

Dimension	Numbers of items	*M*	*SD*
Behavioural engagement	5	5.394	1.058
Agentic engagement	5	4.419	1.353
Cognitive engagement	8	5.248	0.994
Emotional engagement	4	5.310	1.053
Overall	22	5.093	0.970

4.1.1.3 Descriptive Analysis of the PAS Variable

The autonomy enhancement scales (AES) used in this study were based on a 5-point scale with 3 dimensions and 16 items. The mean score of (*M* = 3.862, *SD* = 0.616) indicated that these Chinese college students' PAS was above the medium level, as shown in table 4.3.

Table 4.3

Descriptive Statistical Table of PAS Variable (n =1517)

Dimension	Numbers of items	*M*	*SD*
Providing choice	7	3.764	0.665
Fostering understanding and interest	3	3.944	0.673
Allowing criticism and encouraging independent thinking	6	3.880	0.650
Overall	16	3.862	0.616

4.1.1.4 Descriptive Analysis of the LM Variable

The AMS used in this study was based on a 7-point scale with 7 dimensions and 21 items. The mean score of (*M* = 5.564, *SD* = 0.863) indicated that these Chinese

college students' LM was at the upper middle level, as shown in table 4.4.

Table 4.4

Descriptive Statistical Table of the LM Variable (n = 1517)

Dimension	Numbers of items	*M*	*SD*
Intrinsic motivation - to know and learn	3	5.562	0.997
Intrinsic motivation - towards achievement and accomplishment	3	5.787	0.972
Intrinsic motivation - to experience stimulation	2	5.733	0.989
Extrinsic motivation - identified	4	5.591	0.983
Extrinsic motivation - introjected regulation	2	5.720	1.008
Extrinsic motivation - external regulation	3	5.714	0.939
Amotivation (Reverse scoring)	4	4.839	1.718
Overall	21	5.564	0.863

4.1.1.5 Descriptive Analysis of the CC Variable

The CUCEI was applied in present study based on a 5-point scale, 7 dimensions and 37 items. The CC score of (M = 3.873, SD = 0.553) indicated that the CC of these Chinese college students was at the medium level, as shown in table 4.5.

Table 4.5

Descriptive Statistical Table of the CC Variable (n =1517)

Dimension	Numbers of items	*M*	*SD*
Personalisation	5	3.975	0.656

Cooperation	7	3.991	0.608
Student cohesiveness	5	3.701	0.742
Equity	7	3.974	0.634
Task orientation	3	3.956	0.637
Innovation	6	3.682	0.612
Individualisation	4	3.834	0.657
Overall	37	3.873	0.553

4.1.2 Testing Programme and Validity and Reliability Test of Formal Questionnaire

4.1.2.1 Testing programme of formal questionnaire

After the pilot test questionnaire was revised, the formal questionnaire was distributed to the students. In order to maintain the preciseness of the survey process and ensure the reliability of the formal questionnaire, the reliability and validity were verified by SPSS and Amos software. In addition, SPSS software was used to analyse the internal consistency of the formal questionnaire in this study to confirm its reliability, and Amos software was used to test its validity based on a confirmatory factor analysis (CFA).

4.1.2.2 Test of the validity and reliability of the SE formal questionnaire

4.1.2.2.1 Validity Test

The formal questionnaire data was analysed using AMOS software and the maximum likelihood estimation method for a confirmatory factor analysis (CFA). The

model fitness index of SE was verified based on the absolute fitness index, incremental fitness verification index and simplified fitness verification index. According to Bagozzi and Yi (1988), the smaller the chi square, the better, and $p > 0.05$ means that the theoretical model is suitable for the sample model, but since it is often easy to achieve significance if the sample size is too large, other indicators should be considered to test the convergence validity.

After testing the result was shown in table 4.6, in each adaptation index of this study: χ^2 was 2381.266, and χ^2/df was 11.730; GFI was 0.865, AGFI was 0.831, RMR was 0.084, SRMR was 0.0526 and RMSEA was 0.084; NFI was 0.932, TLI was 0.928, CFI was 0.937 and RFI was 0.922. Therefore, most of the fitness indicators met the standard (Bentler & Chou, 1987; Hair et al., 1998; Lomax & Schumacher, 2004), as shown in table 4.6, indicating that the measurement model of SE in this study met the adaptation standard.

Table 4.6

Fitness Index Checklist of SE

Scale	Index	Criteria of fitness index	Results	Model fitness
Absolute fitness index	χ^2	The smaller, the better	2381.266	-
	χ^2/df	<5.000	11.730	Not fit
	GFI	≧.800	0.865	Fit
	AGFI	≧.800	0.831	Fit
	RMR	≦.080	0.084	Proximity fit
	SRMR	≦.080	0.0526	Fit
	RMSEA	≦.100	0.084	Fit
Incremental fitness index	NFI	≧.900	0.932	Fit
	TLI	≧.900	0.928	Fit
	CFI	≧.900	0.937	Fit

	RFI	≧.900	0.922	Fit

The convergence validity of the scale is shown in table 4.7. The standard factor load of each item of SE was between 0.748 and 0.926, which was significant, having reached the standard of more than 0.5 (Hairet et al., 1998); The combined reliability (*CR*) of the four dimensions were 0.951, 0.939, 0.947 and 0.925, respectively and the average variance extracted (*AVE*) were 0.794, 0.755, 0.691 and 0.756 respectively, which all reached the standard of *AVE* value > 0.5. These results show that the scale had good convergent validity (Bagozzi & Yi, 1988).

Table 4.7

Confirmatory Analysis and Reliability Analysis of SE

Dimension	Item	*SFL*	*c.r.*	*S.E.*	*SMC*	*1-SMC*	*α*	*CR*	*AVE*
Behavioural engagement	Y1-1	0.913***			0.833	0.167	0.950	0.951	0.794
	Y1-2	0.918***	61.074	0.017	0.842	0.158			
	Y1-3	0.866***	50.897	0.018	0.750	0.250			
	Y1-4	0.869***	51.032	0.018	0.755	0.245			
	Y1-5	0.888***	53.648	0.017	0.789	0.211			
Agentic engagement	Y2-1	0.765***			0.586	0.414	0.938	0.939	0.755
	Y2-2	0.832***	35.442	0.034	0.692	0.308			
	Y2-3	0.919***	39.404	0.035	0.845	0.155			
	Y2-4	0.926***	39.785	0.035	0.857	0.143			
	Y2-5	0.891***	38.205	0.034	0.794	0.206			
Cognitive engagement	Y3-1	0.860***			0.739	0.261	0.946	0.947	0.691
	Y3-2	0.867***	46.360	0.021	0.752	0.248			
	Y3-3	0.892***	48.511	0.021	0.796	0.204			
	Y3-4	0.836***	42.366	0.023	0.699	0.301			
	Y3-5	0.832***	41.996	0.022	0.692	0.308			
	Y3-6	0.783***	37.796	0.024	0.614	0.386			
	Y3-7	0.821***	40.992	0.023	0.674	0.326			
	Y3-8	0.748***	35.055	0.025	0.559	0.441			

Emotional engagement	Y4-1	0.891***			0.794	0.206	0.924	0.925	0.756
	Y4-2	0.893***	50.979	0.020	0.797	0.203			
	Y4-3	0.873***	48.633	0.019	0.763	0.237			
	Y4-4	0.819***	42.661	0.023	0.671	0.329			

4.1.2.2.2 Reliability test

Cronbach's α was used to test the reliability coefficient of the formal questionnaire of SE. As shown in the table 4.7, the Cronbach's α of the four dimensions of behavioural engagement, agentic engagement, cognitive engagement and emotional engagement were 0.950, 0.938, 0.946 and 0.924 and the total Cronbach's α of SE was 0.967. These results show that the scale had good internal consistency (Nunnally, 1978).

4.1.2.3 Testing the validity and reliability of the PAS formal questionnaire

4.1.2.3.1 Validity test

Amos was used to measure the PAS scale (PAS), and the maximum likelihood estimation method was used to conduct the confirmatory factor analysis (CFA). After testing result was shown in table 4.8, in each adaptation index of this study: χ^2 was 1458.716, and χ^2/df was 14.443; GFI was 0.872, AGFI was 0.827, RMR was 0.029, SRMR was 0.047, RMSEA was 0.094; NFI was 0.929, TLI was 0.921, CFI was 0.934 and RFI was 0.916. Therefore, most of the fitness indicators met the standard (Bentler & Chou, 1987; Hair et al., 1998; Lomax & Schumacher, 2004), as shown in

table 4.8. indicating that the measurement model of PAS in this study met the adaptation standard.

Table 4.8

Fitness Index Checklist of PAS

Scale	Index	Criteria of fitness index	Results	Model fitness
Absolute fitness index	χ^2	The smaller, the better	1458.716	-
	χ^2/df	<5.000	14.443	Not Fit
	GFI	≧.800	0.872	Fit
	AGFI	≧.800	0.827	Fit
	RMR	≦.080	0.029	Fit

Table 4.8 (Continued)

Scale	Index	Criteria of fitness index	Results	Model fitness
	SRMR	≦.080	0.047	Fit
	RMSEA	≦.100	0.094	Fit
Incremental fitness index	NFI	≧.900	0.929	Fit
	TLI	≧.900	0.921	Fit
	CFI	≧.900	0.934	Fit
	RFI	≧.900	0.916	Fit

The convergence validity of the scale is shown in table 4.9. The results show that, since the load of standardised factors of PAS for each item ranged from 0.710 to 0.895, they were both significant, having reached a standard greater than 0.5 (Hair et al., 1998); The combined reliability (*CR*) of the three dimensions were 0.914, 0.910 and 0.924 respectively, all of which reached the *CR* value > 0.7; The average variance extracted (*AVE*) were 0.605, 0.772 and 0.670 respectively, which all reached the standard of *AVE* value > 0.5. These results show that this scale had good convergent validity (Bagozzi & Yi, 1988).

Table 4.9

Confirmatory Analysis and Reliability Analysis of PAS

Dimension	Item	*SFL*	*c.r.*	*S.E.*	*SMC*	*1-SMC*	*α*	*CR*	*AVE*
Providing choice	X1-1	0.778***			0.605	0.395	0.913	0.914	0.605
	X1-2	0.804***	34.041	0.030	0.646	0.354			
	X1-3	0.761***	31.770	0.031	0.579	0.421			
	X1-4	0.714***	29.407	0.029	0.510	0.490			
	X1-5	0.832***	35.516	0.029	0.692	0.308			
	X1-6	0.710***	29.227	0.034	0.504	0.496			
	X1-7	0.837***	35.774	0.029	0.701	0.299			
Fostering understanding and interest	X2-1	0.864***			0.746	0.254	0.911	0.910	0.772
	X2-3	0.877***	46.073	0.022	0.769	0.231			
	X2-4	0.895***	47.844	0.022	0.801	0.199			
Allowing criticism and encouraging independent	X3-1	0.850***			0.723	0.278	0.922	0.924	0.670

Table 4.9 (Continued)

Dimension	Item	*SFL*	*c.r.*	*S.E.*	*SMC*	*1-SMC*	*α*	*CR*	*AVE*
Allowing criticism and encouraging independent	X3-2	0.836***	41.461	0.022	0.699	0.301			
	X3-3	0.794***	38.074	0.025	0.630	0.370			
	X3-4	0.879***	45.322	0.021	0.773	0.227			
	X3-5	0.798***	38.390	0.024	0.637	0.363			
	X3-7	0.747***	34.642	0.023	0.558	0.442			

Note. All the above factors reach a significant ***p<0.001

4.1.2.3.2 Reliability test

Cronbach's α was used to test the reliability coefficient of the PAS scale and the results are shown in table 4.9. The Cronbach's α of the three dimensions of selection, cultivating understanding and interest, allowing criticism and encouraging independent thinking were 0.913, 0.911 and 0.922, respectively, and the total Cronbach's α of the scale was 0.959. These results show that the scale had good

internal consistency (Nunnally, 1978).

4.1.2.4 Testing the validity and reliability of the LM formal questionnaire

4.1.2.4.1 Validity test

Amos was used to measure the LM scale, and the maximum likelihood estimation method was used for the confirmatory factor analysis (CFA). After testing the result was shown in table 4.10, in each adaptation index of this study: χ^2 was 1205.755, and χ^2/df was 7.177; GFI was 0.927, AGFI was 0.900, RMR was 0.055, SRMR was 0.035, RMSEA was 0.064; NFI was 0.967, TLI was 0.964, CFI was 0.971 and RFI was 0.958. Therefore, all the fitness indices met the standard (Bentler & Chou, 1987; Hair et al., 1998; Lomax & Schumacher, 2004), as shown in table 4.10, indicating that the measurement model of LM in this study met the adaptation standard.

