FACTORS INFLUENCING STUDENT'S ENGAGEMENT: ENVIRONMENTAL ART DESIGN STUDENTS AT SUZHOU VOCATIONAL COLLEGES

BY

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Abstract

The purpose of this study was to explore the factors affecting the participation of students majoring in environmental art design in Suzhou Vocational colleges. Through the method of confirmatory factor analysis (CFA), questionnaire surveys, and interviews, the multi-dimensional factors affecting student participation were analyzed in depth. A questionnaire covering course content, teacher-student interaction, learning environment, and technology use was designed, and 384 valid questionnaires were collected. CFA was used to analyze the questionnaire data, and the results showed that the relevance of course content and the quality of interaction between teachers and students had a significant positive impact on student engagement. The results of the interviews were complementary to the findings of the questionnaire, emphasizing the practicability of curriculum design and the importance of teacher-student interaction, and pointing out that the effective use of technology could further enhance students' sense of participation. This study provided an empirical basis for improving the teaching quality of environmental art design and put forward practical suggestions on how to optimize teaching strategies in vocational colleges to enhance students' participation. The research results not only provided an important reference for educational practice in the field of environmental art design but also laid a foundation for subsequent relevant research.

(Total 155 pages)

Keywords: Student's Engagement, Environmental Art Design, Vocational College

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Table of Content

Table of Contents (continued)

Table of Contents (continued)

List of Tables

List of Tables (continued)

List of Tables (continued)

List of Figures

Chapter 1

Introduction

1.1 Background and Significance of the Study

1.1.1 Background of the Study

It appeared that in today's market-oriented and globalized world, China's interior design professional education was facing an era full of opportunities and challenges. There had been a consensus regarding the effectiveness of art design education that the development of the direction of professional education should focus on the exploration of professional practicability in organizing, directing, transferring knowledge, and directing learning activities (Brosens, 2023). However, in China, according to the discipline catalog of the Ministry of Education (MOE) of the People's Republic of China, the official "Introduction to Degree Discipline of Environmental Design," or in another name, Environmental Art Design was described as concerning a comprehensive planning behavior of space function design and art scheme design for specific environments. This mainly included the space function and aesthetic plan, decoration material and modeling scheme, and lighting and color setting (Qiu, 2023).

In this study, colleges in Suzhou offered a course called Environmental Art Design, in which the course structure included: 1) Interior Design of Spatial Design Concepts; 2) Design Expression, Ergonomics; 3) Material Technology; 4) Architectural Design Foundation; 5) Furnishings Art Design; 6) Furniture Design; 7) Environmental Lighting Design; and 8) Environmental Color Design. This course aimed to become an Interior Design for Environmental Art Course, as it was an art design course that combined art with environmental functionality and sustainability. The goal was to create comfortable, functional, and aesthetic interior spaces through the careful collocation of elements such as layout, materials, and colors (Nathan, 2021)

One of the most important factors that helped Interior Design students participate in their Environmental Art Design course was students' engagement (Care, 2018). Since the Environmental Art Design professional courses were fundamental to vocational education, aiming to cultivate the vocational skills needed to help students improve their job opportunities and serve high-quality employment (Van Hooft, 2021), the process of engaging in these courses was considered one of the most significant factors (Nian, 2020).

Thus, understanding how students engaged during the course was crucial (Hilliger, 2022; Salimi, 2024). Students' engagement was a psychological state of mind while studying (Miller, 2024) that related to their energy, enthusiasm, and motivation in their academic work and participation in learning (Small, 2024).

Moreover, students' engagement was believed to be influenced by various factors, such as: 1) Affective Engagement; 2) Behavioral Engagement; 3) Cognitive Engagement; 4) Course Activities Engagement; and 5) Instructor Skills. It could be seen that students' engagement was highly related to their mind, emotion, and actual behavior, as well as their interaction and participation through course activities with peers and instructors in their learning environment (Bakker, 2017; Hartzog, 2024; Schreiner, 2021). Positive students' engagement helped promote effectiveness in learning performance (Wong, 2022; Sánchez, 2024;), which naturally occurred during their studies (Utterback, 2023).

While affective engagement was the degree to which students actively and effectively participated in their learning activities (Nanney, 2023), positive emotions could lead to effective academic tasks and social interactions (Zhao, 2024), both on campus and off campus (Arnold, 2024), which in turn enhanced positive learning outcomes (Phang, Rogers, Hashem, Sharma, & Noble, 2012).

Behavioral engagement referred to the actual behaviors that could be observed through students' participation in learning activities, including participation

in class discussions, completion of assignments, and attendance in classes (Knudsen, 2023; Van Braak, 2021). It helped encourage long-term relationships between students and their school environment, motivation to achieve, and academic engagement from a multi-dimensional perspective (Abbas, 2022; Pekrun et al., 2012).

Learning-oriented behavior engagement was viewed as the interaction or reaction to various situations, allowing students to produce positive learning outcomes based on their good practices (Ghasemkhani, 2024; Tiana, 2022).

When it came to cognitive engagement, it was key to affective learning and referred to the level of investment students put into their thinking by using deep thought to complete their tasks (Fredricks, Blumenfeld and Paris, 2004). It was a form of engagement that promoted deep thinking and understanding of how to adapt to fulfill academic goals (Wang & Ye, 2023). The more positive cognitive engagement there was, the better the students could manage their learning (Flowerday, 2023; Frost, 2024).

Course Activities Engagement was related to the improvement of academic performance through the active learning of course activities, resulting in effective academic outcomes (El-Mansy, 2023; Nanney, 2023).

Active learning of course activities (Adunlin, 2024; Barlow, 2018), such as: 1) cooperative and collaborative learning (Romero, 2023); 2) case-based studies (Zhang, 2022; Sang, 2024; Sun, 2024); and 3) problem-based learning (PBL) (Córdova, 2020), helped improve student performance. By doing so, the skills obtained through: 1) positive interdependence; 2) face-to-face interaction; 3) individual accountability; 4) interpersonal and small group skills; 5) critical thinking; and 6) problem-solving increased the ability to apply newly learned skills in unfamiliar situations (Alexander, 2008; Dawana, 2023; Weller, 1988).

Instructors' skills engagement in students' engagement referred to the ability to design engaging tasks and activities that helped students succeed in completing their courses (Kurban, 2024). It was argued that instructors who utilized various course strategies were more successful in achieving their goals regarding students' academic outcomes (Wilson, 2024). Additionally, instructors who held positive personalities tended to have better relationships in teaching and learning with students (Sharp, 2021), especially when they demonstrated: 1) strong flexibility; 2) adaptability; 3) intellectual open-mindedness; 4) initiative; and 5) excellent self-regulation skills (Elharrouss, 2024).

As could be seen above, it was very important to understand students' engagement. However, there was a lack of comprehensive and systematic research on the construction and development of engagement among students majoring in Environmental Art Design, especially in vocational education colleges in Suzhou.

Accordingly, to fill this gap, it was necessary to develop measurement scales to assess students' engagement accurately. Hence, this study focused on the scale development of engagement among students studying in the Environmental Art Design course in vocational colleges in Suzhou. In that respect, the testing of the validity of the constructs of 1) Affective Engagement; 2) Behavioral Engagement; 3) Cognitive Engagement; 4) Course Activities Engagement; and 5) Instructor Skills was employed. The validity of the constructs or factors constituting the engagement of students studying Environmental Art Design in Suzhou vocational colleges was obtained through Confirmatory Factor Analysis (CFA) to examine the Five-Factor Model of student engagement.

This approach helped specify the representation of the variables in a construct logically, utilizing Exploratory Factor Analysis (EFA) followed by CFA to validate the construct. Thus, the CFA was performed to analyze the factors, variables within factors, variances, and covariance among the elements, as well as the relationships

among variables and factors (Dorman, 2003), which is a construct validation technique, followed by testing (Han, 2023).

With the technique mentioned above, the present study showed that the CFA analysis of the Five Factors—1) Affective Engagement; 2) Behavioral Engagement; 3) Cognitive Engagement; 4) Course Activities Engagement; and 5) Instructor Skills Engagement—appeared to have a good fit representing the model.

In testing the validity of the construct, the results of the findings depended upon the students' responses and interpretations of their studies in the Environmental Art Design course in vocational colleges in Suzhou. In conclusion, this study investigated the current situation of engagement in the Environmental Art Design course to further understand student participation and classroom engagement during the course in Suzhou.

1.2 Research Objectives

1.2.1 To explore the Confirmatory Factor Analysis (CFA) in supporting the five factors in the model of learning engagement of the students in order to advance the engagement of Environmental Art Design course students in vocational colleges in Suzhou City; and

1.2.2 To gain the perspectives of the administrators to confirm the five factors in the model of learning engagement of the students by the administrators, in order to improve the engagement of Environmental Art Design course students in vocational colleges in Suzhou City.

1.3 Research Questions

1.3.1 What was the Confirmatory Factor Analysis (CFA) in supporting the five factors in the model of learning engagement of the students in order to advance the engagement of Environmental Art Design course students in vocational colleges in Suzhou City?

1.3.2 What were the perspectives of the administrators to confirm the five factors in the model of learning engagement of the students by the administrators, in order to improve the engagement of Environmental Art Design course students in vocational colleges in Suzhou City?

1.4 Research Framework

The Five-Factors of students' Engagement: 1) Affective Engagement; 2) Behavioral Engagement; 3) Cognitive Engagement; 4) Course Activities Engagement; and 5) Instructors' Skill Engagement.

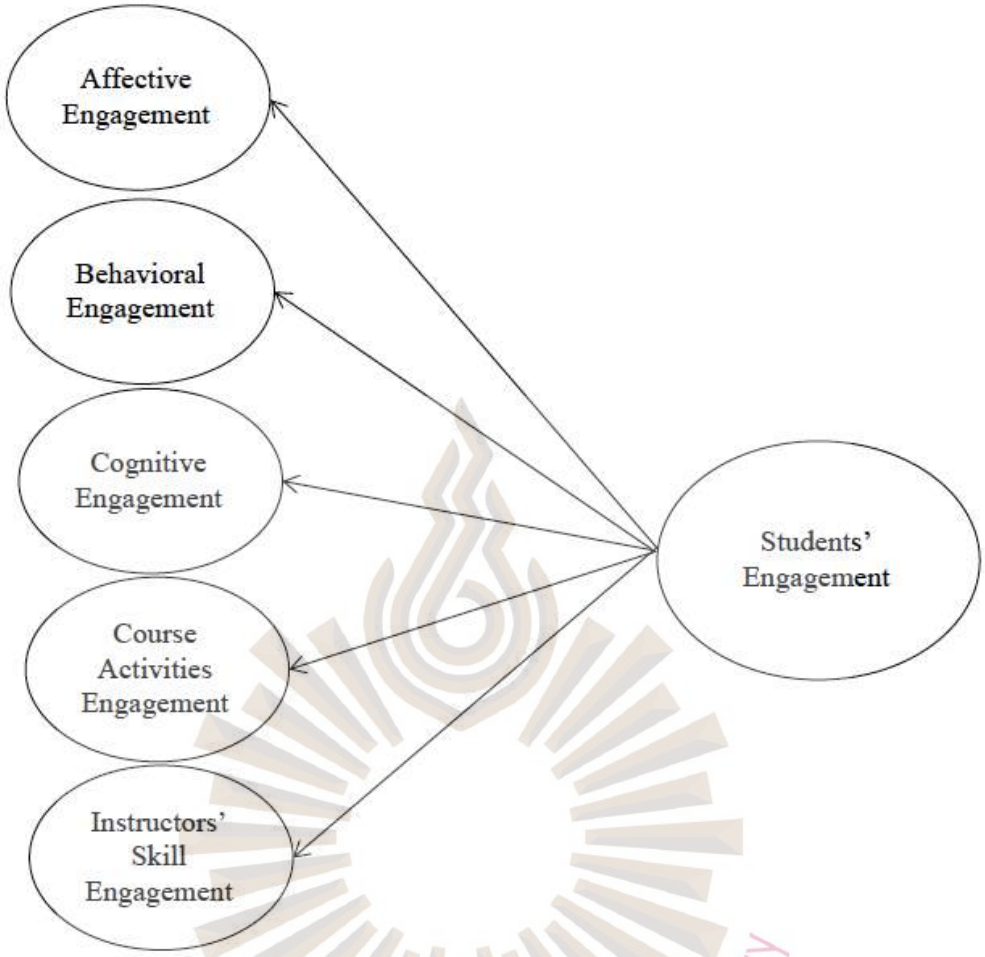

Figure 1.1 The Five Factors

1.5 Research Scope

This study utilized a mixed-methods approach that consisted of an initial quantitative phase to explore the phenomenon and analyze data, followed by a qualitative phase to investigate further and explain the quantitative results in greater depth.

1.5.1 Quantitative Phrase

This study investigated students' engagement of those majoring in the Environmental Art Design course at vocational colleges in Suzhou City.

1.5.2 Population

The population in this study was 689 students majoring in Environmental Art Design. The names of the three schools and the number of students were: 1) Suzhou Polytechnic Institute of Agriculture (294); 2) Suzhou Art & Design Technology Institute (262); and 3) Suzhou Tourism and Finance Institute (133).

1.5.3 Sample Size

The sample size was 384, calculated by Krejcie & Morgan (1970) based on the proportion of the sampled Environmental Art Design students from the targeted colleges, in order to obtain the necessary sample size for this study. By applying a combined stratified and systematic sampling method, the research achieved a representative and well-distributed sample at each targeted college. The combination of stratified and systematic sampling techniques enhanced the reliability and generalization of the research findings, ensuring that each subgroup of the population was adequately represented (Bhandari, 2024).

1.5.4 Research Instrument

The questionnaire used in this study aimed to explore the factors impacting students' learning engagement majoring in Environmental Art Design at vocational colleges in Suzhou City. The questionnaire consisted of two parts:

Part I: Demographic information

Demographic information was usually treated as private data (e.g., gender and age) and was intended to provide data for the preliminary review of research objectives.

In this section, we reviewed the two main objectives of the study in detail and summarized the key findings from the study.

Part II: Factors that influenced the students' learning engagement in the Environmental Art Design course.

The Five-Factors Model of the Students' Engagement.

In this study, all the factors gained from the theory and the literature review concerning students' engagement are named as followed:

1) Affective Engagement (AE)
2) Behavioral Engagement (BE)
3) Cognitive Engagement (CE)
4) Course Activities Engagement (CAE)
5) Instructors' Skill Engagement (ISE)

1.5.5 Data Collection

After the questionnaires were collected, they were organized and coded, with the elimination of invalid data, using Microsoft Excel files for subsequent statistical data analysis by a statistical program.

1.5.6 Data Analysis

A statistical program was used to examine descriptive analysis, including means, standard deviations, skewness, kurtosis, frequency, and percentages.

Analysis of Moment Structures (AMOS Version 20.0) was also utilized to analyze the data. In this study, confirmatory factor analysis (CFA) was conducted to look for associations between the study's latent and observable variables.

1.5.7 Qualitative Phrase

In this study, quantitative and qualitative methods were used. After the results of the questionnaire came out, they were used to write the interview questions. The interviews were conducted with three principals from Suzhou vocational colleges to confirm the five-factor model of students' engagement in Environmental Art Design at Suzhou vocational colleges.

1.5.8 Interviewees/Informants

The interviewees who were interviewed to confirm the five-factor model of students' engagement in Environmental Art Design at Suzhou vocational colleges were six administrators from vocational colleges in Suzhou. The criteria used to verify those interviewees were that all of them had to be Head Instructors or Department heads who had been working in the vocational colleges in Suzhou for at least five years.

1.5.9 Semi-Structured Interview

Semi-structured interviews were employed as the major qualitative data collection method in the study. The interview guide included questions on essential themes determined through students' engagement gained from the questionnaire. The goal, structure, and expected length of the meeting were explained to the participants at the beginning of the interview. Their responses were kept confidential, and they were allowed to decline to answer any question. The site of the interview was properly arranged to avoid any disturbances.

After signing the informed consent, demographic questions were asked, followed by related subject matter, with replies frequently summarized to ensure comprehension and encourage clarification or elaboration as appropriate. Additionally, to prevent leading participants, all questions were worded in an open-ended and

nonjudgmental manner. Observations throughout the interview were documented with field notes, and reflective journalist was completed immediately afterward to capture contextual elements and subjective observations. Recording, transcription, and iterative analysis were also included.

1.6. Definition of Terms

Students' Engagement: Students' engagement was believed to be influenced by various factors such as: 1) Affective Engagement; 2) Behavioral Engagement; 3) Cognitive Engagement; 4) Course Activities Engagement; and 5) Instructor Skills. It was evident that students' engagement was highly related to their minds, emotions, and actual behaviors, with interactions and participation through course activities alongside their peers and instructors in their learning environment.

Affective Engagement: Affective Engagement referred to the degree to which students actively and effectively participated in their learning activities, which could be recognized by the purpose and significance behind their academic tasks and social interactions, accompanied by positive emotions in both on-campus and off-campus activities. This engagement was thought to enhance positive learning outcomes.

Behavioral Engagement: The actual behaviors that could be observed in students' participation in learning activities included participation in class discussions, completion of assignments, attendance at classes, and compliance with school rules. Engaged students exhibited more optimistic behaviors with reflective learning.

Cognitive Engagement: The level of investment students put into their thinking regarding how to use their deep thoughts to complete their tasks.

Course Activities Engagement: The improvement of academic performance through the active learning of course activities engagement resulted in effective

academic outcomes. By doing so, the skills obtained included: 1) positive interdependence; 2) face-to-face interaction; 3) individual accountability; 4) interpersonal and small group skills; 5) critical thinking; and 6) problem-solving, which increased the ability to apply newly learned skills in unfamiliar situations.

Instructors' skills engagement on students' engagement: It referred to the ability to design engaging tasks and activities for students to succeed in the completion of their courses. It was also believed that instructors who held positive personalities tended to have better relationships in teaching and learning with students, particularly those who demonstrated: 1) strong flexibility; 2) adaptability; 3) intellectual open-mindedness; 4) initiative; and 5) excellent self-regulation skills.

Environmental Art Design: Environmental Art Design mainly studied the basic theoretical knowledge of environmental art design, including basic design knowledge, display art design knowledge, architectural drawing and techniques, as well as the knowledge and ability related to environmental design, interior decoration design, effect drawing techniques, outdoor environment design, quotation, and construction management. Environmental art design involved the design process and practice of integrating art with the environment to improve and enhance human living environments, public spaces, or natural landscapes in creative ways, such as environmental landscape design and construction according to design.

Students: Junior college students were those who received junior college education. The main goal of the specialty was to cultivate technical talents, focusing on practicality. This involved training a group of individuals with higher education knowledge and certain professional and technical skills based on the completion of senior secondary education, ensuring that the teaching of knowledge was sufficient and practical. Junior college education was a shorter form of vocational education compared to undergraduate education, based on the completion of secondary education. Like undergraduate and postgraduate education, it was part of China's higher education system.

Students Majoring in Environmental Art Design: It was necessary to cultivate high-level application-oriented design talents with all-around development in morality, intelligence, physical fitness, aesthetics, and labor, along with good humanistic and artistic accomplishments. Students were expected to systematically grasp the basic theories and professional skills of environmental design, develop an innovative spirit and innovation ability, and adapt to the needs of contemporary social development. They were also encouraged to possess strong teamwork skills, lifelong learning abilities, a global vision, and the courage to explore and take responsibility. The program covered the fields of architectural engineering technology, humanities, arts and sciences, as well as urban landscape, primarily focusing on indoor and outdoor human settlement environment design research and environmental construction practice.

Confirmatory Factor Analysis: Confirmatory Factor Analysis (CFA) was a statistical method that examined the validity of the relationship between a latent variable and the indicators, or factors (observed variables), used in its construction. In the research, each of the four dimensions of sustainability represented a latent variable that had been defined by a number of observed variables. By using CFA, the degree of fit of the indicators (observed variables) with the content of the corresponding dimension, as they were placed in each latent variable, was analyzed.

Research Size: This research was conducted in Suzhou City, at three public vocational colleges in Jiangsu Province, on the southern coast of China. The geographical significance of the study sites was as follows: the three vocational colleges were public institutions in Suzhou: 1) Suzhou Polytechnic Institute of Agriculture; 2) Suzhou Art & Design Technology Institute; and 3) Suzhou Tourism and Finance Institute

Chapter 2

Literature Review

2.1 Introduction

In this study, student engagement was determined by the concepts of student engagement during the course learning. Accordingly, the literature review covered the definitions and dimensions of student engagement involving the context of their learning during the courses they were taking. In that respect, the characteristics of learning engagement found during the courses were compiled as the factors of student engagement for this study.

2.2 Student Engagement

2.2.1 Student Engagement

Some authors defined student engagement as having three interrelated dimensions: behavior, emotion, and cognition. Firstly, it involved participation in activities and adherence to rules or norms. Secondly, students' affective or emotional engagement referred to their emotional reactions to activities, peers, and teachers, as well as their sense of belonging to the curriculum. Finally, students' cognitive engagement corresponded to their psychological engagement in activities that involved mastering complex knowledge, as well as their use of learning or metacognitive strategies.

Bond (2020) thought that the concepts of student engagement varied over time and across different disciplines. Fredricks et al. (2004) defined three dimensions of student engagement in their pioneering literature review: affective, behavioral, and cognitive. Active students were emotionally engaged in learning. The factors outlined by Fredricks et al. (2004) and Heilporn (2021) collectively provided a comprehensive approach to student engagement, attempting to capture the countless dimensions involved in complex engagement processes.

2.2.2 Affective Engagement

The dimension of affective engagement was related to the level of stigmatization and persistence of emotions experienced by students, reflecting their level of enthusiasm for higher education experiences. Emotional participation was manifested in the enhancement of positive emotions in both on-campus and off-campus activities, which could be expressed through happiness and joy (Arnold, 2024; Pekrun et al., 2002). Emotionally engaged students were able to recognize the purpose and significance behind their academic tasks and social interactions (Zhao, 2024). Errico et al. (2018) also found that in e-learning, achievement emotions varied depending on the learning task. These positive emotions were found to be associated with behavioral involvement (Errico et al., 2018). Although the emotional component of student experience was the core of participation, there was insufficient research on it in the literature (Amemiya, 2020; Pekrun et al., 2002). However, emotions were closely related to students' learning, achievement, life satisfaction, and health (Zhu, 2024). The feelings of optimism, pride, joy, and enthusiasm could generate sustained psychological investment in higher education experiences outside of college (Pekrun et al., 2002).

Although few studies focused on the relationship between emotional engagement and performance, some studies supported the association between better performance and positively activated emotions (such as enjoyment), as well as poorer

performance and other emotions such as positive deactivation, negative activation, and negative deactivation (Fredricks et al., 2004; Zhu, 2024). The dynamic changes in emotional engagement, coping, and daily resilience during development highlighted the important role of emotional engagement in promoting individual development and resilience (Henry, 2023).

Lawrence, Edwards, Talipski, and Goodhew (2020) noted that higher-performing students appeared more in the classroom, interacted more with course components, set higher quality goals, and completed more work. For behavioral, cognitive, and agency involvement, it seemed that more was better. However, this "more" difference became blurred with emotional engagement—students with higher grades experienced more negative emotions when facing challenges than those with lower grades.

In conclusion, the relationship between affective engagement, emotional participation, and academic performance among students was highlighted. It emphasized how emotions, particularly positive ones, impacted student engagement, learning, and achievement. The importance of emotional engagement in promoting individual development and resilience was underscored. Additionally, it noted the association between emotional engagement and performance, indicating that higher-performing students may have experienced more negative emotions when facing challenges.The higher-performing students exhibited more active participation in classroom activities and set higher quality goals. This information was useful for my dissertation.

2.2.3 Behavioral Engagement

In conclusion, the relationship between affective engagement, emotional participation, and academic performance among students was highlighted. It emphasized how emotions, particularly positive ones, impacted student engagement,

learning, and achievement. The importance of emotional engagement in promoting individual development and resilience was underscored. Additionally, it noted the association between emotional engagement and performance, indicating that higher-performing students may have experienced more negative emotions when facing challenges. The higher-performing students exhibited more active participation in classroom activities and set higher quality goals. This information was useful for my dissertation.

Bond (2020) believed that student engagement was the energy and effort used by students in the learning community, which could be observed through various behavioral, cognitive, or emotional indicators on a continuum. It was formed by a series of structures and internal influences, including complex interactions between relationships, learning activities, and learning environments. The higher the participation and ability of students in the learning community, the more likely they were to redirect this energy into learning, resulting in a series of short-term and long-term outcomes that could further promote participation.

In conclusion, the behavioral engagement dimension in student engagement focused on observable academic performance and participatory actions. It highlighted positive behavioral engagement indicators such as attending classes, working hard, engaging in discussions, participating in activities, managing time, and demonstrating resilience in facing challenges. Active students demonstrated positive engagement behaviors by actively participating in college and extracurricular activities. The paragraph also mentioned that student engagement was influenced by various factors and interactions within the learning community, leading to short-term and long-term outcomes that promoted further engagement.

2.2.4 Cognitive Engagement

The cognitive engagement dimension reflected a series of persistent and active psychological states experienced by the participating focus object. This

included a positive focus and level of interest in the dissemination of higher education, as well as the time spent planning and organizing academic pursuits. Students who engaged in cognitive engagement exhibited a greater understanding of the value and importance of academic work through their perceptions, beliefs, thinking processes, and strategies used in academic tasks. Therefore, considering the cognitive abilities of students regarding the content, significance, and application of academic tasks, those who participated in cognition were more likely to exhibit higher-order thinking (Christenson, Reschly, & Wylie, 2012).

In conclusion, the cognitive engagement dimension in student engagement focused on the psychological states and active involvement of students in higher education. It mentioned that cognitive engagement involved a positive focus, interest in learning, and time spent planning academic pursuits. Students who engaged cognitively demonstrated a deep understanding of academic work through their perceptions, beliefs, thinking processes, and strategies. Those who engaged cognitively were more likely to exhibit higher-order thinking skills due to their cognitive abilities in understanding and applying academic tasks.

2.2.5 Course Activities Engagement

Course Activities Engagement was a commitment of students to their role as learners in learning engagement, corresponding to their tasks (i.e., learning or study), and representing a positive interaction between the student and learning activities. The importance of the information and what they gained from their engagement with the learning activities was emphasized (Andrew, 2024).