Table 4.10

Fitness Index Checklist of LM

Scale	Index	Criteria of fitness index	Results	Model fitness
Absolute fitness index	χ^2	The smaller, the better	1205.755	-
	χ^2/df	<5.000	7.177	Non fit
	GFI	≧.800	0.927	Fit
	AGFI	≧.800	0.900	Fit
	RMR	≦.080	0.055	Fit
	SRMR	≦.080	0.035	Fit
	RMSEA	≦.100	0.064	Fit
Incremental fitness	NFI	≧.900	0.967	Fit
	TLI	≧.900	0.964	Fit

index	CFI	≧.900	0.971	Fit
	RFI	≧.900	0.958	Fit

The convergence validity of the scale is shown in table 4.11. The results show that the load of standardised factors of each item of LM ranges from 0.652 to 0.959, which is significant, having reached a standard greater than 0.5 (Hair et al., 1998); The combined reliability (*CR*) of the seven dimensions were 0.954, 0.957, 0.931, 0.928, 0.903 0.807 and 0.947, respectively, all of which reached the CR value > 0.7; The average variance extracted (*AVE*) were 0.874, 0.882, 0.871, 0.763, 0.824, 0.588 and 0.816 respectively, which all reached the standard of *AVE* value > 0.5. These results show that the scale had good convergent validity (Bagozzi & Yi, 1988).

Table 4.11

Confirmatory Analysis and Reliability Analysis of LM

Dimension	Item	*SFL*	*c.r.*	*S.E.*	*SMC*	*1-SMC*	*α*	*CR*	*AVE*
Intrinsic motivation	M1-2	0.904***			0.817	0.183	0.953	0.954	0.874
- to know and learn	M1-3	0.959***	67.379	0.015	0.920	0.080			

Table 4.11 (Continued)

Dimension	Item	*SFL*	*c.r.*	*S.E.*	*SMC*	*1-SMC*	*α*	*CR*	*AVE*
	M1-4	0.941***	62.934	0.016	0.885	0.115			
Intrinsic motivation	M2-2	0.950***			0.903	0.098			
- towards	M2-3	0.943***	77.932	0.013	0.889	0.111	0.956	0.957	0.882
achievement and	M2-4	0.924***	70.708	0.014	0.854	0.146			
Intrinsic motivation	M3-2	0.921***			0.848	0.152	0.931	0.931	0.871
- to experience	M3-3	0.945***	64.991	0.016	0.893	0.107			
	M4-1	0.868***			0.753	0.247			
Extrinsic motivation	M4-2	0.846***	43.687	0.023	0.716	0.284	0.928	0.928	0.763
- identified	M4-3	0.860***	44.634	0.024	0.740	0.260			
	M4-4	0.918***	50.962	0.021	0.843	0.157			

Extrinsic motivation - Introjected	M5-1	0.897***			0.805	0.195	0.903	0.903	0.824
	M5-4	0.918***	54.599	0.018	0.843	0.157			
Extrinsic motivation - external regulation	M6-2	0.699***			0.489	0.511	0.811	0.807	0.588
	M6-3	0.922***	31.271	0.037	0.850	0.150			
	M6-4	0.653***	24.109	0.040	0.426	0.574			
Amotivation	M7-1	0.878***			0.771	0.229	0.946	0.947	0.816
	M7-2	0.882***	49.389	0.020	0.778	0.222			
	M7-3	0.940***	56.096	0.019	0.882	0.118			
	M7-4	0.912***	52.225	0.019	0.832	0.168			

Note. All the above factors reached a significant ***p<0.001; CR refers to composite reliability; AVE refers to average variance extracted.

4.1.2.4.2 Reliability test

Cronbach's α was used to test the reliability coefficient of the Academic Motivation Scale. As shown in the table 4.11, Cronbach's α of the seven dimensions of intrinsic motivation - to know and learn, intrinsic motivation - toward achievement and accomplishment, Intrinsic motivation - to experience stimulation, extrinsic motivation - identified, extrinsic motivation - introjected regulation, extrinsic motivation - external regulation, amotivation were 0.953, 0.956, 0.931 0.928, 0.903, 0.811 and 0.946 respectively, and the total Cronbach's α of the Academic Motivation Scale was 0.948. These results show that the scale had good internal consistency (Nunnally, 1978).

4.1.2.5 Testing the validity and reliability of the CC formal questionnaire

4.1.2.5.1 Validity test

Amos was used to measure the college and university classroom environment inventory (CUCEI), and the maximum likelihood estimation method was used for the confirmatory factor analysis (CFA). After testing the result was shown in table 4.12, in each adaptation index of this study: χ^2 was 3789.493, and χ^2/df was 6.233; GFI was 0.873, AGFI was 0.853, RMR was 0.025, SRMR was 0.045 and RMSEA was 0.059; NFI was 0.945, TLI was 0.949, CFI was 0.953 and RFI was 0.940. Therefore, all the fitness indices met the standard (Bentler & Chou, 1987; Hair et al., 1998; Lomax & Schumacher, 2004), as shown in table 4.12, indicating that the CC measurement model in this study met the adaptation standard.

The convergence validity of the scale is shown in table 4.13. These results show that the load of standardised factors of each item of CUCEI ranges from 0.700 to 0.946 (except W6-7, which is 0.237). Therefore, they are all significant, having met the standard of more than 0.5 (Hair et al., 1998). The combined reliability (*CR*) of the seven dimensions were 0.952, 0.957, 0.926, 0.965, 0.934, 0.927 and 0.952, respectively, and the average variance extracted (*AVE*) were 0.798, 0.764, 0.716, 0.798, 0.824, 0.701 and 0.832 respectively. Therefore, they all reached the standard of *AVE* > 0.5, indicating that the scale had good convergent validity (Bagozzi & Yi, 1988).

Table 4.12

Fitness Index Checklist of CC

Scale	Index	Criteria of fitness index	Results	Model fitness
Absolute fitness index	χ^2	The smaller, the better	3789.493	-
	χ^2/df	<5.000	6.233	Non fit
	GFI	≧.800	0.873	Fit
	AGFI	≧.800	0.853	Fit
	RMR	≦.080	0.025	Fit

	SRMR	≦.080	0.045	Fit
	RMSEA	≦.100	0.059	Fit
Incremental fitness index	NFI	≧.900	0.945	Fit
	TLI	≧.900	0.949	Fit
	CFI	≧.900	0.953	Fit
	RFI	≧.900	0.940	Fit

Table 4.13

Confirmatory Analysis and Reliability Analysis of CC

Dimension	Item	*SFL*	*c.r.*	*S.E.*	*SMC*	*1-SMC*	*α*	*CR*	*AVE*
Personalisation	W1-1	0.889***			0.790	0.210	0.952	0.952	0.798
	W1-2	0.891***	52.694	0.020	0.794	0.206			
	W1-3	0.912***	55.029	0.018	0.832	0.168			
	W1-4	0.884***	50.941	0.020	0.781	0.219			
	W1-7	0.890***	51.537	0.019	0.792	0.208			
Cooperation	W2-1	0.700***			0.490	0.510	0.954	0.957	0.764
	W2-2	0.826***	31.294	0.034	0.682	0.318			
	W2-3	0.888***	33.408	0.034	0.789	0.211			
	W2-4	0.924***	34.677	0.033	0.854	0.146			
	W2-5	0.902***	33.878	0.033	0.814	0.186			
	W2-6	0.927***	34.721	0.033	0.859	0.141			
	W2-7	0.927***	34.744	0.033	0.859	0.141			
Student cohesiveness	W3-2	0.796***			0.634	0.366	0.924	0.926	0.716
	W3-3	0.804***	34.887	0.024	0.646	0.354			
	W3-5	0.892***	40.898	0.026	0.796	0.204			
	W3-6	0.884***	39.911	0.028	0.781	0.219			
	W3-7	0.851***	37.297	0.026	0.724	0.276			

Table 4.13 (Continued)

Dimension	Item	*SFL*	*c.r.*	*S.E.*	*SMC*	*1-SMC*	*α*	*CR*	*AVE*
Equity	W4-1	0.879***			0.773	0.227	0.964	0.965	0.798
	W4-2	0.864***	48.192	0.022	0.746	0.254			
	W4-3	0.929***	56.925	0.018	0.863	0.137			
	W4-4	0.946***	59.410	0.018	0.895	0.105			
	W4-5	0.836***	44.841	0.022	0.699	0.301			
	W4-6	0.924***	55.895	0.019	0.854	0.146			

	W4-7	0.868***	48.504	0.020	0.753	0.247			
Task orientation	W5-3	0.882***			0.778	0.222	0.933	0.934	0.824
	W5-4	0.938***	56.621	0.019	0.880	0.120			
	W5-5	0.903***	51.838	0.019	0.815	0.185			
Innovation	W6-1	0.848***			0.719	0.281	0.883	0.927	0.701
	W6-2	0.905***	49.024	0.022	0.819	0.181			
	W6-3	0.938***	52.435	0.021	0.880	0.120			
	W6-4	0.945***	52.978	0.022	0.893	0.107			
	W6-6	0.915***	49.553	0.023	0.837	0.163			
	W6-7	0.237***	9.241	0.044	0.056	0.944			
Individualisation	W7-2	0.892***			0.796	0.204	0.951	0.952	0.832
	W7-3	0.931***	58.611	0.018	0.867	0.133			
	W7-4	0.906***	54.782	0.019	0.821	0.179			
	W7-5	0.918***	56.437	0.018	0.843	0.157			

4.1.2.5.2 Reliability test

Cronbach's α was used to test the reliability coefficient of CUCEI. As shown in the table 4.13, the Cronbach's α of the seven dimensions of personalisation, cooperation, student cohesiveness, equity, task orientation, innovation and individualisation were 0.952, 0.954, 0.924, 0.964, 0.933, 0.883 and 0.951 respectively, and the total Cronbach's α of the scale was 0.979. These results show that the scale had good internal consistency (Nunnally, 1978).

4.1.3 Discriminant Validity of the Formal Questionnaire

A more rigorous *AVE* method was used to evaluate the discriminant validity in this study. According to Fornell and Lacker (1981), if the *AVE* root of each factor is

greater than the correlation coefficient of each corresponding variable, it indicates that there is discriminant validity between the factors. The results shown in table 4.14 imply that the ave root value of each factor is greater than most of the standardised correlation coefficients outside the diagonal; therefore, the data in this study still had certain discriminant validity.

Table 4.14

Discriminant Validity of Formal Questionnaire

	Y1	Y2	Y3	Y4	X1	X2	X3	M1	M2	M3
Y1	0.891									
Y2	0.615	0.869								
Y3	0.706	0.644	0.831							
Y4	0.726	0.618	0.783	0.869						
X1	0.507	0.506	0.557	0.611	0.778					
X2	0.463	0.343	0.506	0.561	0.775	0.879				
X3	0.456	0.394	0.494	0.574	0.783	0.835	0.819			
M1	0.531	0.367	0.595	0.612	0.495	0.546	0.566	0.935		
M2	0.428	0.229	0.494	0.512	0.408	0.533	0.520	0.812	0.939	
M3	0.419	0.275	0.520	0.521	0.414	0.506	0.514	0.771	0.853	0.933
M4	0.477	0.340	0.526	0.556	0.509	0.533	0.551	0.710	0.728	0.744
M5	0.444	0.262	0.473	0.506	0.425	0.500	0.516	0.679	0.765	0.757
M6	0.307	0.152	0.368	0.386	0.330	0.435	0.429	0.578	0.692	0.668
M7	0.196	0.000	0.177	0.226	0.224	0.362	0.320	0.304	0.395	0.328
W1	0.422	0.330	0.441	0.507	0.635	0.684	0.716	0.555	0.539	0.514
W2	0.429	0.309	0.449	0.512	0.549	0.610	0.600	0.582	0.592	0.594
W3	0.413	0.416	0.415	0.480	0.502	0.443	0.471	0.399	0.318	0.354
W4	0.410	0.287	0.444	0.507	0.574	0.652	0.659	0.548	0.546	0.538
W5	0.421	0.295	0.425	0.483	0.546	0.594	0.590	0.532	0.534	0.522
W6	0.420	0.350	0.436	0.492	0.571	0.588	0.605	0.500	0.446	0.468

W7	0.407	0.370	0.434	0.490	0.601	0.575	0.607	0.493	0.428	0.460

Table 4.14 (continued)

	M4	M5	M6	M7	W1	W2	W3	W4	W5	W6	W7
M4	0.873										
M5	0.806	0.908									
M6	0.655	0.735	0.767								
M7	0.327	0.351	0.265	0.903							
W1	0.554	0.536	0.455	0.352	0.893						
W2	0.593	0.601	0.528	0.367	0.759	0.874					
W3	0.431	0.374	0.282	0.133	0.552	0.574	0.846				
W4	0.571	0.534	0.454	0.363	0.799	0.766	0.618	0.893			
W5	0.527	0.550	0.475	0.338	0.702	0.714	0.546	0.810	0.908		
W6	0.532	0.493	0.359	0.347	0.710	0.665	0.555	0.740	0.734	0.837	
W7	0.543	0.501	0.369	0.245	0.698	0.655	0.565	0.721	0.697	0.820	0.912

Note. ***$p<0.001$; The oblique lower triangle is the correlation coefficient; The slash is the square of *ave*; Only the correlation coefficients of Y2 and M7 were not significant, and the other correlation coefficients were significant ($p < 0.001$).