Wong and Liem (2022) argued that although student engagement played a crucial role in promoting expected outcomes in school, educational psychology researchers recognized that the conceptual ambiguity of student engagement was a multidimensional structure in which participation corresponded to the role of students as school members, representing the connection between students, peers, and teachers

with their activities (such as classroom or extracurricular activities). Thus, students' engagement in the classroom environment was related to their feelings, behaviors, and thinking in classroom learning activities (such as homework), while school engagement in the same classroom environment was related to students' attachment to teachers and classmates, classroom cooperative behavior, and identification with the classroom. The former was related to the learning experience, while the latter was related to social connections. In addition to addressing the fallacy of jingling, the dual component framework of student participation also resolved the problem of object ambiguity by providing researchers with a useful conceptual means to define the key areas they were involved in.

Course Activities Engagement was the usefulness of the topics and organization for positive class engagement due to its development, organization, design, curriculum, pedagogies, methodologies, timeline, and overall planning of a course before, during, and after it was taught (Aduojo, 2018). This logical and understandable organization helped to increase learning outcomes and ultimately enhanced student engagement in the course (El-Sofany, 2020). The theoretical framework of self-determination theory (SDT) guided this study, defining three basic psychological needs that were essential to fostering students' motivation: competence, autonomy, and relatedness (Norton, 2020). Most teachers fostered students' engagement by presenting a clear, continuous, and unified Course Activities Engagement. This involved indicating when, what, and where (face-to-face, synchronously online, or asynchronously online) activities were to be completed (Heilporn, 2021).

Aduojo (2018) investigated the impact of student engagement on learning outcomes in a cyber-flipped course, analyzing different types of learning activities and their effects on engagement.Lawford (2015) investigated the effects of web-mediated activity-based learning on improving students' learning effects, engagement, and motivation in computing courses.

In conclusion, course activity engagement explored the role of self-determination theory in fostering student motivation and addressed concerns related to course activities engagement and communication processes. Teachers were noted to enhance student engagement through clear course organization, leading to improved learning experiences for students.

2.2.6 Instructors' Skill Engagement

Instructors' skill engagement referred to the ability to design engaging tasks and activities for students to succeed in completing their courses. Pedler (2020) believed that student engagement, characterized by participation, was considered a malleable multidimensional structure that combined three dimensions of behavioral, emotional, and cognitive participation. It revealed a solid understanding of how teachers influenced student engagement and emphasized the important role of teachers in ensuring that students could experience meaningful participation. This review included the education frameworks of various states in Australia and considered the potential impact these frameworks might have had on the teaching profession.

Instructors' skill engagement also recognized how interpersonal skills and communication cues affected students' perceptions of them, which in turn influenced students' engagement and their relationships with teachers (Wang, 2024). This paper was a randomized controlled trial aimed at improving the skills of peer instructors in basic life support training for medical students, focusing on the professional development of peer counselors and its impact on the quality of training for medical students (Yvet, 2020). The importance of needs assessment in improving teachers' skills in mobile website design was discussed, highlighting the significance of competency modeling for understanding the knowledge, skills, and competencies required for UX design, and mentioning the impact of students' engagement with the academic use of mobile devices and the skills they would learn from teachers (Wuttikamonchai, 2024).

In conclusion, the importance of instructor skills engagement in designing engaging tasks for student success in courses was highlighted. It mentioned that student engagement was a multidimensional structure involving behavioral, emotional, and cognitive participation.

The paragraph emphasized the influence of teachers on student engagement and highlighted the role of teachers in facilitating meaningful student participation. Additionally, it referenced education frameworks in Australia and their potential impact on the teaching profession.

2.3 Environmental Art Course in Suzhou Vocational Colleges

The course of Environmental Art Design delved into the process of advanced design structures that incorporated environmental art elements into interior design. The focus was on optimizing the structural aspects of these designs to achieve both aesthetic and functional goals, as discussed in the study on Structural Optimization of the Environmental Art Design Based on Multi-Agent Simulation System (Pan, 2022). Thus, interior design within the framework of Environmental Art Design was a highly comprehensive and interdisciplinary field.

It required an understanding of the concepts, development trends, and related theoretical knowledge of residential space design. Through specialized training in spatial design, students systematically learned the design principles and key points of public, private, and household activity areas, completing practical training in small apartment design, medium apartment space design, and large apartment space design by analyzing the design principles and cases of different apartment structures.

From the study of basic theories in interior design courses to the reinforcement training of typical project work processes, the program stimulated students' initiative and creativity, cultivated their systematic, comprehensive, and

innovative design abilities, and enabled them to clarify the ultimate design purpose—designing to meet human needs. However, with the rapid development of the social economy and technology, there was a requirement for interior design majors to cultivate diverse design talents suitable for contemporary development that could truly solve problems. Nonetheless, there were still challenges in the teaching of interior design majors, such as students' weak hands-on abilities and inconsistencies between the use of traditional elements in indoor spaces and the overall style. Therefore, improving the quality of interior design teaching and cultivating more qualified interior design talents became an important task for contemporary interior design education (Qiu, 2023)

2.3.1 Course Description

2.3.1.1 Background

With the acceleration of urbanization and people's continuous pursuit of quality of life, environmental art design as a comprehensive discipline gradually attracted attention.

2.3.1.2 Objective

In order to respond to the social demand for aesthetic and functional environments, the program aimed to train professionals with a theoretical basis and practical skills in environmental design, promoting the artistic urban environment and the improvement of human settlement environments.

2.3.2 Course Materials

2.3.2.1 Teaching Materials

Introduction to Environmental Art Design—This course introduced the basic concepts, theoretical framework, and practical experience of environmental art design, helping students establish an overall understanding of environmental design.

Principles and Applications of Landscape Design — This course provided an in-depth discussion of the basic principles and design methods of landscape design, covering different types of design cases such as public landscapes, private courtyards, and urban parks.

Interior Model Design and Production — The content included model-making principles, scale, material selection, model display, and other aspects of knowledge. Students needed to understand the different types of interior models, such as flat models, dioramas, and room models, as well as their design principles and production methods.

Commercial Space Design — This course introduced the concept, characteristics, basic principles, design process, and specific methods of commercial space design.

Human Body Engineering—This book introduced the structure and function of the human body, kinematics, biomechanics, and the application modes, environments, and principles of the basic theory in design.

2.3.2.2 Case collection

Urban Public Space Design Case Collection—This collection gathered urban public space design cases from different countries and regions, such as squares, streets, and leisure parks, to showcase various design styles and practical experiences.

Commercial Space Design Case Collection—This collection compiled classic cases of commercial space design, such as shopping malls, restaurants, and retail stores, to explore how to create a positive consumer experience and brand image through design.

2.3.2.3 Academic papers

Research on the Design and Social Function of Urban Public Space -- analyzes the design principles and social functions of urban public space, and explores how to promote social communication and cultural activities of urban residents through design.

Ecological Principles and Sustainable Development in Landscape Design -- Explore the relationship between landscape design and ecological environment protection, and study how to achieve ecological functions and sustainable development of landscape through design.

2.3.2.4 Design manual

Color Design Manual - -Introduces the basic principles and application skills of color, helps students understand the important role of color in environmental design, and can use color collocation to design works with aesthetic and emotional expression.

Space Construction Manual -- Introduces the basic principles and design methods of space construction, including plane construction, volume organization, proportional relations, etc., to help students master the core skills of space design.

2.3.3 Plans, Sequences, and Details of the Subject Matters of the Course-lesson Plan

2.3.3.1 Course handouts and teaching materials prepared by teachers, including lecture notes, PPT presentations, homework requirements, etc., are used to introduce the basic concepts, theoretical framework and practical experience of environmental art design.

2.3.3.2 Collect academic papers and journal articles in related fields, introduce the latest research results and theoretical viewpoints, and help students deeply understand the cutting-edge issues and development trends of environmental art design.

2.3.3.3 Collect field trip materials of different areas and types, such as city parks, commercial blocks, cultural attractions, etc., and analyze and discuss them in class for case analysis and students' field trip experience sharing.

2.3.3.4 Read reference books in related fields, such as classic works in architectural design, landscape planning, interior decoration, etc., for a deep understanding of the relevant knowledge of environmental design.

2.3.3.5 Students work in groups to discuss and analyze different types and styles of environmental design works, such as public space design, commercial space design, landscape design, etc., for other students' reference and learning.

2.3.3.6 Teach students Auto CAD, Sketch Up, Adobe Photo shop and other design software for the production and presentation of design works. Hand drawing tools and model making materials, such as pencils, paper, scissors, glue, etc., are used for students to draw and model making.

2.3.3.7 Job report (including PPT presentation and design of an

environmental space design scheme)

2.4 Instructional Materials and Tools Use in Teaching

2.4.1 Textbooks and Reference Books

2.4.2 Design Manuals and Case Sets

2.4.3 Academic Papers and Journal Articles

2.4.4 Design Tools, Software, Hand-drawing and Model making

2.4.5 Field Visits and Case Studies

2.5 Class Activities Used in Teaching

2.5.1 Lectures and Power Point Presentations

2.5.2 Classic Case Analysis and Discussion

2.5.3 Practical Operation and Project Practice

2.5.4 Field Trips and Project Activities

2.5.5 Team Work

2.5.6 Display and Review of Works

2.6 Environmental Art Design Class Schedule Time at Suzhou. Vocational Colleges

Table 2.1 Environmental Art Design Class Schedule Time at Suzhou Vocational Colleges

The teaching table of professional courses of the College of Environmental Arts Design							
Grade	Grade 2023 Class (A)	Grade 2022 Class (A)	Grade 2022 Class (A)	Grade 2022 Class (A)	Grade 2021 Class (A)	Grade 2021 Class (A)	Grade 2021 Class (A)
Course Title *Period	Modeling expression *48periods	Hand-drawn design performance *30 periods	Geomagnetic *20 periods	External space theory *48 periods	Interior Design Topics (3) *64 periods	Decorative engineering Design Practice B 8 weeks /*128 periods	Decorative engineering Design Practice B 8 weeks /*128 periods
Course Title *Period	Modeling expression *4 periods	Fundamentals of surveying and mapping *16 periods	Architectural space *32 periods	Hand-painted renderings *48 hours	Interior decoration design drawing specification * 48 period	Post practice 1,10 weeks /*160 periods	Post practice 1,10 weeks /*160 periods
Course Title *Period	photography *12 periods	Architectural space *32 periods	Interior design topic(2) *72 periods	Layout design *24 periods	History of World Civilization 16 periods		
Course Title *Period	Format periods *12 periods	Ergonomics and interior design *32 periods	Interior design expression *48 periods	Environmental art design topic *96 period	Post practice 1,10 weeks /*160 periods		

Source: Compiled by the Researcher

2.7 Overall Goals of the Course and the Course Assessments

2.7.1 Goals of the Course

2.7.1.1 To develop students' understanding and mastery of environmental design theories, including the basic concepts and principles of color science, space composition, and human behavior. Students need to develop a systematic understanding of environmental design through academic research and theoretical learning.

2.7.1.2 Develop students' ability to apply scientific methods and design skills to solve environmental design problems. Students need to master different design methods and tools, be able to propose innovative design schemes based on user needs and environmental characteristics, and verify their effectiveness through practice.

2.7.1.3 Cultivate students' innovative thinking and creativity, so that they can put forward novel ideas and design schemes in the field of environmental design. Students are required to constantly explore and experiment, identify problems and propose solutions to drive the development and progress of environmental design.

2.7.1.4 Cultivate students' critical thinking ability, so that they can objectively evaluate and analyze environmental design works. Students need to learn to examine design works from multiple perspectives, analyze their advantages and disadvantages, and make suggestions for improvement, so as to provide guidance and reference for their own design practice.

2.7.1.5 Cultivate students' academic communication ability, so that they can effectively express and disseminate their own design concepts and views. Students need to master academic writing and presentation skills, be able to express their ideas

clearly, and communicate and discuss effectively with others.

2.7.2 Course Assessments

2.7.2.1 Work display and review

Students can demonstrate their design ability and creativity by presenting their design work. These works can include hand-drawn drawings, design sketches, model making, digital design works, etc. The review may be conducted by a panel of teachers, industry experts or fellow students, based on criteria such as design creativity, presentation skills, and design quality. The judging process can be a combination of oral presentations and written explanations from students, who need to clearly express their design philosophy, design process and design thinking in order for judges to better understand and evaluate the work.

2.7.2.2 Design description and paper writing

Students can demonstrate their academic research and theoretical analysis skills by writing a project design description or an academic thesis. These reports or papers can be part of a course assignment or the result of a graduation or research project. The evaluation criteria include the clarity of the research question, the completeness of the literature review, the scientific nature of the research methodology, and the credibility of the research results. Students are required to clearly state the purpose, methods, results and conclusions of the research in their report or thesis, as well as the outlook for future research directions.

2.7.2.3 Class participation and discussion

Assessing students' class participation and discussion can reflect their understanding of the course content and their academic thinking skills. Teachers can promote students' participation and communication through classroom questions,

group discussions, case studies, etc. The evaluation criteria include the students' mastery of the course content, the depth and logic of the analysis of the problems, and the clarity of the questions and opinions. Students need to actively participate in class discussions, express their own views and ideas, and be able to understand and respect the views of others to promote the formation and development of a learning atmosphere.

2.8 Related Research

Because of the very limited research directly involve with students' engagement of the students studying during Environmental Art Design Course, the followings are related research in the areas of learning and/or students' engagement found. Five constructs have been revealed as prominent influences on student engagement as mentioned by several authors (Phang, 2020; Shen,2022; Sinuhin,2022; Stanley, 2022; Xiao, 2024). First, affective engagement, it is revealed that students' experience is related to affective engagement through positive and negative interactions in that students need more support while they are studying. This because, less experience, the less effective engagement (Henry, 2023). Along with the experience, relationship between determination and the influence of the students' engagement in second language learning. Studies have shown that individuals' levels of determination that can affect their behavior and emotional engagement in learning a second language, and this relationship is affected by emotional balance and affective engagement (Hasdina, 2024).

In a study of game engagement, the behavior engagement was reported to be related to the development of game levels that can elicit a range of player engagement and behavior that involve in techniques for designing game environments, mechanics, and challenges that encourage diverse player interactions and experiences (Zhang, 2022). In a study of adolescent behavioral, emotional, and cognitive engagement in school, it was reported there were relations of educational success with student

engagement in the educational professional course of career readiness which emphasized student engagement that improve academic achievement, highlighting how valuing engagement can lead to productive behavioral engagement and academic performance (Hartzog, 2024).

In terms of cognitive engagement, in a study in instrument for college engineering courses, the cognitive engagement scales represented the students' perspectives of engagement in learning in contemporary and digital contexts which emphasized cognitive engagement as investment of efforts in learning through structured-feedback (Barlow, 2018). In a social media context, it is reported that the more people have positive emotional value of content, the more cognitive engagement, can greatly influence engagement on social media platforms (Schreiner, Fischer, & Ried, 2021).

When it comes to Course Activities Engagement, the research revealed that the Course Activities Engagement helped raise awareness, behavior, and ability to learn and participate during the class (Chen, 2020). In a study of the impacts of course activities engagement on student perceptions of engagement and learning in online courses. Using eight interactive course activities engagement as indicators of course interactivity, as students' perceptions of engagement and learning outcomes varied across groups, it was reported students had the most favorable perceptions of engagement and learning outcomes with the classes that offered high levels of interactive participation activities (Tsai & Ku, 2021). Also, in the paper that reflected on the educational challenges and research opportunities in running data visualization design activities in the context of large courses, with the increasing number and sizes of data visualization course, the scaling of teaching efforts was draw on experiences in organizing and facilitating activities primarily based on one instance of a master's course with the discussions about balancing topical diversity, scaling courses activities engagement to many students, and problem-based learning (Knudsen, 2023). Moreover, The American Association of Colleges of Pharmacy's (AACP) Center for the Advancement of Pharmaceutical Education (CAPE) outcomes emphasized the

importance of equipping pharmacy students with HRM skills of the Course Activities Engagement which resulted in improving physical aspects of the safety, efficacy, and environmental impact of medication use systems (Adunlin, 2024).

Finally, the factor of learning engagement instructor' skill engagement, with a findings of instructors' skill effectiveness in engaging with students and classes. It was reported that students are more likely to learn and develop intellectually when they have effective instructors with: 1) the instructors' skill engagement; and 2) the rapport with students' factor that have also emerged in student evaluations. It was suggested that even the small amount of instructors' interactions skill, the enjoyment of engagement could be occurred while teaching and learning (Sandstrom, 2023).

2.9 The Table of the Synthesis of Students' Engagement Characteristics from Diverse Previous Research

The following was the table of the Synthesis of Students' Engagement Characteristics taken and adapted from the literature review, theoretical concepts, and previous research by several authors. The consistency and frequency of the characteristics of the Students' Engagement of the five factors from which the 50 questionnaire items were drawn and written accordingly (see Appendix A). Those five were presented as follows:

1) Affective Engagement,items 1-8;
2) Behavioral Engagement,items 9-15;
3) Cognitive Engagement,items 16-19;
4) Course Activities Engagement,items 20-31; and
5) Instructors' Skills Engagement,items 32-35.

Table2.2 The Synthesis of Students' Engagement Characteristics

CHARACTERISTICS	Affective Engagement	Active Participation	Positive emotions (Be happy) in while participating	Task Fulfilling while participating	Be happy while doing activities both on campus and off campus	Positive learning outcomes caused by participation	Social interactions, persistence of emotions, optimism, pride, joy, and enthusiasm	The more of the participation the more complete of the high performance
AUTHORS	Nannev 2023		✓				✓	
	Zhao 2024		✓	✓				
	Arnold 2024				✓			
	Bowden, 2013	✓					✓	
	Lyubomirsky 2013				✓			
	Shapiro, S., 2008				✓			
	Demir, M., 2007				✓			
	Pekrun 2012					✓	✓	
	Lawrence 2020	✓						✓
	Henry, 2023	✓						
	Ameniya, 2020							
	Knudsen 2023							
	Van Brunt 2021						✓	
	Abbas 2022							
	Khademi 2018							
	Kahu, 2013			✓		✓		
	Ghasemkhani 2024							
	Tiana 2022	✓				✓	✓	
	Fredricks 2004	✓				✓	✓	
	Wang, 2013							
	Frost 2024	✓	✓			✓	✓	
	Elsawerdy, 2023							✓
	El-Mansy 2023							
	Romero 2023							
	Sun 2024							
	Zhang 2022							
	Sang 2024							
	Córdova 2020							
	Boswel, 1991							
	Dawna 2023							
	Alexander 2008							
	Weller 1988							
	Kurban, 2024							
	Wilson, 2024							
	Sharo, 2021							
	Elbarrouss, 2024							
	frequency	7	6	12	1	3	5	4

Table 2.2 The Synthesis of Students' Engagement Characteristics (continued)

Through beliefs in academic tasks																																					
Right choices, Concise mind of being the students in particular major																				✓	✓	✓															3
Through strategies in academic tasks														✓	✓	✓																					3
Course Activities Engagement																																					
Active learning of course activities (Model making, sketching, etc.)	✓											✓	✓						✓				✓		✓												6
Improvement of the academic performance	✓								✓										✓				✓		✓												5
Cooperative and collaborative learning																			✓				✓	✓	✓						✓						5
Case-based studies																			✓						✓	✓	✓						✓				5
Problem-based learning												✓							✓									✓									3
Improve the students' performance																			✓				✓		✓				✓								4
Positive interdependence																			✓				✓							✓	✓	✓					5
Face-to-face interaction																			✓											✓	✓	✓					[illegible]
Individual accountability																			✓											✓	✓	✓					4
Interpersonal and small group skills																			✓											✓	✓	✓					4
Critical thinking																														✓	✓	✓					3

Table 2.2 The Synthesis of Students Engagement Characteristics (continued)

Problem solving increase skills													✓						✓						✓					✓	✓	✓					6
Instructors' Skills Engagement																																					
Completion students' course, utilize various course strategies, teaching more successful on academic course											✓		✓						✓														✓	✓			5
Positive personalities, intellectual open-mindedness, excellent self-regulation skills																																			✓		1
Better relationships																			✓																✓		2
Strong flexibility, Strong adaptability													✓																							✓	2

Chapter 3

Research Methodology

This chapter provided a comprehensive overview of the research methodology employed in this study. It began by explaining the rationale for using an explanatory sequential approach and focused on the qualitative phase and quantitative phase, respectively. The chapter also addressed the population, sampling, and measures taken to maintain research reliability and validity. Overall, this chapter served as a guide for the subsequent chapters and the findings presented.

3.1 Research Design

This study utilized an explanatory sequential design, a commonly employed approach in mixed-methods research. The explanatory sequential design consisted of an initial quantitative phase to explore the phenomenon and analyze data, followed by a qualitative phase to further investigate and explain the quantitative results in greater depth. This design typically included two phases: quantitative and qualitative. Surveys and focus group interviews were used in the two phases.

3.2 The First Phrase: Quantitative Research

Quantitative research depended on survey questionnaires to collect data for analysis. The respondents completed the questionnaires separately. The survey questionnaires were distributed to the three target colleges, namely, Suzhou Agricultural Vocational and Technical College, Suzhou Art and Design Technology Institute, and Suzhou Institute of Industrial Technology.

3.3 Population and Samples

3.3.1 Population

The population in this study was 689 students majoring in environmental art design. The names and numbers of the three schools were: 1) Suzhou Polytechnic Institute of Agriculture (294); 2) Suzhou Art & Design Technology Institute (262); and 3) Suzhou Tourism and Finance Institute (133).

3.3.2 Sample Size

The sample size was 384, calculated by Krejcie and Morgan (1970) based on the proportion of Environmental Art Design students from the targeted colleges. The adequacy of the sample size depended on various factors, including the research objectives, the complexity of the analysis, the variability within the population, and the desired level of statistical power. While this paper discussed how sample size impacted the accuracy and reliability of the measurement, it highlighted the importance of adequate sample sizes for robust statistical analyses. The inclusion of random intercepts improved the expected prediction accuracy, so that beyond at least 300 to 400 respondents, considering other factors such as validity and representativeness provided a better understanding of sample size than merely considering achievable technical prediction accuracy (Hansen, 2022).

Finally, a proportional sampling was conducted based on the proportion of Environmental Art Design students from the targeted colleges to obtain the necessary sample size for this study. By applying this combined stratified and systematic sampling method, the research achieved a representative and well-distributed sample at each targeted college. The combination of stratified and systematic sampling techniques enhanced the reliability and generalizability of the research findings, guaranteeing that each subgroup of the population was adequately represented (Bhandari, 2024).

3.4 Research Instrument

The questionnaire used in this study aimed to explore the factors impacting students' learning engagement majoring in Environmental Art Design at vocational colleges in Suzhou city. The questionnaire consisted of two parts:

Part I: Demographic information

Demographic information was usually treated as private data (e.g., gender and age) and was provided for the preliminary analysis of the survey research (Zhen, 2022). The demographic information included: 1) gender; 2) age; 3) years of study; and 4) names of the colleges.

Part II: Factors that influenced the students' learning engagement in the Environmental Art Design course.

3.4.1 The Five-Factors Model of the Students' Engagement

In this study, all the factors derived from the theory and the literature review concerning students' engagement were named as follows:

1) Affective Engagement (AE)
2) Behavioral Engagement (BE)
3) Cognitive Engagement (CE)
4) Course Activities Engagement (CAE)
5) Instructors' Skill Engagement (ISE)

In this study, a five-point Likert scale was used to verify the factors connected to the students' behavioral intention.

The Likert scale was extremely widely utilized in quantitative measurement research (Lodico, 2006; Salkind, 2017). Likert scales were scored by assigning a weight to each point along the scale, and the respondent's score represented the evenness across all the items.

Levels of agreement and attitudes were analyzed and determined based on the study of Taherdoost (2019).

The Mean scores of 4.5-5.00 = Strongly Agree
The Mean scores of 3.50-4.49 = Agree
The Mean scores of 2.5-3.49 = Neutrally Agree
The Mean scores of 1.50-2.49 = Disagree
The Mean scores of 1.00-1.49 = Strongly Disagree

The Level of Attitudes were:

The Mean scores of 4.5-5.00 = Strongly Positive Attitude (SPA)
The Mean scores of 3.50-4.49 = Positive Attitude (PA)
The Mean scores of 2.5-3.49 = Moderately Positive Attitude (MPA)
The Mean scores of 1.50-2.49 = Negative Attitude (NA)
The Mean scores of 1.00-1.49 = Strongly Negative Attitude (SNA)

3.5 Validity and Reliability of Quantitative Research

Back translation had been conducted (Son, 2018; Ozolins, Hale, Cheng, Hyatt, and Schofield, 2020). First, the English version of the questionnaire had been translated into Chinese and then translated back into English to be checked by an expert in English to ensure the accuracy of the translation. After careful verification and revision, the translation accuracy of the Chinese version of the questionnaire in this study had met the criteria for back translation.

3.5.1 Content Validity

To ensure content validity, it is advisable for the assessment team to establish a dedicated group of experts or educators in the relevant field. This group would be tasked with evaluating how well the assessment items align with the intended objectives and determining the level of content validity present (Ary, Jacobs, Irvine, & Walker, 2018).

The method used to analyze the congruence between items and objectives has proven to be the most effective way to quantitatively assess evaluations conducted by content experts on individual items.

Item-object congruence requires experts to evaluate the questionnaire items to ensure they accurately measure the specific constructs or variables the study aims to analyze. The experts would utilize a set of rating scales with values of +1, 0, and -1. Here, a score of +1 indicates a high level of confidence from the expert regarding the accuracy and validity of the item, while a score of -1 indicates the expert's belief that the item does not adequately assess the intended construct. Ultimately, this process is essential for establishing the validity of the assessment items.the designation of "0" signifies the specialist's lack of certainty about the item's ability to appropriately assess its intended measure.

Scoring +1 = Certain that the test is congruent with the objectives or content.

Scoring 0 = Uncertain that the test is congruent with the objectives or content.

Scoring - 1 = Certain that the test is NOT congruent with the objective or content.

$$IOC = \frac{\sum R}{N} \quad (3\text{-}1)$$

IOC = item-objective congruence index

R = point given by specialists

ΣR = total points of each specialist

N = numbers of specialists

The result of the IOC was 1.