4.2 Common Method Variance

Since the self-reporting method was used to collect the data in this study, there is a chance of common method deviation. Therefore, based on the practice of previous scholars, two methods were adopted to avoid common method deviation, namely, prior programme control and a post-hoc statistical test. Specific to this study, to control the impact of common method deviation on the research results, strict procedural control was adopted in implementing the questionnaire, clear guidelines

were provided and it was emphasised that the questionnaire results would only be used for academic research, completed anonymously, and the data would remain absolutely confidential. In terms of the response to the questions, the method of scoring was different for each question. Some were scored on a 5-point or 7-point scale. As for the post-hoc statistical test after the data collection, the Harman single factor test method was used to put all the items into one EFA. In the first principal component without rotation, factor explained variance was used to determine the existence of common method deviation. The results of the study show that 13 factors had an eigenvalue greater than 1, and the variation explained by the first factor was 44.330%, which was less than 50% of the reference value. Therefore, it can be considered that there was no serious common method deviation in the data of this study.

4.3 Differential Analysis

A differential analysis is used to test the differences of various factors in background variables. An independent sample t-test was used in this study to test the differences of SE, PAS, LM and CC based on gender, family location, class representative and university category. A single factor ANOVA was used to test the differences of each factor in terms of grade and major.

4.3.1 Analysis of Gender Differences in Various Variables

An independent sample t-test was used to analyse the differences of college students of different genders in respect of SE, PAS, LM and CC, and the results are

shown in table 4.15.

In terms of LM, the difference between genders, $t = 3.065$, $p = 0.002$ (< 0.01), reached a significant level of 0.01, and the LM of females ($M = 5.141$) was significantly higher than that of males ($M = 4.246$), indicating that female students were closer to intrinsic motivation in the motivation continuum. In summary, there were significant differences due to gender in the variable of LM among the four variables of SE, PAS, LM and CC in this study, while there were no gender differences in other variables.

Table 4.15

Analysis of T-test for Gender Differences

Dimension	Mean (*SD*)		*t*	*p*	Result
	Female (*n* = 1175)	Male (*n* = 342)			
SE	5.090 (0.941)	5.104 (1.063)	-0.221	0.826	-
PAS	3.855 (0.613)	3.888 (0.626)	-0.859	0.391	-
LM	5.141 (4.414)	4.246 (4.852)	3.065	0.002	F > M
CC	3.875 (0.546)	3.867 (0.580)	0.224	0.823	-

Note. F is female; M is male.

4.3.2 ANOVA Analysis of Grade in Various Variables

A one-way ANOVA was used to analyse the differences of four grades of college students in terms of SE, PAS, LM and CC. The homogeneity of the data was tested first before conducting an ANOVA test, and finally a Scheffe post-hoc test was chosen to show the differences and ranking of grades. The results are shown in table 4.16.

In terms of SE, there were significant differences in the students' overall SE in terms of grades, with $F = 2.969$ ($p = 0.031$), reaching a significant level of 0.05, and senior students' SE ($M = 5.327$) was much greater than that of freshmen ($M = 5.022$). This data shows that the level of SE of senior students was significantly higher than that of freshmen among these college students.

There was no significant difference in PAS and CC.

In terms of LM, there were significant differences between grades, with $F = 11.935$ ($p = 0.000$), reaching a significant level of 0.001. The LM of freshmen was higher than that of sophomores and juniors, seniors' LM was higher than that of sophomores, and seniors were more motivated to learn than juniors. This data shows that seniors and freshmen were closer to being intrinsically motivated, while sophomores and juniors were closer to amotivation.

Table 4.16

Analysis of ANOVA for Grades

Dimension	Mean (*SD*) Freshman (*n* = 691)	Sophomore (*n* = 431)	Junior (*n* =3 07)	Senior (*n* = 73)	*F*	*p*	Result
SE	5.022 (0.949)	5.1218 (0.999)	5.1361 (0.965)	5.327 (1.018)	2.969	0.031	Se > F
PAS	3.881 (0.594)	3.875 (0.644)	3.793 (0.627)	3.880 (0.619)	1.565	0.196	-
LM	5.533 (4.443)	4.463 (4.531)	3.935 (4.492)	5.914 (4.533)	11.935	0.000	F > So, F> J, Se > So, Se> J
CC	3.873	3.878	3.833	3.980	1.441	0.229	-

	(0.544)	(0.581)	(0.532)	(0.572)

Note: Se=Senior; F=Freshman; So=Sophomore; J= Junior

4.3.3 ANOVA Analysis of Majors in Various Variables

A one-way ANOVA was applied to analyse the differences of college students of four majors, namely, liberal arts, science, engineering and art, in terms of SE, PAS, LM and CC. The data was first tested for homogeneity before applying the ANOVA test, and a Scheffe post-hoc test was finally chosen to show the differences and ranking of majors. The results are shown in table 4.17.

There were significant differences in majors in terms of SE, with $F = 10.168$, ($p = 0.000$), reaching a significant level of 0.001, and liberal arts' students' engagement was higher than that of science and engineering students. Art students were more highly engaged than their science and engineering counterparts. Therefore, according to these results, liberal arts and art students had a higher level of SE.

As for PAS, there were significant differences in majors with $F = 3.460$ ($p = 0.016$). Liberal arts majors perceived more teacher autonomy support than science and art majors, and engineering majors' perception of teacher autonomy support was higher than that of science and art majors. Therefore, according to these results, liberal arts and engineering majors generally had a greater perception of teacher autonomy support.

There were significant differences among majors in terms of LM, with $F = 4.370$ ($p = 0.005$), reaching a significant level of 0.01. Liberal arts, science and engineering students were significantly more motivated to learn than art students, who had the lowest level of LM.

In terms of CC, there were significant differences in majors, with $F = 2.865$ ($p = 0.036$), reaching a significant level of 0.05, CC was more important for liberal art students than art students and it was also less important for art students than engineering students.

In summary, major was a very important factor to indicate significant differences in all variables and, according to these results, liberal arts students perform best.

Table 4.17

Analysis of ANOVA for Major

Dimension	Mean (*SD*) Liberal (*n* = 558)	Science (*n* = 592)	Engineering (*n* = 195)	Art (*n* = 125)	*F*	*p*	Result
SE	5.231 (0.930)	4.959 (0.961)	5.024 (1.045)	5.313 (0.964)	10.168	0.000	L>S, L>E, A>S, A>E
PAS	3.901 (0.600)	3.824 (0.592)	3.939 (0.637)	3.770 (0.733)	3.460	0.016	L>S,L>A, E>S,E>A
LM	5.020 (4.546)	5.188 (4.494)	4.817 (4.442)	3.602 (4.536)	4.370	0.005	L>A,S>A, E>A
CC	3.912 (0.536)	3.862 (0.547)	3.904 (0.548)	3.763 (0.620)	2.865	0.036	L>A, E>A

Note. L=Liberal Arts, S=Science, E=Engineering, A=Art.

4.3.4 Analysis of Family Location Differences in Various Variables

According to the location of the students' families, the sources of college students can be divided into rural and urban areas. An independent sample *t*-test was used to analyse the differences of college students in terms of SE, PAS, LM and CC,

and the results are shown in table 4.18. As for SE, PAS, LM and CC, the *p* values were greater than 0.05, indicating that there was no significant difference in each variable in the students' location.

Table 4.18

Analysis of T-test for Family Location Differences

Dimension	Mean (*SD*)		*t*	*p*	Result
	Rural (*n* = 891)	Urban (*n* = 626)			
SE	5.056 (0.987)	5.145 (0.942)	-1.779	0.075	-
PAS	3.863 (0.605)	3.861 (0.632)	0.067	0.946	-
LM	4.872 (4.470)	5.035 (4.618)	-0.689	0.491	-
CC	3.872 (0.530)	3.875 (0.585)	-0.098	0.922	-

4.3.5 Analysis on the Difference of Variables between Whether to Serve as Class Representative

Administrators of Chinese universities usually form class representatives by choosing students with an excellent character and learning ability. The class representatives are an example of the heart of students. Therefore, an independent sample t-test was used to analyse the differences in SE, PAS, LM and CC from the perspective of whether to serve as a class representative, and the results are shown in table 4.19.

In terms of SE, there was a significant difference in students who are members of the class representatives or not, t = -3.560, P = 0.000 (< 0.001), reaching a significant level of 0.001, and the SE of those who are class representatives (M = 5.272) was significantly higher than that of not as cadres (M = 5.049). Therefore, these results

show that the SE of class representatives was significantly higher than that of non-class representative.

There was no significant difference in PAS, LM and CC. The t values were: -0.392 (p = 0.695), -0.201 (p = 0.841), -1.867(p = 0.062). This data shows that students' performance was the same in terms of PAS, LM and CC, whether to serve as class representatives or not.

Table 4.19

Analysis of T-test of Class Representatives

Dimension	Mean (*SD*)		*t*	*p*	Result
	No (n = 1221)	Yes (n = 296)			
SE	5.049 (0.968)	5.272 (0.958)	-3.560	0.000	Yes > No
PAS	3.859 (0.611)	3.875 (0.638)	-0.392	0.695	-
LM	4.928 (4.488)	4.988 (4.711)	-0.201	0.841	-
CC	3.860 (0.553)	3.927 (0.552)	-1.867	0.062	-

4.3.6 Analysis of differences at the Categories of Higher Educational Institutions in Various Variables

The categories of higher educational institutions attended by these college students can be divided into teaching university and key university. An independent sample *t*-test was used to analyse the differences of SE, PAS, LM and CC of students at different categories of higher educational institutions. The results are shown in table 4.20.

There were significant differences in SE at the categories of higher educational institutions, t = 2.591, p = 0.010, reaching a significant level of 0.05, and

the SE of teaching university students (M = 5.119) was significantly higher than that of research University students (M = 4.934). On the other hand, there was no significant difference of PAS, with a score between 3.851 and 3.936, and t = -1.836, p = 0.067 (> 0.05), which did not reach the significant level of 0.05. In terms of LM, there was a significant difference between teaching university students and research university students, t = -2.295, p = 0.022 (< 0.05), reaching a significant level of 0.05, and the LM of research university students (M = 5.625) was significantly higher than that of teaching university students (M = 4.855). This result shows that research university students are closer to intrinsic motivation in the continuum of self-determined motivation. As for the CC, there was a significant difference between teaching university students and research university students, t = -2.164, p = 0.031 (< 0.05), reached a significant level of 0.05, and the CC of research university students (M = 3.950) was significantly higher than that of teaching university students (M = 3.860). In conclusion, there were significant differences in SE, LM and CC at the categories of higher educational institutions.

Table 4.20

Analysis of T-test for Categories of Higher Educational Institutions

	Mean (*SD*)				
Dimension	Teaching university (n = 1283)	Research university (n = 210)	t	p	Result
SE	5.119 (0.952)	4.934 (0.999)	2.591	0.010	T > S
PAS	3.851 (0.616)	3.936 (0.614)	-1.836	0.067	-
LM	4.855 (4.503)	5.625 (4.530)	-2.295	0.022	S > T
CC	3.860 (0.551)	3.950 (0.570)	-2.164	0.031	S > T

Note. T is teaching university, S is research University.

4.4 Correlation Analysis

Pearson's correlation coefficient was used in this study to analyse the degree of correlation between the four variables. The mean, standard deviation and correlation coefficient of each variable are shown in table 4.21, in which it is indicated that the Chinese college students' total average scores of SE (M = 5.093, SD = 0.970, 7-point scale), PAS (M = 3.862, SD = 0.616, 5-point scale), LM (M = 4.939, SD = 4.531, value range - 18 ~ + 18) and CC (M = 3.873, SD = 0.553, 5-point scale) were higher than the theoretical median, and at the upper middle level. At the same time, the results of Pearson's correlation coefficient analysis of SE and PAS (R = 0.608, p < 0.001), indicated that SE and PAS were significantly moderately positively correlated; SE and LM (R = 0.374, p < 0.001) indicated that SE and LM were nearly moderately positively correlated; SE and CC (R = 0.561, p < 0.001) indicated a moderate positive correlation between SE and CC; PAS and LM (R = 0.502, p < 0.001) indicated that PAS was moderately positively correlated with LM; PAS and CC (R = 0.740, p < 0.001) indicated that PAS was highly positively correlated with CC; and LM and CC (R = 0.540, p < 0.001), indicated that there was a moderate positive and significant correlation between LM and CC. In short, there was almost a medium intensity positive correlation between the four variables.

Table 4.21

Summary of Correlation Analysis of the Four Variables

Variables	*M*	*SD*	*SE*	PAS	LM	CC
SE	5.093	0.970	1			

PAS	3.862	0.616	0.608***	1		
LM	4.939	4.531	0.374***	0.502***	1	
CC	3.873	0.553	0.561***	0.740***	0.540***	1

Note.***p＜0.001.