3.5.2 Reliability of Quantitative Research

In this study, Cronbach's alpha (CA) and the composite reliability coefficient (CR) were applied to assess the study's reliability.

3.5.3 Pre-test and Pilot Test

A pilot test was conducted with 30 samples outside the population. Accordingly, 30 students majoring in Environmental Art Design at the Suzhou vocational colleges participated in the pilot test for the internal consistency reliability analysis. Ten students from each of the target colleges were chosen for the pilot test. Two freshmen, four sophomores, and four juniors made up the 10 students from each college to ensure validity and internal consistency.

3.5.4 Cronbach's Alpha

A pilot test had been conducted with 30 samples outside the population. Accordingly, 30 students majoring in Environmental Art Design at the Suzhou vocational colleges had participated in the pilot test for the internal consistency reliability analysis. Ten students from each of the target colleges had been chosen for the pilot test. Two freshmen, four sophomores, and four juniors had made up the 10 students from each college to ensure validity and internal consistency.

Table 3.1 Cronbach's Alpha Coefficient Size.

Cronbach's Alpha Coefficient Range	Strength
< 0.6	Poor
0.6 to < 0.7	Moderate
0.7 to < 0.8	Good
0.8 to < 0.9	Very Good
≥ 0.9	Excellent

Source: Hair, Money, Page, & Samouel, 2007

3.6 Data Collection

After the questionnaires were collected, they were organized and coded with the elimination of invalid data using Microsoft Excel files for subsequent statistical data analysis by the Statistical Program.

3.7 Data Analysis

A Statistical Program was used to examine descriptive analysis, including means, standard deviations, skewness, kurtosis, frequency, and percentages.

Analysis Moment of Structures (AMOS Version 20.0) was also utilized to analyze the data. In this study, Confirmatory Factor Analysis (CFA) was conducted to look for associations between the study's latent and observable variables.

3.7.1 Confirmatory Factor Analysis (CFA)

In this survey, CFA was conducted after the data collection procedure to determine whether the number of structures and loadings for each observed variable met expectations, aiming for the smallest number of factors that could account for the correlations among the variables. The focus was on data preparation, factor extraction methods, rotation techniques, and interpretation of results.

Confirmatory Factor Analysis (CFA) was a statistical method used to test the hypothesis that a set of observed variables represented different dimensions or factors of a latent construct, where each observed variable loaded onto only one factor and the factors were correlated (Kline, 2011).

Usually, Confirmatory Factor Analysis (CFA) aimed to determine whether the amount of the constructions and loadings for each of the observed variables was in accordance with what was anticipated in the hypotheses (Huang, 2020; Malhotra, Hall, Shaw & Oppenheim, 2004).

In employing CFA, the concerned assumptions were as follows:

Construct Validity

Construct validity was the degree to which an instrument accurately predicted the construct that was examined (Bolarinwa, 2015).

Construct validity aimed at the stability of the connection of convergent validity and less or no relationship for discriminant validity (Ginty, 2013).

Convergent Validity

Convergent validity was the assessment of how numerous high-degree indices were related to a single construct.

Factor loading, average extracted variance (AVE), and composite reliability (CR) were some of the conditions or indicators used to establish convergent validity

Factor Loading

Factor loading described or explained the relationships between the observed variables. An acceptable factor loading value was typically above 0.4, while a factor loading of 0.7 or higher was considered sufficient to capture the variance of the variable (National Library of Medicine, 2020).

II. Average Variance Extracted (AVE)

The average variance extracted level had to be greater than 0.50 to demonstrate an acceptable level of convergent validity (Hair et al., 2014).

III. Composite Reliability

Composite reliability, or construct reliability, represented the relationship between each true value variance and the variances of the composite for correlated variables for constructs.

The threshold of composite reliability had to be greater than 0.60 or 0.70, reflecting the optimal extent of the inherent consistent reliability of all the observed variables.

Discriminant Validity

According to Hair et al. (2014), discriminant validity ensured that the construct being examined was distinct, with correlation assessments of higher than or equal to two and standard errors less than 1.00, indicating that discriminant validity was present.

Goodness of Fit

Goodness of fit determined the fit between the hypothesized model and the observed covariance matrix (Hair et al., 2014).

Absolute Fit Indices

The degree to which the study model fit the statistical data which includes Chi-Square Value to Degree of Freedom (CMIN/DF),

Root Mean Square Error of Approximation (RMSEA), the Adjusted Goodness of Fit Index (AGFI), and the Ratio of the Goodness of Fit Index (GFI).

Chi-Square Value to Degree of Freedom (CMIN/DF) -- the index requirement of less than or equal to 3.00 is acceptable.

Goodness of Fit Index (GFI) – a special category that assesses how well the assumed model fits the observed covariance matrix of a GFI value ≥ 0.9 is a good fit, while $0.8 \leq GFI \geq 0.9$ is referred to as suitable fit or acceptable model.

Adjust Goodness of Fit Index (AGFI)

An adjusted GFI(AGFI) -- the number of indices for each statistical study construct that has an impact on goodness of fit, which is modified by the AGFI. A value of 0.90 or more is regarded as satisfactory for this weighted decision coefficient, which theoretically ranges from 0 (bad fit) to 1 (perfect fit)

Root Mean Square Error of Approximation (RMSEA) -- a particular statistical indicator used to eliminate the sample size issues according to the diversities between the hypothetical matrix with the optimal arguments. The range of RMSEA should be between 0 and 1.00, with less than 0.05 is the suitable degree for the model fit.

Incremental fit indices (IFI) -- the incremental fit indications show how closely the examined matrix resembles the baseline pattern with a good match that exceeds.9, however the index can go above 1.

Comparative Fit Index (CFI) -- The CFI scale runs from 0 to 1, with higher numbers indicating greater fit. In the past, model fitting was deemed good when the CFI value was 0.90 or higher.

Normed Fit Index (NFI) -- should be above or equal to 0.90 for NFI (Hair et al., 2014).

3.8 Qualitative Research

In this study, quantitative and qualitative methods were used. After the results of the questionnaire came out, they were used to formulate the interview questions. The interviews were conducted with six principals from Suzhou vocational colleges to confirm the five-factor model of students' engagement in Environmental Art Design at Suzhou vocational colleges.

3.9 Research Tools

This study used NVivo12 qualitative software as the research tool. NVivo stood for Non-numerical Unstructured Data by techniques of Indexing, Searching, and Theorizing. This software met the needs of both qualitative and quantitative analysis.

It supported qualitative research methods and mixed research methods, could process various types of data including text, and had powerful functions such as searching, querying, visualization, data coding, data splitting, and data statistics.

NVivo12 qualitative analysis software, as a recently launched product in the NVivo series, had many improvements in terms of both functionality and user experience compared to previous versions. In this study, relevant thematic interview text materials were imported into NVivo12 qualitative analysis software, and a text project was established. Corresponding nodes, including tree nodes and child nodes, were established according to the research framework. NVivo12 qualitative analysis software was used to transcribe the text as required by the research. The text materials were coded using the established research framework, including interview dimensions such as course activities, instructors' skills engagement, affective engagement, learning behavior, and cognitive engagement. NVivo12 qualitative analysis software allowed direct coding in the transcribed text. Finally, the coding coverage and coding density tables generated by NVivo12 qualitative analysis software were used for analysis.

Based on the above analysis, using NVivo12 qualitative analysis software provided strong technical support for data analysis and processing work in this study.

In this study, first, the interview texts from three interviewees were imported into NVivo12 qualitative analysis software. Then, according to the research framework, corresponding tree nodes and child nodes were established in NVivo12 qualitative analysis software to prepare for subsequent coding work. Next, the selected texts were entered, and the entered text materials were coded and analyzed. This precisely matched the nodes, interview texts, and transcribed texts. Through the coding coverage and coding density tables obtained from NVivo12 analysis software, organization and specific analysis were conducted to further study the characteristics of factors influencing the engagement of Environmental Art Design students. The specific steps were as follows:

3.9.1 Importing Raw Materials

3.9.1.1 Creating a New Project

Downloaded the selected interview texts on relevant topics, then established a new project in NVivo12 qualitative analysis software. For clarity in the research, the three interview texts were imported into different projects and named separately. The following explanation used interview material F2 as an example:

Opened NVivo12 qualitative analysis software, created a new project titled "Factors Influencing the Engagement of Environmental Art Design Students," and clicked OK. The transcription and coding work of the interview materials on "Factors Influencing the Engagement of Environmental Art Design Students" was carried out under this project. For subsequent analysis, the file location of this project could be directly found and opened for corresponding operations. In the file name, the disk D where the project was located was selected, and the file named "Factors Influencing the Engagement of Environmental Art Design Students.nvp" was clicked OK to complete the creation of the new project.

3.9.1.2 Importing Text

(1) Create a New Project

NVivo12 analysis software was compatible with various formats of text files, including AVI, MP4, MPG, 3GP, etc. The text chosen during the research process was in MP3 format, which was compatible with NVivo12 qualitative analysis software. Therefore, NVivo12 qualitative analysis software could be used to perform detailed operations on the interview text. During the research, 48 interview texts were imported into different projects respectively. The following explanation used interview material F5 as an example to illustrate the process of importing text.

The interview text named "Factors Influencing the Engagement of Environmental Art Design Students" was imported into the project "Factors Influencing the Engagement of Environmental Art Design Students.nvp." The process involved selecting "Import File," opening the folder where the text material was saved, selecting the text file to be coded, and clicking "Open" followed by "Import." After clicking import, the text properties appeared. After confirming that there were no errors, clicking OK completed the entire process of text import.

(2) Establishing Nodes

After importing the materials, the research process entered its core step: establishing nodes. Throughout the entire research process, the coding node framework occupied a central position. All text materials needed to be coded according to this framework. Therefore, when coding the text materials, the researcher first found the matching nodes. NVivo12 qualitative analysis software provided two ways to set up nodes. The first method involved obtaining a standard coding structure model by classifying and summarizing existing data. If the researcher already had a fixed coding framework, they could first construct a mind map based on their own coding system and then convert the mind map into nodes with one click. This method was relatively simple and could quickly yield suitable coding schemes. The second method was for researchers who did not have a fixed coding system prior to coding. They could directly select the content to be coded from the research materials, right-click to select "Create New Node," and then fill in the node content.

Since this study already had a fixed coding framework, the first-level dimensions in the research framework served as tree nodes: Course Activities, Instructors' Skills Engagement, Affective Engagement, Learning Behavior, Cognitive Engagement, and Environmental Factors. To analyze the data more finely, corresponding child nodes were established under these tree nodes. Course Activities Engagement included Teaching Content Arrangement, Teaching Method Application, and Assessment and Evaluation Methods; Instructors' Skills Engagement encompassed

Professional Knowledge Level, Teaching Organization Ability, Teacher-Student Interaction Level, and Information Technology Application Ability; Affective Engagement included Professional Interest, Learning Motivation, Professional Identity, and Self-Efficacy; Behavioral Engagement encompassed Classroom Participation, Extracurricular Learning, Practical Training, and Homework Completion; Cognitive Engagement included Critical Thinking, Innovation Ability, Knowledge Mastery, and Metacognitive Ability; Environmental Factors included Teaching Facilities and Resources, Practice Platform Construction, and Campus Cultural Atmosphere.

In total, there were 6 tree nodes and 22 child nodes. Therefore, a mind map was constructed first and then converted into nodes. During coding, these could be directly selected, which greatly improved coding efficiency.

3.9.1.3 Coding

Coding was an important link in studying the factors influencing the engagement of Environmental Art Design students and was a crucial step in using NVivo12 software to analyze interview material texts. By coding the text materials, the research moved from the surface to the essence, discovering characteristics and patterns in the data. This study adopted a structured coding form. Since the study already had a research framework, coding of the factors influencing the engagement of Environmental Art Design students was conducted from five dimensions: Course Activities, Instructors' Skills Engagement, Affective Engagement, Learning Behavior, and Cognitive Engagement. The percentage of node coverage for different interview dimensions and the coding density table were statistically derived from NVivo12 qualitative analysis software. This helped to understand the current status of factors influencing the engagement of Environmental Art Design students and summarize the characteristics and implications of these factors.

3.9.2 Interviewees/Informants

The interviewees who were interviewed to confirm the five-factors model of students' engagement in Environmental Art Design at Suzhou vocational colleges were 6 administrators from vocational colleges in Suzhou. The criteria used to verify those interviewees were that all of them had to be Head Instructors/Departments who had been working in the vocational colleges in Suzhou for at least 5 years.

3.9.3 Measures

The interview items gained from the questionnaire results were used to confirm the five-factors model of students' engagement in Environmental Art Design at Suzhou vocational colleges.

3.9.4 Semi-Structured Interview

Semi-structured interviews were employed as the major qualitative data collection method in the current study. The interview guide included questions on essential themes determined through students' engagement gained from the questionnaire. The goal, structure, and expected length of the meeting were communicated to the participants at the beginning of the interview. Their responses were maintained as confidential, and they were allowed to decline any question. The site of the interview was properly arranged to prevent disturbances from any side.

After signing the informed consent, demographic questions were asked, followed by inquiries related to the subject matter, with replies frequently summarized to ensure comprehension and encourage clarification or elaboration as appropriate. Additionally, to prevent leading participants, all questions were worded as open-ended and nonjudgmental. Observations throughout the interview were documented with field notes and a reflective journal immediately afterward to capture contextual elements and subjective observations, while recording, transcription, and iterative analysis were conducted by the researcher.

3.9.5 Informed Consent

All consent forms were requested to be signed willingly, with the option of withdrawing from the interview at any point without consequences.

3.9.6 Confidentiality and Anonymity

Privacy and anonymity of participants were strictly protected to ensure secure data and encryption to prevent unauthorized access. All information gained by any means was safely kept without any leaks of information. Upon publication of the research, all documents from the interviews were completely destroyed.

3.9.7 Data analysis

In this study, content analysis with thematic analysis was used to analyze the interview data to identify the key themes that emerged.

3.9.8 Content Analysis

The following was the procedure of thematic analysis as a method for identifying, analyzing, and reporting patterns and themes within data by combining multiple perspectives and focusing on analyzing the interview data through the following steps:

Phase 1: Generating initial codes;
Phase 2: Searching for themes;
Phase 3: Defining and naming; and
Phase 4: Producing the reports (Nizza et al.,2021).

Chapter 4

Results of Data Analysis

This chapter presented the data obtained through the questionnaire survey and interview analysis. It was completed by a sample of 384 respondents who met the target requirements. Meanwhile, the sample size was randomly selected according to the number of layers in the sampling and the retention of questionnaire results. Additionally, three relevant professional interviewees were interviewed, and the interview data were collected. The final result was divided into two parts: findings derived from statistics and interview data. The statistical findings were divided into descriptive analysis and inferential analysis, while the interview data were analyzed through content analysis.

Quantitative Analysis

4.1 Statistics of the Basic Information of the Survey Respondents

As can be seen from Table 4.1, for gender, there were 191 males, accounting for 46.93%, and 216 females, accounting for 53.07%. There were more females than males. For age, there were 82 respondents aged 18-19, 154 aged 19-20, 139 aged 20-21, and 32 categorized as "Others," accounting for 20.15%, 37.84%, 34.15%, and 7.86% respectively. Most respondents were in the 19-21 age range. For the current year of study, there were 54 in 2021, 238 in 2022, and 115 in 2023, respectively, accounting for 13.27%, 58.48%, and 28.26%. Nearly 60% were in the year 2022. For the universities' names, the Suzhou Polytechnic Institute of Agriculture (SPIA) had 90 respondents, accounting for 22.11%; the Suzhou Art & Design Technology Institute (SADTI) had 176 respondents, accounting for 43.24%; and the Suzhou Tourism and

Finance Institute (STFI) had 141 respondents, accounting for 34.64%. Most of the respondents were from the Suzhou Art & Design Technology Institute (SADTI).

Table 4.1 Statistics of Basic Information of Respondents

(n = 407)

Variable	Category	Frequency	Percent（%）
Gender	Male	191	46.93
	Female	216	53.07
Age	18-19	82	20.15
	19-20	154	37.84
	20-21	139	34.15
	Others	32	7.86
Current Year of The Study	2021	54	13.27
	2022	238	58.48
	2023	115	28.26
Universities' Name	Suzhou Polytechnic Institute of Agriculture (SPIA)	90	22.11
	Suzhou Art & Design Technology Institute (SADTI)	176	43.24
	Suzhou Tourism and Finance Institute (STFI)	141	34.64

4.2 Inter-Scorers Reliability

In Table 4.2, reliability was used to measure the consistency or stability of the scale results. Using the internal consistency reliability detection scale, Cronbach's Alpha of reliability statistics was greater than or equal to 0.9, indicating that the reliability of the scale was good. Cronbach's Alpha values between 0.8 and 0.9 indicated good reliability, while values between 0.7 and 0.8 indicated acceptable reliability.

Judging from the table, Affective Engagement had a Cronbach's Alpha coefficient of 0.935, Behavior Engagement had a coefficient of 0.928, Cognitive

Engagement had a coefficient of 0.921, Course Activities Engagement had a coefficient of 0.963, and Instructors' Skills Engagement had a coefficient of 0.936. The total Cronbach's Alpha coefficient was 0.964, indicating good reliability of the data and a high degree of data reliability. At the same time, the total item correlation (CITS) of each item was greater than 0.4, and the deleted α coefficient of any item was not higher than the dimensional Cronbach's Alpha coefficient, indicating that the selected questionnaire items had good correlation, good data reliability, and high data quality.

Table 4.2 Reliability Statistics

dimension	Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha □
Affective Engagement	AE1	0.740	0.928	0.935
	AE2	0.727	0.929	
	AE3	0.738	0.928	
	AE4	0.753	0.928	
	AE5	0.718	0.929	
	AE6	0.722	0.929	
	AE7	0.752	0.928	
	AE8	0.776	0.927	
	AE9	0.708	0.930	
	AE10	0.768	0.927	
Behavior Engagement	BE1	0.745	0.919	0.928
	BE2	0.755	0.918	
	BE3	0.739	0.919	
	BE4	0.747	0.919	
	BE5	0.751	0.919	
	BE6	0.751	0.919	
	BE7	0.794	0.915	
	BE8	0.740	0.919	

Table 4.2 Reliability Statistics (continued)

dimension	Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha □
Cognitive Engagement	CE1	0.739	0.910	0.921
	CE2	0.742	0.910	
	CE3	0.788	0.905	
	CE4	0.744	0.909	
	CE5	0.795	0.904	
	CE6	0.722	0.912	
	CE7	0.737	0.910	
Course Activities Engagement	CAE1	0.760	0.961	0.963
	CAE2	0.797	0.961	
	CAE3	0.795	0.961	
	CAE4	0.753	0.961	
	CAE5	0.744	0.962	
	CAE6	0.761	0.961	
	CAE7	0.760	0.961	
	CAE8	0.773	0.961	
	CAE9	0.791	0.961	
	CAE10	0.768	0.961	
	CAE11	0.793	0.961	
	CAE12	0.797	0.961	
	CAE13	0.769	0.961	
	CAE14	0.788	0.961	
	CAE15	0.752	0.961	
	CAE16	0.774	0.961	
Instructors' Skills Engagement	ISE1	0.734	0.930	0.936
	ISE2	0.757	0.928	
	ISE3	0.758	0.928	
	ISE4	0.749	0.929	

Table 4.2 Reliability Statistics (continued)

dimension	Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha □
Instructors' Skills Engagement	ISE5	0.748	0.929	0.936
	ISE6	0.771	0.928	
	ISE7	0.780	0.927	
	ISE8	0.753	0.929	
	ISE9	0.768	0.928	
Total amount of table				0.964

4.3 Validation

4.3.1 Factor analysis

Validity illustrated the validity and authenticity of the data. First, for the KMO value; if this value was above 0.8, the validity was considered good;

if this value was between 0.7 and 0.8, it was good;

if this value was between 0.6 and 0.7, the validity was acceptable;

if the KMO value was less than 0.6, the validity was poor, requiring further revision.

From Table 4.3, the KMO values of Course Activities Engagement, Instructors' Skills Engagement, and the total table were 0.959, 0.941, 0.852, 0.971, 0.958, and 0.966.

The KMO values were greater than 0.8, and the Bartlett test was significant (Sig < 0.001), indicating good validity among the questionnaire variables and suitability for conducting factor analysis.

Table 4.3 KMO and Bartlett's Test

dimension	Items	KMO Value	Approx.Chi-Square	df	Sig
Affective Engagement	10	0.965	2522.635	45	0.000
Behavior Engagement	8	0.951	2061.084	28	0.000
Cognitive Engagement	7	0.933	1778.940	21	0.000
Course Activities Engagement	16	0.984	5020.558	120	0.000
Instructors' Skills Engagement	9	0.960	2415.575	36	0.000
Total amount of table	50	0.965	14938.357	1225	0.000

As the results from the above table, Affective Engagement, Behavior Engagement, and Cognitive Engagement

From Table 4.4, it could be seen that the matrix components after orthogonal rotation showed that the 50 measures of the questionnaire were extracted from 5 common factors with an eigenvalue of 1, and the cumulative explained variance reached 65.739%. This indicated that these five common factors could reflect 65.739% of the information from the 35 items, demonstrating that the data was fully extracted.

Table 4.4 Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.290	36.580	36.580	18.290	36.580	36.580	10.360	20.719	20.719
2	5.061	10.122	46.702	5.061	10.122	46.702	6.411	12.821	33.540
3	3.359	6.718	53.420	3.359	6.718	53.420	5.945	11.890	45.431
4	3.288	6.576	59.996	3.288	6.576	59.996	5.401	10.802	56.232
5	2.871	5.743	65.739	2.871	5.743	65.739	4.753	9.507	65.739

From Table 4.5, principal component factor analysis was used to test the division of each observed variable after rotation. Generally, the measured indices of

the same dimension could be aggregated together, with larger factor load values (the reference index being greater than 0.5, as shown in the table) and smaller dimensional load values in other dimensions (less than 0.5, omitted from the table). This indicated a clearer internal structure of the variable data from the questionnaire and a higher overall characteristic validity. The factor load values of the corresponding dimensions of the measurement indicators in the table were all greater than 0.5, which was consistent with the expected division, indicating that the internal structural validity of the questionnaire in this study was good.

Table 4.5 Rotated Component Matrix

	Component				
Project	1	2	3	4	5
AE1		0.742			
AE2		0.715			
AE3		0.729			
AE4		0.749			
AE5		0.725			
AE6		0.747			
AE7		0.742			
AE8		0.801			
AE9		0.709			
AE10		0.764			
BE1				0.74	
BE2				0.766	
BE3				0.745	
BE4				0.754	
BE5				0.761	
BE6				0.762	
BE7				0.773	
BE8				0.759	
CE1					0.76
CE2					0.746
CE3					0.789
CE4					0.753
CE5					0.787
CE6					0.723
CE7					0.76
CAE1	0.759				

Table 4.5 Rotated Component Matrix (continued)

Project	Component				
	1	2	3	4	5
CAE2	0.787				
CAE3	0.777				
CAE4	0.771				
CAE5	0.739				
CAE6	0.746				
CAE7	0.751				
CAE8	0.76				
CAE9	0.782				
CAE10	0.747				
CAE11	0.781				
CAE12	0.787				
CAE13	0.75				
CAE14	0.771				
CAE15	0.743				
CAE16	0.747				
ISE1			0.685		
ISE2			0.77		
ISE3			0.731		
ISE4			0.735		
ISE5			0.763		
ISE6			0.773		
ISE7			0.797		
ISE8			0.739		
ISE9			0.769		

4.4 Correlation Analysis

Correlation analysis was the method used to determine the degree of correlation and correlation coefficient r value, which ranged from -1 and 1, when r <0, it indicated a negative correlation between variables, when r> 0,it indicated a positive correlation when r was greater than or equal to 0.8, it represented a strong correlation,when r between 0.5-0.8, indicated a moderate correlation, when r between 0.3-0.5. suggested a weak correlation. The closer the correlation coefficient was to 1, the higher the correlation between the variables; the closer it was to 0, the lower the correlation.

Judging from Table 4.6, Affective Engagement with Behavior Engagement, Cognitive Engagement, Course Activities Engagement, and Instructors' Skills Engagement had correlation coefficient values of 0.430, 0.401, 0.418, and 0.473, respectively. The correlation coefficients were significant at the 0.01 confidence level. It was noted that both Affective Engagement and Behavior Engagement, as well as Cognitive Engagement and Course Activities Engagement, showed a positive correlation with Instructors' Skills Engagement. The correlation coefficient values for Behavior Engagement with Cognitive Engagement, Course Activities Engagement, and Instructors' Skills Engagement were 0.401, 0.445, and 0.418, respectively, indicating that there was a positive correlation between Behavior Engagement and both Cognitive Engagement and Course Activities Engagement with Instructors' Skills Engagement.

The correlation coefficient value between Cognitive Engagement and Course Activities Engagement was 0.440, which showed significance at the 0.01 level, indicating a significant positive correlation between Cognitive Engagement and Course Activities Engagement. The correlation coefficient value between Cognitive Engagement and Instructors' Skills Engagement was 0.449.

This study showed significance at the 0.01 level, indicating a significant positive correlation between Cognitive Engagement and Instructors' Skills Engagement. Finally, the correlation coefficient value between Course Activities Engagement and Instructors' Skills Engagement was 0.428, which demonstrated significance at the 0.01 level, indicating a significant positive correlation between Course Activities Engagement and Instructors' Skills Engagement.

Table 4.6 Correlation Analysis of Each Dimension

		Affective Engagement	Behavior Engagement	Cognitive Engagement	Course Activities Engagement	Instructors' Skills Engagement
Affective Engagement	Pearson Correlation	1				
	Sig.(2-tailed)	-				
Behavior Engagement	Pearson Correlation	0.430**	1			
	Sig.(2-tailed)	0.000	-			
Cognitive Engagement	Pearson Correlation	0.401**	0.401**	1		
	Sig.(2-tailed)	0.000	0.000	-		
Course Activities Engagement	Pearson Correlation	0.418**	0.445**	0.440**	1	
	Sig.(2-tailed)	0.000	0.000	0.000	-	
Instructors' Skills Engagement	Pearson Correlation	0.473**	0.418**	0.449**	0.428**	1
	Sig.(2-tailed)	0.000	0.000	0.000	0.000	-

pour ***. Correlation is significant at the 0.01 level (2-tailed).