4.5 Mediating Effect Test of Process Model

Because the influence of the background variable is very small, so the background variable is only used for the above difference analysis, and these will not be considered in the following model test. The possible effects was revealed, and the process model (Model 4) compiled by Hayes (2013) was used to test the mediating effect of PAS as an independent variable, SE as a dependent variable and LM as a mediating variable. The results are shown in table 4.22, in which it is indicated that Chinese college students' PAS can significantly and directly predict SE (B = 0.956, t = 29.786, p < 0.001); PAS can significantly and positively predict LM (B = 3.694, t = 22.617, p < 0.001); LM can significantly and positively predict SE (B = 0.020, t = 3.886, p < 0.001); and although PAS has less ability to predict SE after adding the mediating variable of LM, it still has a significant effect (B = 0.884, t = 23.922, p < 0.001). This shows that LM has a partially mediating effect.

The bootstrapping method was used to further test the mediating effect of LM and the results are shown in table 4.23, in which it is indicated that the indirect effect of LM was 0.072, and the confidence interval was [0.031, 0.111], excluding 0. According to these results, LM has a certain partially mediating effect.

Table 4.22

Analysis of Mediating Effect (n =1517)

Dependent variables	Model1 SE		Model2 LM		Model3 SE	
	B	*t*	*B*	*t*	*B*	*t*
Constant	1.399	11.142***	-9.329	-14.603***	1.581	11.846***
PAS	0.956	29.786***	3.694	22.617***	0.884	23.922***
LM					0.020	3.886***
F	887.233***		511.530***		455.295***	
R^2	0.369		0.252		0.376	

*Note.*****p*＜0.001

Table 4.23

Bootstrapping Mediation Effect Test

Effect type	*B*	*SE*	*95% LLCI*	*95% ULCI*
Total effect	0.956	0.032	0.893	1.019
Direct effect	0.884	0.037	0.812	0.957
Indirect effect	0.072	0.021	0.031	0.111

Hypotheses H1, H2, H3 and H4 were all supported by this analysis. It was proved that hypothesis H1: College students' PAS has a positive effect on SE; H2: College students' PAS has a positive effect on LM; H3: College students' LM has a positive effect on SE; and H4: LM has a mediating effect between college students' perceived teacher's autonomy support and SE.

4.6 Moderated Mediating Effect Test of the Process Model

Because the influence of the background variable is very small, so the background variable is only used for the above difference analysis, and these will not be considered in the following model test. In this section, a PROCESS Macro was used

to test the moderating effect of CC, and the bootstrap method was chosen for more rigorous verification. Specifically, PAS was taken as the independent variable, SE as the dependent variable, LM as the mediating variable, CC as the moderating variable, and the CC data was classified by dividing it into 27% high and low groups. In addition, various demographic variables were taken as the control variables and input into the process macro. The results are shown in table 4.24, in which it is indicated that the regression coefficient B value of the independent variable, PAS on LM was 1.561 (t = 4.801, p < 0.001, *CI*: 0.923~20200), and indicates that PAS has a positive impact on LM. The regression coefficient B value of the moderating variable, CC, on LM was 3.286 (t = 9.294, p < 0.001, *CI:* 2.592~3.980), and indicates that the CC has a positive impact on LM. The regression coefficient *B* value of the intersection of PAS and CC on LM was 1.919 (t = 4.173, p < 0.001, *CI:* 1.017 ~ 2.822), and reaching a significant level of 0.001. These results demonstrate that the impact of PAS on LM is moderated by CC.

Table 4.24

Moderating Effect of CC (n =767)

Dependent Variables	Model1 LM				Model2 SE			
	B	*t*	*LLCI*	*ULCI*	*B*	*t*	*LLCI*	*ULCI*
Constant	3.304	13.216***	2.813	3.795	4.847	95.671***	4.748	4.947
PAS	1.561	4.801***	0.923	2.200	0.884	18.297***	0.789	0.979
LM					0.032	4.183***	0.017	0.047
CC	3.286	9.294***	2.592	3.98				

				0		
PAS × CC	1.919	4.173***	1.017	2.822		
F		250.473***			384.392***	
R^2		0.480			0.485	

Note. ***p<0.001

The direction and size of the moderating effect can be further analysed by drawing an interaction diagram, as shown in figure 4.1. It can be seen from the data in the figure that the lines of the low group and high group of CC intersect, which indicates that there is an interactive effect between them. When the CC changes from low to high, the coefficient and slope of the line increase, and the LM also increases, that indicating a positive moderating effect. In other words, college students are more motivated to learn and LM increase more faster in a high-CC than in a low-class one.

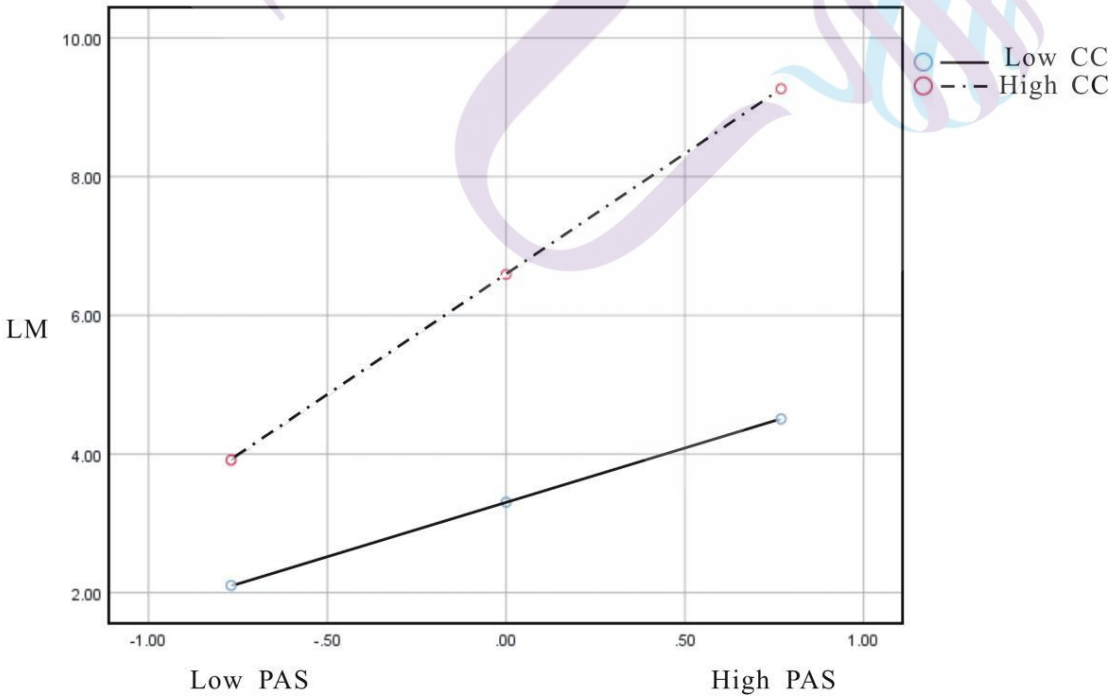

Figure 4.1 *Moderation Effect*

Hypothesis H5: CC has a moderating effect on college students' PAS and LM is supported by the above analysis. Therefore, hypothesis H5 is supported.

4.7 Verification of Research Hypotheses

Some conclusions in relation to the research hypotheses can be made based on the statistical analyses of the research data and these are summarised in figure 4.2 and table 4.25.

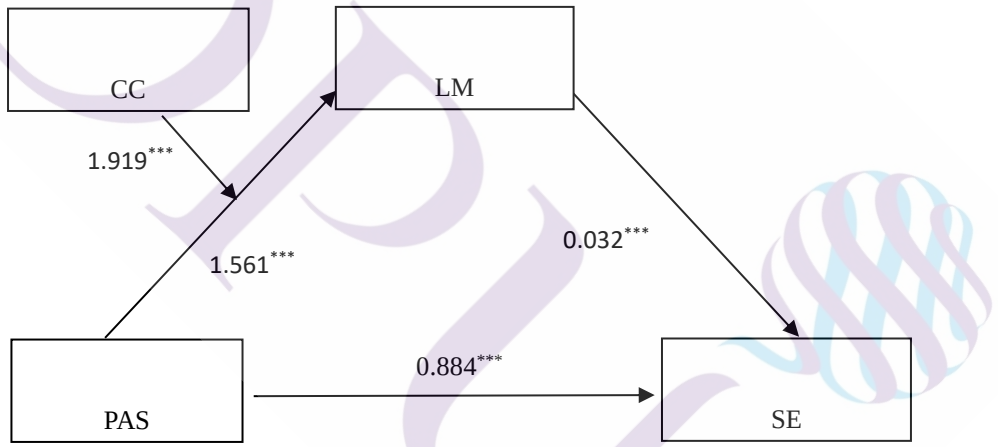

Figure 4.2 *Empirical Study Results*

Table 4.25

The Summary of Research Hypotheses

Hypothesis	Results
H1: College students' PAS has a positive effect on SE.	Supported
H2: College students' PAS has a positive effect on LM.	Supported
H3: College students' LM has a positive effect on SE.	Supported
H4: LM has a mediating effect between college students' PAS and SE.	Supported

H5: CC has a moderating effect on college students' PAS and LM.	Supported

CHAPTER 5

DISCUSSION

The results of the pilot test questionnaire and the formal questionnaire confirmed that the questionnaire, which comprised SEDLAS, AES, AMS, and CUCEI, had a ideal reliability and a good validity. In chapter 5, the present status of Chinese college students' engagement, PAS, LM and CC will be discussed first, as well as the differences of the background variables. The discussion will then turn to the impact of each variable on SE and finally, of the mediating effect of LM between Chinese college students' PAS and SE, and the moderating effect of the CC on their PAS and LM.

5.1 The Status and Differences of Background Variables

5.1.1 Current Status and Different Levels of SE

The results showed that the mean level of these Chinese college students' SE was higher than 4 (the median value), which means it is above the middle level. This result is consistent with Li et al. (2021) and Wang (2013), which indicates that the current status of Chinese college students' engagement is good. This may be due to the fierce competition Chinese students face to be admitted to their ideal university through examination selection. Only those who are deeply engaged in learning and have the ability can enter the university of their choice. Therefore, college students who have succeeded in doing so are reaping the reward of their hard work.

Meanwhile, the analysis of the effect of different background variables (gender, grade, major, place of origin, class representative or not, university category) on the SE of Chinese college students, produced the following results:

Students of different grades were found to have significantly different levels of overall SE, with the SE of senior students being at a significantly higher level than freshmen. This result is consistent with another Chinese scholars, Li et al. (2021) and Wang (2013), and it may be because senior students will graduate soon and, since they cherish the opportunity to study in university, they work harder and engage more than freshmen.

The SE of students of different majors was found to be significantly different. It was higher for those students studying liberal arts than those studying science or engineering, and higher for those studying art than those studying science or engineering, which showed that liberal arts and art majors had a high level of SE. This is similar to the results of Chinese scholars Li et al. (2021), who also found that liberal arts students' engagement was higher than that of science students. This may be because liberal arts and art majors have a higher cognitive engagement and emotional experience, while science and engineering students are more pragmatic and active (Li et al., 2021).

In terms of the class representatives, a significant difference were revealed in the SE of college students, whether they are class representatives or not, and the SE of who are class representatives was significantly higher than that of who are not. The possible reason for this is that excellent students are often chosen to be class leaders,

and their excellent qualities make them more involved in learning.

In terms of the category of university, significant differences were found in college students' degree of engagement, with the engagement of students in teaching universities being significantly higher than researching universities. This result from present study is inconsistent with that of Bu (2021). This may be because the competition in key universities is so fierce that is has a negative impact on students' engagement.

5.1.2 Current Status and Different Levels of PAS

The results showed that the average score of these Chinese college students' PAS was higher than 3 (the median value), which presents it is above the medium level. This is consistent with the research results of Sun (2016), who found that Chinese college students' PAS was currently better. The possible reason for this is that Chinese teachers can effectively show the characteristics of autonomy support in the classroom, which enables the college students to effectively perceive it.

Meanwhile, the analysis of the effect of different background variables (gender, grade, major, place of origin, class representative or not, university category) on the Chinese college students' PAS produced the following results:

There were significant differences in the PAS of different majors. It was higher in liberal arts majors than in science or art majors, and higher in engineering majors than in science or art majors, which indicated that liberal arts and engineering majors generally have a higher perception of teachers' autonomous support. This may

be because the different teaching methods, teaching contents and teachers' abilities in different majors cause students to have a different perception of teacher autonomy support.

5.1.3 Current Status and Different Levels of LM

The results showed that the average score of these Chinese college students' LM was higher than 0 (the median value), which illustrate it is consistent with the medium level, similar to the results of Vallerand (1997). The possible reason for this is that Chinese college students pay more attention to their internal interests, desires and experiences in learning, which makes their intrinsic motivation stronger than their extrinsic motivation (and amotivation), which can reflect a greater self-determination motivation to some extent.

Meanwhile, the analysis of the effect of different background variables (gender, grade, major, place of origin, class representative or not, university category) on Chinese college students' LM produced the following results:

Current study' result explain that a significant differences in the students' LM of different genders. The LM of female students was significantly greater than male students, indicating that female students are closer to intrinsic motivation in the motivation continuum (in other words, female students have greater self-determination motivation). This research result is consistent with the Zhang et al. (2021), who found which female college students' LM was greater than that of male students. This may be because female students' learning is driven by their interests, hobbies and other internal needs, whereas male students depend more on external needs, such as external

achievements, honours and future status to drive their learning.

Significant differences were found in the LM of college students by grade, with freshmen being more motivated to learn than sophomores and juniors, and seniors' LM being greater than that of sophomores and juniors, indicating that seniors and freshmen are closer to intrinsic motivation, while sophomores and juniors are closer to amotivation. Special attention was paid to the most serious degree of amotivation of juniors. This findings is similar to the Zhang et al. (2021), who found that freshmen and seniors have greater LM. This may be because the school's management of students is gradually loosened with the improvement of their grades, which causes their LM to fall to a downward trend. On the other hand, senior students can choose courses and learn according to their own interests in order to obtain employment, which improves their self-determination motivation (Zhang et al., 2021).

In terms of LM, There also show a significant differences among Chinese college students. The motivation to learn of those who majored in liberal arts, science major and engineering major was significantly greater than art major students. In other words, art students' LM was the lowest. This result is consistent with the Zhang et al., (2021) and Zhan (2019), who both found that liberal arts students have stronger LM. However, the results of art majors are inconsistent. This may be because liberal arts and science students prefer interest-orientated learning, while art and engineering students pay more attention to a good reputation and finding jobs with a high salary after graduation (Zhang et al., 2021).

In the university category, a significant difference was found between the LM of research university students and teaching university students, with the LM of

research university students significantly higher than teaching university students, which indicates that the research university students have greater self-determination motivation. This may be because the quality of teachers and teaching methods in key universities are more optimised and reasonable, which is conducive to the improvement of students' motivation to learn, whereas the LM of students in ordinary universities is low due to a shortage of teachers and school resources.

5.1.4 Current Status and Different Levels of CC

The results showed that the average score of the effect of CC on these Chinese college students was higher than the 3, which is above the middle level, and these finding is consistent with the Li and Chen et al. (2020). This may be because Chinese university administrators traditionally pay attention to the CC and university institutions employ full-time counsellors to manage students' daily affairs, organise class activities and guide students to study carefully. Therefore, the CC of Chinese college students under this counselling system is better.

Meanwhile, the analysis of the effect of different background variables (gender, grade, major, place of origin, class representative or not, university category) on the CC of Chinese college students produced the following results:

There are significant differences in the effect of the CC on majors, with liberal arts majors and engineering majors being more affected by the CC than science and art majors. This may because the liberal arts class has better teacher-student interaction and humanistic care, and engineering students have more practical tasks and group cooperation, which is more conducive to the maintenance of the CC than science

and art, which focus on the completion of individual works.

In the university category, a significant difference was found between the effect of the CC on research university students and teaching university students, with the CC of key universities having a significantly better effect on students than that of ordinary universities on students. This research result is consistent with the Li and Chen et al. (2020). This may be because the humanistic environment, resource allocation and teaching methods of key universities are more optimised and reasonable, which is conducive to improving the CC, whereas the CC in ordinary universities is low due to the shortage of teachers and school resources, (Li and Chen et al., 2020).

5.2 Effect of Chinese College Students' PAS, LM and CC on SE

5.2.1 Effect of Chinese College Students' PAS on SE

The results supported hypothesis 1 that college students' PAS positively and significantly affects students' SE by demonstrating that the higher is Chinese college students' PAS, the higher is their SE, which is consistent with previous studies (Gutiérrez, & Tomás, 2019; Li, Gao, 2020; Jang et al., 2010; Wang et al., 2017). According to the SDT, the satisfaction of Chinese college student basic psychological needs has a positive impact on individuals' behaviour (Fredricks et al., 2019; Reeve & Cheon, 2021; Ryan & Deci 2020). Therefore, the current study's results support the view that college students' PAS can promote students' engagement because, when college students perceive autonomous support from teachers and feel valued, they behave accordingly and make more effort to become engaged in learning (Einolander, 2021; Zhao & Qin, 2021).

5.2.2 Effect of Chinese college students' PAS on LM

The results supported hypothesis 2 that Chinese college students' PAS has a significant positive impact on their LM. In other words, the higher is their PAS, the greater is their LM, which show it is consistent with the result of recent research (Domen et al., 2019; Fredricks et al., 2019; Stolk et al., 2018; Maldonado, 2019). This may be because the perceive autonomous support of teachers in the classroom stimulates students' intrinsic motivation, curiosity and desire for a challenge, which serves to enhance their self-determination motivation to learn (Black & Deci, 2000; Domen et al., 2019; Fredricks et al., 2019; Jang et al., 2016; Ryan & Deci, 2000a; Ryan & Deci, 2000b). This result shows that college students' PAS can directly predict their LM.

5.2.3 Effect of Chinese college students' LM on SE

The results supported hypothesis 3 that Chinese college students' LM has a significant positive impact on SE. In other words, the higher their LM is, the higher is their SE, which exhibition that is consistent with the results of latest research (Fredricks et al., 2017; Guo, 2018; Yin, 2018). This may be because of the SDT, which points out that self-determination motivation drives behaviour (Burkley & Burkley, 2018), so that the behaviour of individuals is usually regulated by psychological processes (Ryan & Deci, 2000b). In other words, when their LM is high, college students will more actively participate in activities and have a greater positive emotional experience and classroom performance (Ryan & Deci, 2000a). This result shows that LM can directly predict

college students' engagement.

5.3 Mediating Effect of LM on College Students' PAS and SE

The results supported hypothesis 4 that LM partially mediates the association between PAS and the SE of Chinese college students. This research finding is consistent with the previous researchers, who have taken LM as a mediating variable (Jang, 2008; Wang & Eccles, 2013), and subsequently found that it plays a mediating role in PAS and students' engagement (Benita et al., 2021; Guay et al., 2016; Jang, 2008; Yoo (2015). The current study's results show that the more college students PAS for their learning, the more self-determined and motivated they tend to become, which promotes SE. This result also supports the SDT. This may be because the teaching methods experienced by college students (PAS) will affect their behaviour (SE) through individual characteristics (LM; Deci & Ryan, 2000). In other words, teaching activities that provide students with choices in learning generate a willingness to learn, which encourages them to entirely agree with what they are doing and draws them into the learning (Guay et al., 2016). This study's finding can further broaden the results of the above research and deepens ours comprehension of the internal mechanism about the effect of PAS on SE in Chinese colleges. It was found that college students' PAS not only has a direct influence on their engagement, but can also influence their engagement by means of their LM. In addition, the results showed that the SDT has cross-cultural characteristics, which indicates that college students' LM still has a mediating effect between PAS and students' engagement in the Chinese cultural background.

5.4 Moderating Effect of CC on College Students' PAS and LM

The findings supported hypothesis 5 that the CC moderates the effect of PAS on students' LM in Chinese colleges. In other words, the impact of college students' PAS on their LM was greater among those studying in researching universities with a better CC than those studying in ordinary universities with a low CC. These results are consistent with previous researchers (Patrick et al., 2011; Reeve & Cheon, 2021; Vallerand et al.,1997), who has found that college students which studied in a good CC tended to be more self-determined in their LM than those studying in a low CC (Jafari & Asgari, 2020; Ryan & Patrick, 2001; Mucherah et al., 2014). This may be because the students who study in a low CC receive less humane care and peer support, less cooperation and have a poor learning experience. These disadvantages undermine their self-determined motivation. On the contrary, college students who study in a high CC are more advantaged and have a better learning experience, which motivates them to make egalitarian relationships and engage in interpersonal support, as well as enhances their self-determined motivation, so that they perform better in school (Allodi, 2010; Cayubit, 2021; Reyes et al., 2012; Wang, Lee et al., 2020). Overall, the current study's findings was provide a empirical support to the notion that the CC boosts the effect of college students' PAS on their LM.

CHAPTER 6

CONCLUSION

Form the respect of Chapter 4 and Chapter 5, this chapter were discuss the conclusions and suggestions of present study, and it is in three sections in this chapter. The theoretical significance and practical significance of current study is presented in first section. And the second section contains some recommendations for school-related educational institutions and teachers, while the third section is devoted to the present study's limitations and some future research suggestions in this field, as well as directions for college teacher's future teaching method.

6.1 The Theoretical and Practical Significance

6.1.1 The Theoretical Significance

Based on previous literature in the educational field, most researchers have only studied it from the perspectives of teacher support and learning engagement (Gutiérrez and Tomás, 2019), LM and learning engagement (Fredricks et al., 2017), learning climate and learning engagement (Wang, Degol et al., 2020), and the mediating role of LM (Benita et al., 2021). However, few researchers have combined these four variables. Most current studies are based on the Western culture (Ryan & Deci, 2020), and because a lack of empirical evidence that emphasises in Chinese cultural background. Therefore, the SDT from Deci and Ryan (2000) is taken astheoretical basis of present study to

examine the current status of Chinese college

students' SE. Specifically, College students' PAS is taken as the independent variable, students engagement as the dependent variable, LM as the mediating variable, and CC as the moderating variable to construct a moderated mediating model to explore SE and support several hypotheses. This study is deemed to enrich the research of the influence of the SDT on students' engagement and LM, and provide a reference for future researchers in this field.

The research results also showed that Chinese college students' PAS has a significant and positive impact on SE, LM acts as a mediator between PAS and SE, and the CC acts as a moderator of PAS on LM. It was verified in this study that college students' PAS not only directly influences SE, but also indirectly influences it through the mediating variable of LM. Finally, it was verified that the CC moderates the relationship between PAS and LM. More specifically, the impact of PAS on LM is stronger among college students who study in key universities with a high CC than those who study in ordinary universities with a low CC. These findings support the SDT and enrich the understanding of the combined effects of PAS, LM, and CC on college students' engagement, hence providing a new perspective as a reference for future research in this field.

6.1.2 The Practical Significance

This research was focused on students' learning process in classroom teaching. The research of students' engagement and the mechanisms that influence it will be beneficial to students, teachers, universities and society (Ryan & Deci, 2020; Yin, 2018). At the same time, it is hoped that the quality of college education will be

enhanced by the reform of classroom teaching processes and methods, and the improvement of learning psychology. This study's results could provide same theoretical support for the teaching of Chinese college teachers, as well as some useful suggestions for classroom teaching practices.

In terms of PAS, some strategies were proposed in this study to improve teachers' teaching methods in order to enhance the quality of their teaching. As for the CC, suggestions were provided to effectively foster it in order to improve the level of class management. On the other hand, it was proposed that teachers should pay attention to college students' LM. In a word, SE is the key factor that significantly affects students' performance, ability, satisfaction and school development (Einolander, 2021; Ryan & Deci, 2020). The results of the study are expected to remind teachers and college administrators to pay close attention to classroom teaching methods and create a good CC to further improve college students' engagement and LM. This will be conducive to teachers' development, students' engagement and the improvement of the school's teaching quality. Therefore, this study has a certain practical significance for teaching reform and improving the quality of university teaching.

6.2 Recommendations

6.2.1 Suggestions for Colleges

It was found in this study that college students' PAS has a significant and positive impact on SE. Therefore, it is suggested that colleges offer teacher training programmes that are focused on autonomy support for improve the teaching ability of college teachers to increase students' PAS. For example, through training, college

teachers should strengthen their understanding of autonomous support and improve the teaching methods of autonomous support, so that teachers can provide more autonomous support to college students in the classroom. because these measures are advantageous to support more autonomous support for college students, and then improve their SE.

It was also found that LM has a partially mediating effect between college students' PAS and SE. Therefore, it is suggested that colleges should increase the related training and lectures for students, so that they can more clearly understand and effectively manage their LM, and hence, improve their engagement.

In addition, it was found that the CC plays a moderating role between college students' PAS and their LM. Therefore, it is suggested that colleges should formulate relevant measures and policies to encourage teachers to deliver humanized teaching, maintain a harmonious teacher-student relationship and fairness in the classroom, so promote students' cohesion and form an atmosphere of mutual cooperation and help to improve college students' engagement.

6.2.2 Suggestions for College Teachers

It was found in present study that college students' PAS has a significant and positive impact on SE. Therefore, it is suggested that college teachers are supposed to strive to improve classroom teaching methods, especially the use of autonomous support teaching methods to students among colleges. For example, providing students with more choices in the classroom, increasing in-depth explanations of knowledge points to improve students' comprehension, and connecting the knowledge with the real

world to help students draw inferences from one instance. In addition, college teacher should allowing students present more criticize and encouraging them to think widely and independently.

It was also found that LM has a partially mediating effect between college students' PAS and SE. Therefore, this study put out a suggestion that college teachers should pay attention to college students' LM. In particular, college teachers should cultivate students' autonomous motivation through independent support and a kind, tolerant and fair teaching climate.In addition, college teachers should guide college students' learning behavior more based on the interest, curiosity and fun of internal motivation, rather than the achievement, prestige and honor of external motivation, and they should not use the words of threaten and punishment, because intrinsic motivation can better drives students' SE than extrinsic motivation.