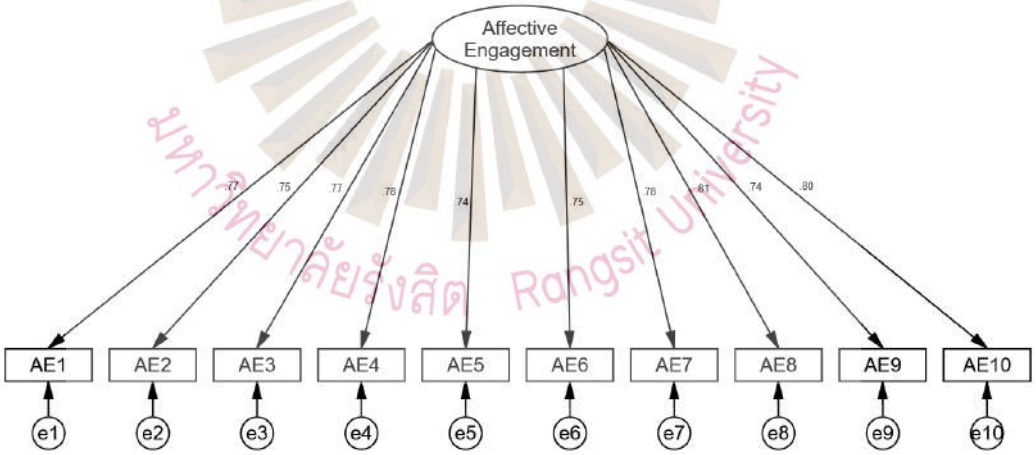

Figure 4.1Affective Engagement Normalized Estimate of the Confirmatory Factor Analysis Model Plot

From Table 4.7, CMIN/DF was 0.737, which was less than 3. The RMSEA value was 0.000, and the NFI, IFI, TLI, and CFI values were 0.990, 1.004, 1.005, and 1.000, respectively, all above 0.9. The GFI and AGFI values were 0.988 and 0.981, both above 0.85, indicating acceptable model fit. As observed from the table, each index in the measurable model was within the standard range, and the fit degree of the model was high, indicating that all the items could effectively reflect the latent variables.

Table 4.7 Affective Engagement Confirmatory Factor Analysis of Model Fit

reference index	CMIN/DF	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
statistic	0.737	0.988	0.981	0.990	1.004	1.005	1.000	0.000
Adaptation standard	<3	>0.85	>0.85	>0.9	>0.9	>0.9	>0.9	<0.08

It could be seen from Table 4.8 that all the standardized factor loads of the measurement model were above 0.5, excluding the paths set with a fixed parameter of 1. The coefficients of the path in the model met the requirements, and the P values in the model were significant, indicating that the quality of the model was good.

Table 4.8 Affective Engagement Measured Model Significance Tests

			Estimate	Standardized	S.E.	C.R.	P
AE10	<---	Affective_Engagement	1.000	0.796			
AE9	<---	Affective_Engagement	0.917	0.735	0.057	16.190	***
AE8	<---	Affective_Engagement	1.024	0.805	0.056	18.240	***
AE7	<---	Affective_Engagement	0.966	0.779	0.055	17.457	***
AE6	<---	Affective_Engagement	0.950	0.749	.0057	16.593	***
AE5	<---	Affective_Engagement	0.919	0.744	0.056	16.450	***
AE4	<---	Affective_Engagement	0.989	0.783	0.056	17.558	***
AE3	<---	Affective_Engagement	0.950	0.765	0.056	17.045	***
AE2	<---	Affective_Engagement	0.945	0.755	0.056	16.739	***
AE1	<---	Affective_Engagement	0.952	0.769	0.056	17.152	***

Note * * * indicates p <0.001

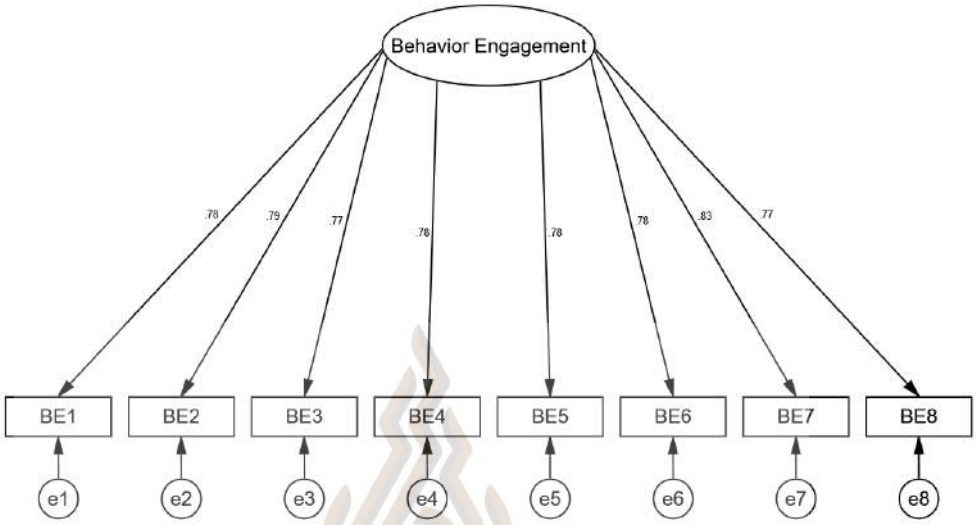

Figure 4.2 Behavior Engagement Normalized Estimate of the Confirmatory Factor Analysis Model Plot

From Table 4.9, it was noted that CMIN/DF was 1.084, which was less than 3, and the RMSEA value was 0.014. The NFI, IFI, TLI, and CFI values were 0.990 and 0.999, respectively, all above 0.9. The GFI and AGFI values were 0.987 and 0.976, respectively, both above 0.85, indicating that the model adaptation was acceptable. As observed from the table, each index in the measurable model was within the standard range, and the fit degree of the model was high, indicating that all the items could effectively reflect the latent variables.

Table 4.9 Behavior Engagement Confirmatory Factor Analysis of Model Fit

reference index	CMIN/DF	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
statistic	1.084	0.987	0.976	0.990	0.999	0.999	0.999	0.014
Adaptation standard	<3	>0.85	>0.85	>0.9	>0.9	>0.9	>0.9	<0.08

It could be seen from Table 4.10 that all the standardized factor loads of the measurement model were above 0.5, excluding the paths set with a fixed parameter of 1. The coefficients of the path in the model met the requirements, and the P values in the model were significant, indicating that the quality of the model was good.

Table 4.10 Behavior Engagement Measurement of Model Significance Testing

			Estimate	Standardized Estimate	S.E.	C.R.	P
BE8	<---	Behavior Engagement	1.000	0.773			
BE7	<---	Behavior Engagement	1.098	0.831	0.061	18.080	***
BE6	<---	Behavior Engagement	1.000	0.782	0.060	16.797	***
BE5	<---	Behavior Engagement	1.049	0.784	0.062	16.841	***
BE4	<---	Behavior Engagement	1.045	0.779	0.063	16.713	***
BE3	<---	Behavior Engagement	0.987	0.770	0.060	16.494	***
BE2	<---	Behavior Engagement	1.030	0.789	0.061	16.975	***
BE1	<---	Behavior Engagement	1.053	0.776	0.063	16.637	***

Note * * * indicates p <0.001

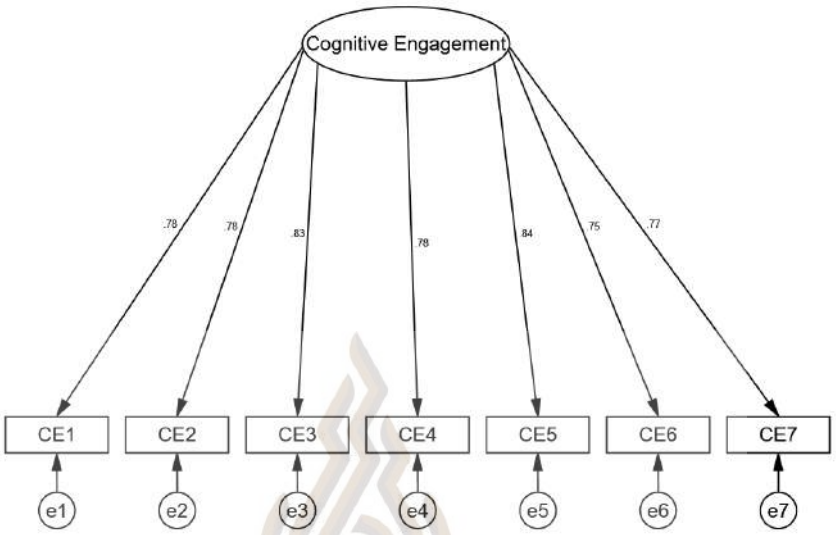

Figure 4.3 Cognitive Engagement Normalized Estimate of the Confirmatory Factor Analysis Model Plot

From Table 4.11, it was noted that CMIN/DF was 2.127, which was less than 3, and the RMSEA value was 0.053. The NFI, IFI, TLI, and CFI values were 0.983, 0.991, 0.987, and 0.991, respectively, all above 0.9. The GFI and AGFI values were 0.980 and 0.960, both above 0.85, indicating acceptable model fit. As observed from the table, each index in the measurable model was within the standard range, and the fit degree of the model was high, indicating that all the items could effectively reflect the latent variables.

Table 4.11 Cognitive Engagement Confirmatory Factor Analysis of Model Fit

reference index	CMIN/DF	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
statistic	2.127	0.980	0.960	0.983	0.991	0.987	0.991	0.053
Adaptation standard	<3	>0.85	>0.85	>0.9	>0.9	>0.9	>0.9	<0.08

It could be seen from Table 4.12 that all the standardized factor loads of the measurement model were above 0.5, excluding the paths set with a fixed parameter of

1. The coefficients of the path in the model met the requirements, and the P values in the model were significant, indicating that the quality of the model was good.

Table 4.12 Cognitive Engagement Measurement of Model Significance Testing

			Estimate	Standardized Estimate	S.E.	C.R.	P
CE 7	<---	Cognitive Engagement	1.000	0.773			
CE 6	<---	Cognitive Engagement	0.984	0.754	0.062	15.967	***
CE 5	<---	Cognitive Engagement	1.121	0.837	0.062	18.133	***
CE4	<---	Cognitive Engagement	1.013	0.777	0.061	16.575	***
CE 3	<---	Cognitive Engagement	1.126	0.830	0.063	17.935	***
CE 2	<---	Cognitive Engagement	1.010	0.778	0.061	16.587	***
CE 1	<---	Cognitive Engagement	0.986	0.776	0.060	16.545	***

Note * * * indicates p <0.001

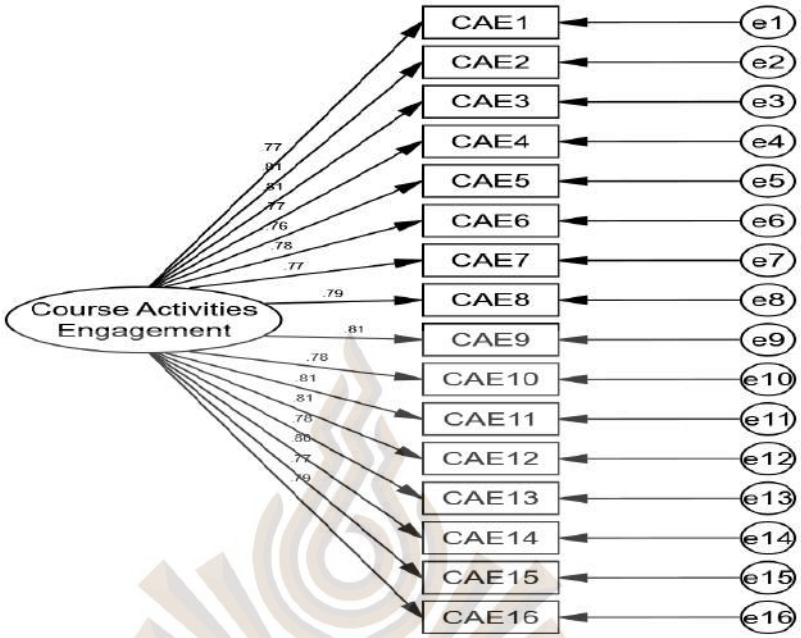

Figure 4.4 Course Activities Engagement Normalized Estimate of the Confirmatory Factor Analysis Model Plot

From Table 4.13, it was noted that CMIN/DF was 0.921, which was less than 3, and the RMSEA value was 0.000. The NFI, IFI, TLI, and CFI values were 0.981, 1.002, and 1.000, respectively, all above 0.9. The GFI and AGFI values were 0.971 and 0.962, respectively, both above 0.85, indicating that the model adaptation was acceptable. As observed from the table, each index in the measurable model was within the standard range, and the fit degree of the model was high, indicating that all the items could effectively reflect the latent variables.