In addition, it was found in this study that the CC plays a moderating role between college students' PAS and their LM. So, it is suggested that college teachers should cultivate a good CC when designing teaching activities. They should particularly create a cohesive and fair CC with a good teacher-student relationship and student-student relationship and good teaching interaction with novel teaching methods and maintain a teaching framework with clear learning objectives, in order to improve college students' engagement and motivation to learn.

6.3 Limitations and Future Directions

Present study has produced some expected results, there are still some limitations due to the researchers' limited research ability and level. In this section, the

limitations of present study will be described in terms base on the research participants, research method and research variables.

Due to the time limit of researchers and the limited research ability, the research samples only consisted of college students from 6 universities in Shaanxi Province of China, and did not account of students from other provinces. However, college students in different regions and different universities have different PAS, SE, LM and CC. Therefore, future research will expand the geographical areas and participants of the research to China's other provinces, such as Beijing, Jiangsu, Sichuan and other provinces of college students as the sample object, expand the number of research samples in order to collect more comprehensive information, the number of research samples will be more conducive to collecting more comprehensive information. Furthermore, in the future, the research will cover more categories of universities, such as vocational colleges, as well as elite universities and other university categories; hence, it is likely to obtain more supportive evidence. Therefore, the follow-up study will consider further expanding the geographical scope of sampling and the types of universities.

The self-reporting questionnaire survey method was used in present study to collect the sample data of Chinese college students' background variables, SE, PAS, LM and CC. However, the participants' expression and reflection of the real situation may have been biased, which may have some negative effects on the accuracy of the research results. Therefore, future research should add qualitative interviews to better clarify the potential impact of college students' PAS on students' engagement.

This study was made a discussion of the relationship between college

students' PAS, LM, CC and SE. Some studies have found that there are more factors that will affect SE, so new impact factors will be added to the future research, such as adding teacher' structure and controlled teaching methods to the model for research (Benita & Matos, 2021; Domen et al., 2019). In addition, future research can also use belonging as mediating variables (Guo et al., 2021; Zumbrunn et al., 2014), and mindfulness as a moderating variable (Zhang & Yue, 2021), in order to obtain more empirical research evidence.

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APPENDICES

Appendix I: Pilot Test Questionnaire

I. Guidance

Dear students,

Greeting!

Welcome to participate in the survey of College Students' learning engagement. Please choose the most suitable option according to your actual situation. Here is only your most real feelings, there is no right or wrong, no should or shouldn't. The questionnaire is distributed to college students (undergraduates), and the content will investigate your overall feelings in the college; It is not specific to a course, a teacher, or a specific learning method (online or offline). This questionnaire is anonymous, and the data is only used for scientific research. Your information will be kept strictly confidential in accordance with academic ethics. There are many questions in the questionnaire, which takes about 10 minutes. Please be patient.

Thank you for your valuable information!

PHD Class of Education Management Department of Dhurakij Pundit University

II. Basic Information on the Individual

1. Gender: Female ( ) Male ( )

2. Grade: Freshman ( ) Sophomore ( ) Junior ( ) Grade four ( )

3. Your major: ( )

4. Family location: Rural ( ) city ( )

5. Whether to serve as a class representative : Yes ( ) No ( )

6. Your university ( )

III. Subject Questionnaire

Answers to questions in the item won't be judged to be right or wrong. Carefully read questions and add " √ " to the corresponding position in light of your own situation.

Part I:

Students Engagement During Learning Activities Scale (pilot test)

Code	Students Engagement During Learning Activities Scale	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Y1-1	1. I listen carefully in class. 1. 我上课时认真细致，一丝不苟。	1	2	3	4	5	6	7
Y1-2	2. I pay attention in class. 2. 我上课时注意力很集中。	1	2	3	4	5	6	7
Y1-3	3. The first time my teacher talks about a new topic, I listen very carefully. 3. 当发现老师开始讲解新内容时，我总是听得很仔细。	1	2	3	4	5	6	7
Y1-4	4. I try very hard in school. 4. 我在学校非常努力。	1	2	3	4	5	6	7
Y1-5	5. I work hard when we start something new in class. 5. 我努力学习课堂上的新知识。	1	2	3	4	5	6	7
Y2-1	6. During class, I express my preferences and opinions. 6. 我在课堂上能够表达自己的喜好和观点。	1	2	3	4	5	6	7
Y2-2	7. During class, I ask questions. 7. 上课时,我会提问。	1	2	3	4	5	6	7
Y2-3	8. I tell the teacher what I like and what I don't like.	1	2	3	4	5	6	7

	8. 我会告诉老师：自己喜欢什么，不喜欢什么。							
Y2-4	9. I let my teacher know what I am interested in. 9. 我让老师知道：我的兴趣点。	1	2	3	4	5	6	7
Y2-5	10. I offer suggestions about how to make the class better. 10. 我能提出建议,以使课堂变得更好。	1	2	3	4	5	6	7
Y3-1	11. When doing schoolwork, I try to relate what I'm learning to what I already know. 11. 做功课时,我尝试将新知识和旧知识有机联系起来。	1	2	3	4	5	6	7

Part I (Continued)

Code	Students Engagement During Learning Activities Scale	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Y3-2	12. When I study, I try to connect what I am learning with my own experiences. 12. 当我学习时,我试着把现在学到的原理与过去的经验相联系起来。	1	2	3	4	5	6	7
Y3-3	13. I try to make all the different ideas fit together and make sense when I study. 13. 在学习时,我努力让各种观点融会贯通在一起,并且我喜欢这样做。	1	2	3	4	5	6	7
Y3-4	14. I make up my own examples to help me understand the important	1	2	3	4	5	6	7

	concepts I study. 14. 我使用自己琢磨出来的例子,来理解重要概念。							
Y3-5	15. When what I am working on is difficult to understand, I change the way I learn the material. 15. 当学习材料难以理解时,我会改变学习方法。	1	2	3	4	5	6	7
Y3-6	16. When I'm working on my schoolwork, I stop once in a while and go over what I have been doing. 16. 当我做功课时,我偶尔会抽出时间来反省正在做的事情。	1	2	3	4	5	6	7
Y3-7	17. As I study, I keep track of how much I understand not just if I am getting the right answers. 17. 我学习时会努力思考和理解原理,而不是仅仅得到答案。	1	2	3	4	5	6	7
Y3-8	18. Before I begin to study, I think about what I want to get done. 18. 在开始学习之前,我会预料自己的掌握程度。	1	2	3	4	5	6	7
Y4-1	19. When I am in class, I feel curious about what we are learning. 19. 我对上课时正在学的东西,很好奇。	1	2	3	4	5	6	7
Y4-2	20. When we work on something in class, I feel interested. 20. 我对课堂上的活动,很有兴趣。	1	2	3	4	5	6	7
Y4-3	21. I enjoy learning new things in class. 21. 我喜欢在课堂上学习新事物。	1	2	3	4	5	6	7
Y4-4	22. Class is fun. 22. 课堂是快乐的，有趣的。	1	2	3	4	5	6	7

Part II:

Autonomy Enhancement Scale (AES, pilot test)

Code	Autonomy Enhancement Scale (AES)	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
X1-1	1. When I am doing something that interests me – the teacher gives me enough time to finish it. 1. 老师会给我充足的时间,让我完成感兴趣的事。	1	2	3	4	5
X1-2	2. The teacher allows me to choose how to do my work in the classroom. 2. 在课堂上老师允许我：选择自己最佳的学习方式。	1	2	3	4	5
X1-3	3. The teacher asks us which topics we would like to study more and which we prefer. 3. 老师会询问我们：哪些知识点是希望详细学习,或者是概略学习的。	1	2	3	4	5
X1-4	4. The teacher asks us if there are things we would like to change in the way we study. 4. 老师会询问我们：在学习中有哪些不懂的地方。	1	2	3	4	5
X1-5	5. The teacher allows me to choose to study topics that interest me. 5. 老师允许我：选择自己感兴趣的知识点,来自主研究。	1	2	3	4	5
X1-6	6. When the teacher gives us an assignment she allows us to choose which questions to answer. 6. 老师允许我们：从作业清单中,选择部分内容来完成。	1	2	3	4	5
X1-7	7. The teacher encourages me to work in my own way. 7. 老师鼓励我,使用我自己的方式来完成学习任务。	1	2	3	4	5
X2-1	8. The teacher talks about the connection between what we study in school and what happens in real life. 8. 老师注重将理论与现实情景有机联系起来。	1	2	3	4	5
X2-2	9.It is important for the teacher that I learn things that interest me. 9. 老师重视并培育我的兴趣点。	1	2	3	4	5
X2-3	10. The teacher explains why it is important to study certain subjects in school. 10. 老师能够解释所学习内容的重要性,以帮助我们更好的理解。	1	2	3	4	5
X2-4	11. The teacher talks to us about how we feel about the subjects we study. 11. 老师会与我们谈论：大家对知识点的认识和理解。	1	2	3	4	5

X3-1	12. The teacher listens to my opinions and ideas. 12 老师会倾听我的看法。	1	2	3	4	5
X3-2	13. The teacher tells us that it is important that we express our disagreement if we do not agree with her. 13. 在师生观点有分歧时,老师鼓励大家表达不同的观点。	1	2	3	4	5
X3-3	14. The teacher is willing to listen to students' complaints about her. 14. 老师愿意倾听,学生对教师本人的抱怨(或消极情绪)。	1	2	3	4	5
X3-4	15. The teacher respects students who tell her what they really think and are not ingratiating. 15. 对于说出真实想法的学生,老师是尊重学生,而不是表面糊弄。	1	2	3	4	5
X3-5	16. The teacher allows me to decide things myself. 16. 老师允许我：自己决定事情。	1	2	3	4	5
X3-6	17. The teacher allows us to talk about things we find unacceptable in school. 17. 老师允许我们：谈论不合理，不公平的事情	1	2	3	4	5
X3-7	18. The teacher shows me how to solve my problems myself. 18. 老师教导我：要独立思考和解决问题。	1	2	3	4	5

Part III:

Academic Motivation Scale (AMS, pilot test)

Code	Academic Motivation Scale (AMS)	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
M1-1	1. Because I experience pleasure and satisfaction while learning new things. 1. 我学习新知识,是为了体验到快乐和满足感。	1	2	3	4	5	6	7
M1-2	2. For the pleasure I experience when I discover new things I have never seen before. 2. 为了追求新鲜知识，新事物时的欣喜感。	1	2	3	4	5	6	7
M1-3	3. For the pleasure I experience in broadening my knowledge about subjects that appeal to me.	1	2	3	4	5	6	7

	3. 为在有趣的学科中拓宽知识面,使我快乐。							
M1-4	4. Because my studies allow me to continue to learn about many things that interest me. 4. 因为学习能让我接触到许多吸引我的新事物。	1	2	3	4	5	6	7
M2-1	5. For the pleasure I experience when surpassing myself in my studies. 5. 我为了追求能够提升自己而学习	1	2	3	4	5	6	7
M2-2	6. For the pleasure I experience when I surpass myself in one of my personal achievements. 6. 为了追求当个人成就有所突破时的欣慰感。	1	2	3	4	5	6	7
M2-3	7. For the satisfaction I feel when I am in the process of accomplishing difficult academic activities. 7. 因为在攻克难关后,我获得满足感。	1	2	3	4	5	6	7
M2-4	8. Because college allows me to experience personal satisfaction in my quest for excellence in my studies. 8. 为了寻找在大学追求卓越的求学过程中的满意感。	1	2	3	4	5	6	7
M3-1	9. For the intense feelings I experience when I am communicating my ideas to others. 9. 当我将自己的观点告诉他人时,我会产生一种美好体验。	1	2	3	4	5	6	7
M3-2	10. For the pleasure I experience when I read books by interesting authors. 10. 当我读到令人青睐的作家时,我感到怦然心动。	1	2	3	4	5	6	7

Part III (Continued)

Code	Academic Motivation Scale (AMS)	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree

M3-3	11. For the pleasure I experience when I feel completely absorbed by what certain authors have written. 11. 当我完全被著名作品吸引时,我体验到美好。	1	2	3	4	5	6	7
M3-4	12. For the "high" feeling I experience when reading about various interesting subjects. 12. 当阅读非常有趣的东西时,我会感到兴奋。	1	2	3	4	5	6	7
M4-1	13. Because I think a college education will help to better prepare me for the career I have chosen. 13. 为了增加我的职业技能,所以到大学学习。	1	2	3	4	5	6	7
M4-2	14. Because eventually it will enable me to enter the job market in a field I like. 14. 因为有大学文凭,可以帮我找到一些工作。	1	2	3	4	5	6	7
M4-3	15. Because this will help me to make a better choice in relation to my career orientation. 15. 大学教育将使我明确：我的就业方向。	1	2	3	4	5	6	7
M4-4	16. Because I believe that a few additional years of education will improve my competence as a worker. 16. 我相信经过这几年的学习,将会提升我的工作能力。	1	2	3	4	5	6	7
M5-1	17. To prove to myself that I am capable of completing my college degree. 17. 为了向自己证明：我有能力获得大学学位。	1	2	3	4	5	6	7
M5-2	18. Because when I succeed in college I feel important. 18. 因为我觉得：在大学里取得成功,很重要。	1	2	3	4	5	6	7
M5-3	19. To show myself that I am an	1	2	3	4	5	6	7

	intelligent person. 19. 为了向自己展示：我是一个聪明人。							
M5-4	20. Because I want to show myself that I can succeed in my studies. 20. 因为我想向自己证明：我能行,我能在学业上取得成功。	1	2	3	4	5	6	7

Part III (Continued)

Code	Academic Motivation Scale (AMS)	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
M6-1	21. Because I would not find a high-paying job later with only a high-school degree. 21. 因为仅有高中学历,以后可能找不到什么好工作。	1	2	3	4	5	6	7
M6-2	22. In order to obtain a more prestigious job later. 22. 上大学,是为了将来能获得更好的工作。	1	2	3	4	5	6	7
M6-3	23. Because I want to have "a good life" later. 23. 因为我希望未来有个“美好的生活”。	1	2	3	4	5	6	7
M6-4	24. In order to have a better salary later. 24. 为了以后有更高的薪水。	1	2	3	4	5	6	7
M7-1	25. Honestly, I don't know; I really feel I am wasting my time in school. 25. 老实说：我不知道学习是为了什么； 我真的觉得：我在大学是浪费时间。	1	2	3	4	5	6	7
M7-2	26. I once had good reasons for going to college, but now I wonder if I should continue.	1	2	3	4	5	6	7

	26. 我现在很迷茫；我不知道：是否还要继续读下去。							
M7-3	27. I can't see why I go to college and frankly, I couldn't care less. 27. 我不明白为什么要上大学,坦白说：无所谓啦。	1	2	3	4	5	6	7
M7-4	28. I don't know; I can't understand what I am doing in school. 28. 我不知道，不清楚我在大学到底做什么。	1	2	3	4	5	6	7

Part IV:

College and university classroom environment inventory (CUCEI, pilot test)

Code	College and university classroom environment inventory (CUCEI)	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
W1-1	1. The instructor considers students' feelings. 1. 老师能够考虑到：学生的感受。	1	2	3	4	5
W1-2	2. The instructor talks individually with students. 2. 老师能够与学生,进行心对心的交谈。	1	2	3	4	5
W1-3	3. The instructor goes out of his/her way to help students. 3. 老师尽最大努力,来帮助学生。	1	2	3	4	5

Part IV (Continued)

Code	College and university classroom environment inventory (CUCEI)	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
W1-4	4. The instructor helps each student who is finding the work difficult. 4. 老师能够帮助每一个在学业中遇到困难的学生。	1	2	3	4	5
W1-5	5. The instructor always moves around the classroom to talk with students. 5. 在课堂上与学生对话时,老师会主动靠近学生。	1	2	3	4	5

W1-6	6. The instructor isn't interested in students' problems. 6. 老师不理睬学生的提问。(R)	5	4	3	2	1
W1-7	7. The instructor is friendly and considerate toward students. 7. 老师重视学生,对学生友好。	1	2	3	4	5
W2-1	8. I cooperate with other students when doing assignments. 8. 我与同学合作完成作业。	1	2	3	4	5
W2-2	9. I share my books and resources with other students when doing assignments. 9. 在做作业时,我给同学分享了自己的书籍和资料。	1	2	3	4	5
W2-3	10. When I work in a group in this class, there is teamwork. 10. 课上小组分工时,我有团队精神。	1	2	3	4	5
W2-4	11. I work with other students on projects in this class. 11. 当课上有研究内容时,我与同学通力合作。	1	2	3	4	5
W2-5	12. I learn from other students in this class. 12. 在课堂上,我从其他同学那儿学到了有用的东西。	1	2	3	4	5
W2-6	13. I cooperate with other students on class activities. 13. 在课堂活动中,我能与他人合作。	1	2	3	4	5
W2-7	14. Students work with me to achieve class goals. 14. 我配合同学,完成了课堂目标。	1	2	3	4	5
W3-1	15. The class consists of individuals who don't know each other well. 15. 班里同学之间都比较陌生.(R)	5	4	3	2	1
W3-2	16. Each student knows the other members of the class by their first name. 16. 每个学生都知道班上其他人的名字。	1	2	3	4	5
W3-3	17. Friendships are made among students in this class.	1	2	3	4	5

	17. 班里学生之间,建立了友谊。					
W3-4	18. Students don't have much chance to get to know each other in this class. 18. 班里同学之间缺乏相互认识的机会。(R)	5	4	3	2	1
W3-5	19. It not takes a long time to get to know everybody's first name in this class. 19. 在班里,过不了多久,大家就能叫出对方的名字。	1	2	3	4	5

Part IV (Continued)

Code	College and university classroom environment inventory (CUCEI)	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
W3-6	20. Students in this class get to know each other well. 20. 班里学生之间都很熟悉。	1	2	3	4	5
W3-7	21. Students in this class are very interested in getting to know other students. 21. 班里同学都愿意认识对方。	1	2	3	4	5
W4-1	22. The instructor gives my questions as much attention as other students' questions. 22. 无论是我的提问,还是其他同学的提问,老师都同样重视。	1	2	3	4	5
W4-2	23. I get the same amount of help from the instructor as other students do. 23. 老师给我的帮助,与其他学生一样多。	1	2	3	4	5
W4-3	24. I am treated the same as other students in this class. 24. 课堂上,老师公平对待我和其他学生。	1	2	3	4	5
W4-4	25. I receive the same encouragement from the instructor as other students do. 25. 我和其他学生一样,都从老师那里获得了同等的鼓励。	1	2	3	4	5
W4-5	26. I am given the same opportunity to answer questions as other students. 26. 我回答问题的机会,与其他同学一样多。	1	2	3	4	5
W4-6	27. My work receives as much praise as other students' work.	1	2	3	4	5

	27. 老师对我的评价,与他人一视同仁。 28. I have the same amount of say as other students in this class.					
W4-7	28. 我在课堂上的发言权,跟其他同学一样多。	1	2	3	4	5
W5-1	29. Students know exactly what has to be done in our class. 29. 对于课堂上应该做的事,同学们都很清楚。	1	2	3	4	5
W5-2	30. It is important to complete a certain amount of work in this class. 30. 我认为：在课堂上,老师布置明确的学习任务,是十分重要的。	1	2	3	4	5
W5-3	31. The group is often sticking to the point instead of side-tracked. 31. 课堂内容紧紧围绕教学目标,而不是漫无边际的胡侃。	1	2	3	4	5
W5-4	32. This is an organised class. 32. 课堂上的活动,都有明确的计划。	1	2	3	4	5
W5-5	33. Class assignments are clear so that everyone knows what to do. 33. 课堂任务很明确,所以每个人都知道该做什么。	1	2	3	4	5
W5-6	34. This class seldom starts on time. 34. 课程没有计划,内容混乱(R)	5	4	3	2	1
W5-7	35. Activities in this class are clearly and carefully planned. 35. 课堂活动的内容,是清晰的,安排周全的。	1	2	3	4	5

Part IV (Continued)

Code	College and university classroom environment inventory (CUCEI)	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
W6-1	36. New ideas are often tried out in this class. 36. 课堂上,老师能够尝试新的教学理念。	1	2	3	4	5
W6-2	37. New and different ways of teaching are often used in this class. 37. 课堂上,老师能够采用新的，与众不同的教	1	2	3	4	5

	学方法。					
W6-3	38. The instructor thinks of innovative activities for students to do. 38. 老师能够设计出新型课堂活动。	1	2	3	4	5
W6-4	39. Teaching approaches in this class are characterised by innovation and variety. 39. 老师的课堂教学方法,具有创新性，多样性。	1	2	3	4	5
W6-5	40. The seating in this class is arranged in the same way each week. 40. 上课时的座位安排都是死板的。(R)	5	4	3	2	1
W6-6	41. The instructor often thinks of unusual class activities. 41. 老师会搞出很有特色的课堂活动。	1	2	3	4	5
W6-7	42. Students seem to do the same type of activities in every class. 42. 基本上都是满堂灌,堂课活动比较单一。(R)	5	4	3	2	1
W7-1	43. All the students in the class are expected to do the same work, in the same way, the same time. 43. 所有学生都被期望于单一的课堂活动。(R)	5	4	3	2	1
W7-2	44. Students are generally allowed to work at their own pace. 44. 根据学生的学习水平,老师允许学生按照自己的节奏来学习。	1	2	3	4	5
W7-3	45. Students have a say in how class time is spent. 45. 根据学生的掌握情况,老师允许学生自主分配更多的课堂活动时间。	1	2	3	4	5
W7-4	46. Students are allowed to choose activities and how they will work. 46. 老师允许学生选择课堂活动的类型，活动方式。	1	2	3	4	5
W7-5	47. Teaching approaches allow students to proceed at their own pace. 47. 根据学生能力,允许学生掌控自己的进度。	1	2	3	4	5
W7-6	48. There is little opportunity for students to pursue their particular interest in class.	5	4	3	2	1

W7-7	48. 在课堂上,当学生看到有趣的内容时,老师会相应的多讲一点。 49. It is the instructor who decides what will be done in our class. 49. 课堂上教师死板地掌控一切。	5	4	3	2	1

Dear students,

Please click the submit button to end the questionnaire. The information you provided is very valuable! Thank you for your participation!

Appendix II: Formal Questionnaire

I. Guidance

Dear students,

Greeting!

Welcome to participate in the survey of College Students' learning engagement. Please choose the most suitable option according to your actual situation. Here is only your most real feelings, there is no right or wrong, no should or shouldn't. The questionnaire is distributed to college students (undergraduates), and the content will investigate your overall feelings in the college; It is not specific to a course, a teacher, or a specific learning method (online or offline).This questionnaire is anonymous, and the data is only used for scientific research. Your information will be kept strictly confidential in accordance with academic ethics. There are many questions in the questionnaire, which takes about 10 minutes. Please be patient.

Thank you for your valuable information!

PHD Class of Education Management Department of Dhurakij Pundit University

Advising professor:

Doctor HUANG JIANHAO

II. Basic Information on the Individual

1. Gender: Female ( ) Male ( )

2. Grade: Freshman ( ) Sophomore ( ) Junior ( ) Grade four ( )

3. Your major: ( )

4. Family location: Rural ( ) city ( )

5. Whether to serve as a class representative: Yes ( ) No ( )

6. Your university ( )

III. Subject Questionnaire

Answers to questions in the item won't be judged to be right or wrong. Carefully read questions and add " √ " to the corresponding position in light of your own situation.

Part I:

Students Engagement During Learning Activities Scale (Formal)

Code	Students Engagement During Learning Activities Scale	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Y1-1	1. I listen carefully in class. 1. 我上课时认真细致，一丝不苟。	1	2	3	4	5	6	7
Y1-2	2. I pay attention in class. 2. 我上课时注意力很集中。	1	2	3	4	5	6	7
Y1-3	3. The first time my teacher talks about a new topic, I listen very carefully. 3. 当发现老师开始讲解新内容时，我总是听得很仔细。	1	2	3	4	5	6	7
Y1-4	4. I try very hard in school. 4. 我在学校非常努力。	1	2	3	4	5	6	7
Y1-5	5. I work hard when we start something new in class. 5. 我努力学习课堂上的新知识。	1	2	3	4	5	6	7
Y2-1	6. During class, I express my preferences and opinions. 6. 我在课堂上能够表达自己的喜好和观点。	1	2	3	4	5	6	7
Y2-2	7. During class, I ask questions. 7. 上课时,我会提问。	1	2	3	4	5	6	7
Y2-3	8. I tell the teacher what I like and what I don't like.	1	2	3	4	5	6	7

	8. 我会告诉老师：自己喜欢什么，不喜欢什么。							
Y2-4	9. I let my teacher know what I am interested in. 9. 我让老师知道：我的兴趣点。	1	2	3	4	5	6	7
Y2-5	10. I offer suggestions about how to make the class better. 10. 我能提出建议,以使课堂变得更好。	1	2	3	4	5	6	7
Y3-1	11. When doing schoolwork, I try to relate what I'm learning to what I already know. 11. 做功课时,我尝试将新知识和旧知识有机联系起来。	1	2	3	4	5	6	7

Part I (Continued)

Code	Students Engagement During Learning Activities Scale	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Y3-2	12. When I study, I try to connect what I am learning with my own experiences. 12. 当我学习时,我试着把现在学到的原理与过去的经验相联系起来。	1	2	3	4	5	6	7
Y3-3	13. I try to make all the different ideas fit together and make sense when I study. 13. 在学习时,我努力让各种观点融会贯通在一起,并且我喜欢这样做。	1	2	3	4	5	6	7
Y3-4	14. I make up my own examples to help me understand the important concepts I study. 14. 我使用自己琢磨出来的例子,来理解重要概念。	1	2	3	4	5	6	7
Y3-5	15. When what I am working on is difficult to understand, I change the way I learn the material.	1	2	3	4	5	6	7

	15. 当学习材料难以理解时,我会改变学习方法。							
Y3-6	16. When I'm working on my schoolwork, I stop once in a while and go over what I have been doing. 16. 当我做功课时,我偶尔会抽出时间来反省正在做的事情。	1	2	3	4	5	6	7
Y3-7	17. As I study, I keep track of how much I understand not just if I am getting the right answers. 17. 我学习时会努力思考和理解原理,而不是仅仅得到答案。	1	2	3	4	5	6	7
Y3-8	18. Before I begin to study, I think about what I want to get done. 18. 在开始学习之前,我会预料自己的掌握程度。	1	2	3	4	5	6	7
Y4-1	19. When I am in class, I feel curious about what we are learning. 19. 我对上课时正在学的东西,很好奇。	1	2	3	4	5	6	7
Y4-2	20. When we work on something in class, I feel interested. 20. 我对课堂上的活动,很有兴趣。	1	2	3	4	5	6	7
Y4-3	21. I enjoy learning new things in class. 21. 我喜欢在课堂上学习新事物。	1	2	3	4	5	6	7
Y4-4	22. Class is fun. 22. 课堂是快乐的，有趣的。	1	2	3	4	5	6	7

Part II:

Autonomy Enhancement Scale (AES, Formal)

Code	Autonomy Enhancement Scale (AES)	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree

X1-1	1. When I am doing something that interests me – the teacher gives me enough time to finish it. 1. 老师会给我充足的时间,让我完成感兴趣的事。	1	2	3	4	5
X1-2	2. The teacher allows me to choose how to do my work in the classroom. 2. 在课堂上老师允许我：选择自己最佳的学习方式。	1	2	3	4	5
X1-3	3. The teacher asks us which topics we would like to study more and which we prefer. 3. 老师会询问我们：哪些知识点是希望详细学习,或者是概略学习的。	1	2	3	4	5
X1-4	4. The teacher asks us if there are things we would like to change in the way we study. 4. 老师会询问我们：在学习中有哪些不懂的地方。	1	2	3	4	5
X1-5	5. The teacher allows me to choose to study topics that interest me. 5. 老师允许我：选择自己感兴趣的知识点来自主研究。	1	2	3	4	5
X1-6	6. When the teacher gives us an assignment she allows us to choose which questions to answer. 6. 老师允许我们：从作业清单中,选择部分内容来完成。	1	2	3	4	5
X1-7	7. The teacher encourages me to work in my own way. 7. 老师鼓励我,使用我自己的方式来完成学习任务。	1	2	3	4	5
X2-1	8. The teacher talks about the connection between what we study in school and what happens in real life. 8. 老师注重将理论与现实情景有机联系起来。	1	2	3	4	5
X2-3	9. The teacher explains why it is important to study certain subjects in school. 9. 老师能够解释所学习内容的重要性,以帮助我们更好的理解。	1	2	3	4	5
X2-4	10. The teacher talks to us about how we feel about the subjects we study. 10. 老师会与我们谈论：大家对知识点的理解和认识。	1	2	3	4	5
X3-1	11. The teacher listens to my opinions and ideas. 11. 老师会倾听我的看法。	1	2	3	4	5

X3-2	12. The teacher tells us that it is important that we express our disagreement if we do not agree with her. 12. 在师生观点有分歧时,老师鼓励大家表达不同的观点。	1	2	3	4	5
X3-3	13. The teacher is willing to listen to students' complaints about her. 13. 老师愿意倾听,学生对教师本人的抱怨(或消极情绪)。	1	2	3	4	5
X3-4	14. The teacher respects students who tell her what they really think and are not ingratiating. 14. 对于说出真实想法的学生,老师是尊重学生,而不是表面糊弄。	1	2	3	4	5
X3-5	15. The teacher allows me to decide things myself. 15. 老师允许我自己决定事情。	1	2	3	4	5
X3-7	16. The teacher shows me how to solve my problems myself. 16. 老师教导我：如何自己独立解决问题。	1	2	3	4	5

Part III:

Academic Motivation Scale (AMS, Formal)

Code	Academic Motivation Scale (AMS)	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
M1-2	1. For the pleasure I experience when I discover new things I have never seen before. 1. 当我发现从未见过的新事物时,我感到了欣喜。	1	2	3	4	5	6	7
M1-3	2. For the pleasure I experience in broadening my knowledge about subjects that appeal to me. 2. 在有趣的学科中拓宽知识面,使我快乐。	1	2	3	4	5	6	7
M1-4	3. Because my studies allow me to continue to learn about many things that interest me. 3. 学习能让我接触到许多吸引我的新事物。	1	2	3	4	5	6	7
M2-2	4. For the pleasure I experience when I surpass myself in one of my	1	2	3	4	5	6	7

	personal achievements. 4. 当个人成就有所突破时,我感到很欣慰。							
M2-3	5. For the satisfaction I feel when I am in the process of accomplishing difficult academic activities. 5. 在攻克难关后,我获得满足感。	1	2	3	4	5	6	7
M2-4	6. Because college allows me to experience personal satisfaction in my quest for excellence in my studies. 6. 在追求卓越的求学过程中,使我感到满意。	1	2	3	4	5	6	7
M3-2	7. For the pleasure I experience when I read books by interesting authors. 7. 当我读到令人青睐的作家时,我感到怦然心动。	1	2	3	4	5	6	7
M3-3	8. For the pleasure I experience when I feel completely absorbed by what certain authors have written. 8. 当我完全被名家作品吸引时,我体验到美好。	1	2	3	4	5	6	7
M4-1	9. Because I think a college education will help to better prepare me for the career I have chosen. 9. 大学学习能增加我的职业技能。	1	2	3	4	5	6	7
M4-2	10. Because eventually it will enable me to enter the job market in a field I like. 10. 有大学文凭,可以帮我找到一些工作。	1	2	3	4	5	6	7

Part III (Continued)

Code	Academic Motivation Scale (AMS)	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
M4-3	11. Because this will help me to make a better choice in relation to	1	2	3	4	5	6	7

	my career orientation. 11. 大学教育将使我明确：我的就业方向。							
M4-4	12. Because I believe that a few additional years of education will improve my competence as a worker. 12. 我相信经过这几年的学习,将会提升我的工作能力。	1	2	3	4	5	6	7
M5-1	13. To prove to myself that I am capable of completing my college degree. 13. 为了向自己证明：我有能力获得大学学位。	1	2	3	4	5	6	7
M5-4	14. Because I want to show myself that I can succeed in my studies. 14. 为了向自己证明：我有能力获得大学学位。	1	2	3	4	5	6	7
M6-2	15. In order to obtain a more prestigious job later. 15. 上大学,是为了将来能获得更好的工作。	1	2	3	4	5	6	7
M6-3	16. Because I want to have "a good life" later. 16. 因为我希望未来有个“美好的生活”。	1	2	3	4	5	6	7
M6-4	17. In order to have a better salary later. 17. 为了以后有更高的薪水。	1	2	3	4	5	6	7
M7-1	18. Honestly, I don't know; I really feel I am wasting my time in school. 18. 老实说：我不知道学习是为了什么；我真的觉得：我在学校是浪费时间。	1	2	3	4	5	6	7
M7-2	19. I once had good reasons for going to college, but now I wonder if I should continue. 19. 我现在很迷茫,我不知道是否还要继续读下去。	1	2	3	4	5	6	7

M7-3	20. I can't see why I go to college and frankly, I couldn't care less. 20. 我不明白为什么要上大学,坦白说：无所谓啦。	1	2	3	4	5	6	7
M7-4	21. I don't know; I can't understand what I am doing in school. 21. 我不知道，我不清楚：我在大学到底做什么？	1	2	3	4	5	6	7

Part IV:

College and university classroom environment inventory (CUCEI, Formal)

code	College and university classroom environment inventory (CUCEI)	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
W1-1	1. The instructor considers students' feelings. 1. 老师能够考虑到：学生的感受。	1	2	3	4	5
W1-2	2. The instructor talks individually with students. 2. 老师能够与学生,进行心对心的交谈。	1	2	3	4	5
W1-3	3. The instructor goes out of his/her way to help students. 3. 老师尽最大努力,来帮助学生。	1	2	3	4	5
W1-4	4. The instructor helps each student who is finding the work difficult. 4. 老师能够帮助每一个在学业中遇到困难的学生。	1	2	3	4	5
W1-7	5. The instructor is friendly and considerate toward students. 5. 老师重视学生,对学生友好。	1	2	3	4	5
W2-1	6. I cooperate with other students when doing assignments. 6. 我与同学合作完成作业。	1	2	3	4	5
W2-2	7. I share my books and resources with other students when doing assignments. 7. 在做作业时,我给同学分享了自己的书籍和资料。	1	2	3	4	5
W2-3	8. When I work in a group in this class, there is teamwork. 8. 课上小组分工时,我有团队精神。	1	2	3	4	5
W2-49	9. I work with other students on projects in this class.					

	9. 当课上有研究内容时,我与同学通力合作。	1	2	3	4	5
W2-5	10. I learn from other students in this class. 10. 在课堂上,我从其他同学那儿学到了有用的东西。	1	2	3	4	5
W2-6	11. I cooperate with other students on class activities. 11. 在课堂活动中,我能与他人合作。	1	2	3	4	5
W2-7	12. Students work with me to achieve class goals. 12. 我配合同学,完成了课堂目标。	1	2	3	4	5
W3-2	13. Each student knows the other members of the class by their first name. 13. 每个学生都知道班上其他人的名字。	1	2	3	4	5
W3-3	14. Friendships are made among students in this class. 14. 班里学生之间,建立了友谊。	1	2	3	4	5
W3-5	15. It not takes a long time to get to know everybody's first name in this class. 15. 在班里,过不了多久,大家就能叫出对方的名字。	1	2	3	4	5
W3-6	16. Students in this class get to know each other well. 16. 班里学生之间都很熟悉。	1	2	3	4	5
W3-7	17. Students in this class are very interested in getting to know other students. 17. 班里同学都愿意认识对方。	1	2	3	4	5
W4-1	18. The instructor gives my questions as much attention as other students' questions. 18. 无论是我提问,还是其他同学提问,老师都同样重视。	1	2	3	4	5
W4-2	19. I get the same amount of help from the instructor as other students do. 19. 老师给我的帮助,与其他学生一样多。	1	2	3	4	5
W4-3	20. I am treated the same as other students in this class. 20. 课堂上,老师公平对待我和其他学生。	1	2	3	4	5
W4-4	21. I receive the same encouragement from the instructor as other students do. 21. 我和其他学生一样,都从老师那里获得了同样的鼓励。	1	2	3	4	5

Part IV (Continued)

code	College and university classroom environment inventory (CUCEI)	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
W4-5	22. I am given the same opportunity to answer questions as other students. 22. 我回答问题的机会与其他同学一样多。	1	2	3	4	5
W4-6	23. My work receives as much praise as other students' work. 23. 老师对我的评价,与他人一视同仁。	1	2	3	4	5
W4-7	24. I have the same amount of say as other students in this class. 24. 我在课堂上的发言权和其他同学一样多。	1	2	3	4	5
W5-3	25. The group is often sticking to the point instead of side-tracked. 25. 课堂内容紧紧围绕教学目标,而不是漫无边际的胡侃。	1	2	3	4	5
W5-4	26. This is an organized class. 26. 课堂上的活动,都有明确的计划。	1	2	3	4	5
W5-5	27. Class assignments are clear so that everyone knows what to do. 27. 课堂任务很明确,所以每个人都知道该做什么。	1	2	3	4	5
W6-1	28. New ideas are seldom tried out in this class. 28. 课堂上,老师能够尝试新的教学理念。	5	4	3	2	1
W6-2	29. New and different ways of teaching are used in this class. 29. 课堂上,老师能够采用新的，与众不同的教学方法。	1	2	3	4	5
W6-3	30. The instructor thinks of innovative activities for students to do. 30. 老师能够设计新型课堂活动。	1	2	3	4	5
W6-4	31. Teaching approaches in this class are characterised by innovation and variety. 31. 老师的课堂教学方法,具有创新性和多样性。	1	2	3	4	5
W6-6	32. The instructor often thinks of unusual class activities. 32. 老师会搞出很有特色的课堂活动。	1	2	3	4	5
W6-7	33. Students seem to do the same type of activities in every class. 33. 基本上都是满堂灌,堂课活动比较单一。	1	2	3	4	5

W7-2	34. Students are generally allowed to work at their own pace. 34. 老师普遍允许学生按照自己的节奏来学习。	1	2	3	4	5
W7-3	35. Students have a say in how class time is spent. 35. 学生有权分配课堂活动的时间。	1	2	3	4	5
W7-4	36. Students are allowed to choose activities and how they will work. 36. 老师允许学生：选择课堂活动的类型，活动方式。	1	2	3	4	5
W7-5	37. Teaching approaches allow students to proceed at their own pace. 37. 教学方法允许学生掌控自己的进度。	1	2	3	4	5

Dear students,

Please click the submit button to end the questionnaire. The information you provided is very valuable! Thank you for your participation!