Table 4.13 Course Activities Engagement Confirmatory Factor Analysis of Model Fit

reference index	CMIN/DF	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
statistic	0.921	0.971	0.962	0.981	1.002	1.002	1.000	0.000
Adaptation standard	<3	>0.85	>0.85	>0.9	>0.9	>0.9	>0.9	<0.08

It could be seen from Table 4.14 that all the standardized factor loads of the measurement model were above 0.5, excluding the paths set with a fixed parameter of 1. The coefficients of the path in the model met the requirements, and the P values in the model were significant, indicating that the quality of the model was good.

Table 4.14 Course Activities Engagement Measurement Model Significance Test

			Estimate	Standardized Estimate	S.E.	C.R.	P
CAE1	<---	Course Activities Engagement	1.000	0.775			
CAE2	<---	Course Activities Engagement	1.044	0.814	0.057	18.193	***
CAE3	<---	Course Activities Engagement	1.054	0.810	0.058	18.088	***
CAE4	<---	Course Activities Engagement	1.005	0.768	0.059	16.930	***
CAE5	<---	Course Activities Engagement	0.978	0.758	0.059	16.652	***
CAE6	<---	Course Activities Engagement	0.990	0.777	0.058	17.152	***
CAE7	<---	Course Activities Engagement	0.989	0.775	0.058	17.096	***
CAE8	<---	Course Activities Engagement	1.047	0.788	0.060	17.471	***
CAE9	<---	Course Activities Engagement	1.047	0.808	0.058	18.018	***
CAE10	<---	Course Activities Engagement	1.030	0.783	0.059	17.341	***
CAE11	<---	Course Activities Engagement	1.058	0.810	0.059	18.073	***
CAE12	<---	Course Activities Engagement	1.064	0.813	0.059	18.157	***
CAE13	<---	Course Activities Engagement	1.009	0.784	0.058	17.360	***
CAE14	<---	Course Activities Engagement	1.021	0.803	0.057	17.899	***
CAE15	<---	Course Activities Engagement	0.993	0.767	0.059	16.902	***
CAE16	<---	Course Activities Engagement	1.004	0.790	0.057	17.518	***

Note * * * indicates p <0.001

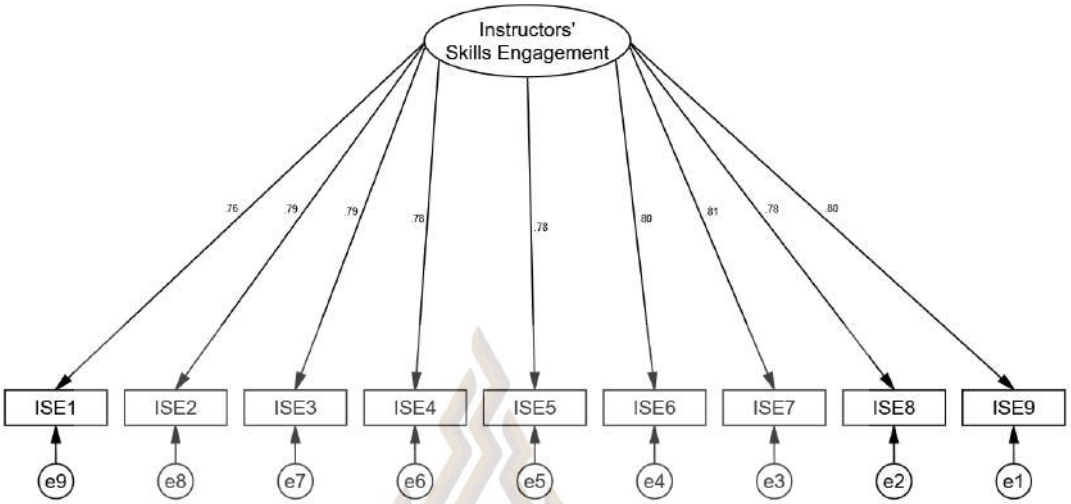

Figure 4.5 Instructors' Skills Engagement Normalized Estimate of the Confirmatory Factor Analysis Model Plot

From Table 4.15, it was noted that CMIN/DF was 1.044, which was less than 3, and the RMSEA value was 0.010. The NFI, IFI, TLI, and CFI values were 0.981, 1.000, 0.999, and 1.000, all above 0.9. The GFI and AGFI values were 0.985 and 0.975, both above 0.85, indicating that the model fit was acceptable. As observed from the table, each index in the measurable model was within the standard range, and the fit degree of the model was high, indicating that all the items could effectively reflect the latent variables.

Table 4.15 Instructors' Skills Engagement Confirmatory Factor Analysis of Model Fit

reference index	CMIN/DF	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
statistic	1.044	0.985	0.975	0.981	1.000	0.999	1.000	0.010
Adaptation standard	<3	>0.85	>0.85	>0.9	>0.9	>0.9	>0.9	<0.08

It could be seen from Table 4.16 that all the standardized factor loads of the measurement model were above 0.5, excluding the paths set with a fixed parameter of 1. The coefficients of the path in the model met the requirements, and the P values in the model were significant, indicating that the quality of the model was good.

Table 4.16 Instructors' Skills Engagement Measurement of Model Significance Testing

			Estimate	Standardized Estimate	S.E.	C.R.	P
ISE 9	<---	Instructors' Skills Engagement	1.000	0.798			
ISE 8	<---	Instructors' Skills Engagement	0.980	0.780	0.056	17.553	***
ISE 7	<---	Instructors' Skills Engagement	1.047	0.811	0.057	18.471	***
ISE 6	<---	Instructors' Skills Engagement	1.002	0.802	0.055	18.211	***
ISE5	<---	Instructors' Skills Engagement	0.960	0.777	0.055	17.452	***
ISE 4	<---	Instructors' Skills Engagement	0.975	0.776	0.056	17.434	***
ISE 3	<---	Instructors' Skills Engagement	1.002	0.786	0.056	17.735	***
IS E2	<---	Instructors' Skills Engagement	0.976	0.786	0.055	17.719	***
ISE 1	<---	Instructors' Skills Engagement	0.970	0.760	0.057	16.949	***

Note * * * indicates p <0.001

As could be seen from Table 4.17, convergence validity was generally used to measure that the combined reliability (CR) of the correlation between the same latent variables was greater than 0.7, and the average variance extraction (AVE) was greater than 0.5. Therefore, the convergence degree of the model was considered to meet the requirements. From the table, it was noted that all the AVE values corresponding to the five public factors were greater than 0.5, and all the CR values were higher than 0.7, indicating that the analyzed data had good aggregation (convergence) validity.

Table 4.17 Results for Model AVE and CR

Subjective variables	AVE price	CR price
Affective Engagement	0.591	0.935
Behavior Engagement	0.617	0.928
Cognitive Engagement	0.624	0.921
Course Activities Engagement	0.623	0.963
Instructors' Skills Engagement	0.619	0.936

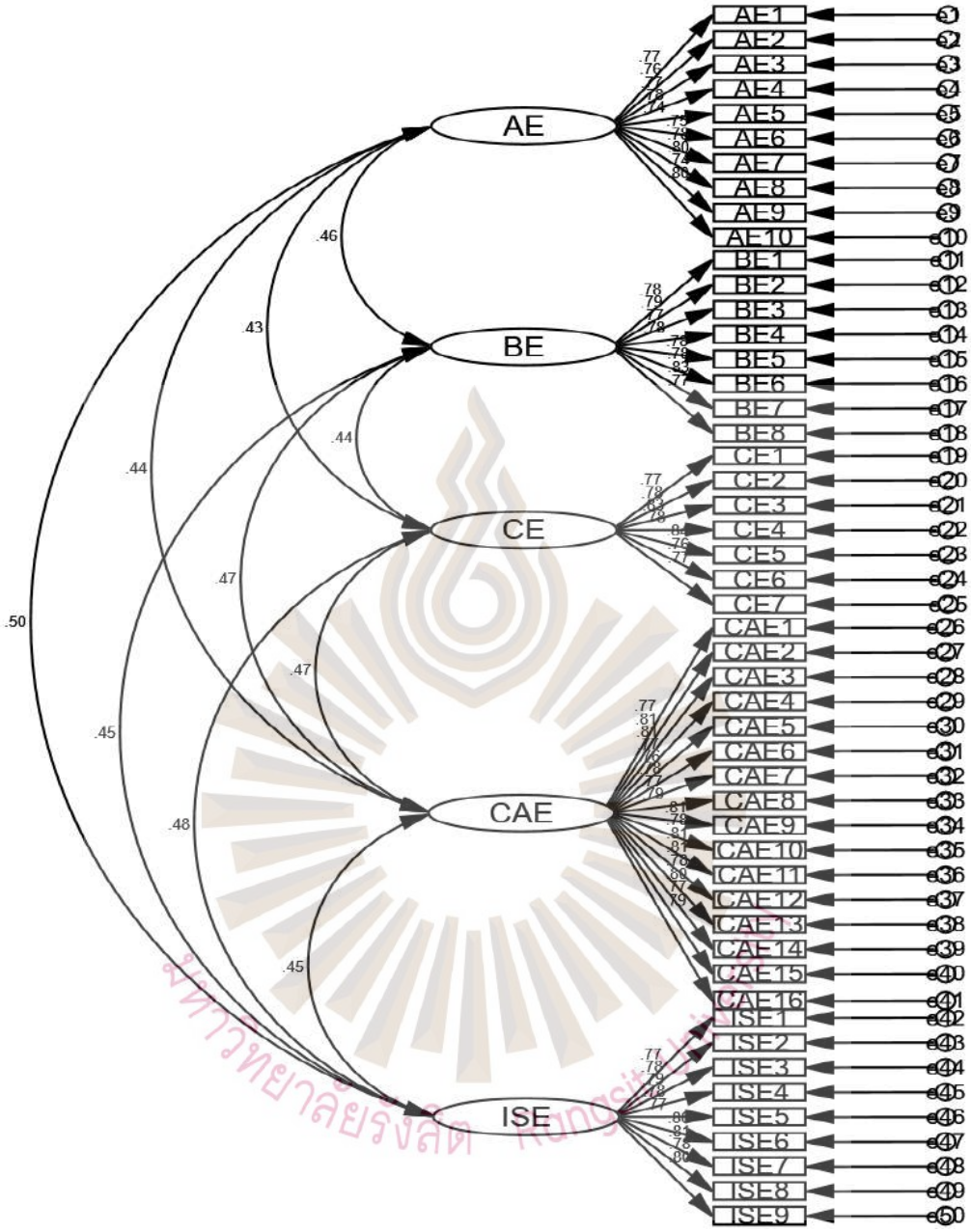

Figure 4.6 Confirmatory Factor Analysis (CFA)

From Table 4.18, it was noted that CMIN/DF was 1.157, which was less than 3, and the RMSEA value was 0.020. The NFI, IFI, TLI, and CFI values were 0.914, 0.987, 0.986, and 0.987, all above 0.9. The GFI and AGFI values were 0.890 and

0.879, respectively, both above 0.85, indicating acceptable model fit. As observed from the table, each index in the measurable model was within the standard range, and the fit degree of the model was high, indicating that all the items could effectively reflect the latent variables.

Table 4.18 Affective Engagement Confirmatory Factor Analysis of Model Fit

reference index	CMIN/DF	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
statistic	1.157	0.890	0.879	0.914	0.987	0.986	0.987	0.020
Adaptation standard	<3	>0.85	>0.85	>0.9	>0.9	>0.9	>0.9	<0.08

It could be seen from Table 4.19 that all the standardized factor loads of the measurement model had been above 0.5, excluding the paths set with a fixed parameter of 1. The coefficients of the path in the model had met the requirements, and the P values in the model had been significant, indicating that the quality of the model had been good.

Table 4.19 Significance Test of Measurement Model

Latent variable	Visible variable	Non-standard load factor	SE	C.R.	p	Standard factor load
Affective Engagement	AE1	1.000	-	-	-	0.769
	AE10	1.050	0.061	17.218	0.000	0.797
	AE2	0.995	0.061	16.192	0.000	0.757
	AE3	0.999	0.061	16.437	0.000	0.767
	AE4	1.039	0.062	16.869	0.000	0.783
	AE5	0.965	0.061	15.879	0.000	0.745
	AE6	0.993	0.062	15.937	0.000	0.747
	AE7	1.016	0.060	16.800	0.000	0.781
	AE8	1.069	0.062	17.331	0.000	0.801
	AE9	0.964	0.062	15.670	0.000	0.736

Table 4.19 Significance Test of Measurement Model (continued)

Latent variable	Visible variable	Non-standard	SE	C.R.	p	Standard factor load
Behavior Engagement	BE1	1.000	-	-	-	0.778
	BE2	0.975	0.057	17.148	0.000	0.788
	BE3	0.935	0.056	16.689	0.000	0.771
	BE4	0.989	0.059	16.899	0.000	0.779
	BE5	0.992	0.058	17.010	0.000	0.783
	BE6	0.946	0.056	16.957	0.000	0.781
	BE7	1.042	0.057	18.372	0.000	0.833
	BE8	0.945	0.057	16.699	0.000	0.771
Cognitive Engagement	CE1	1.000	-	-	-	0.775
	CE2	1.028	0.061	16.743	0.000	0.779
	CE3	1.143	0.063	18.056	0.000	0.829
	CE4	1.031	0.062	16.718	0.000	0.778
	CE5	1.139	0.062	18.277	0.000	0.837
	CE6	1.003	0.062	16.147	0.000	0.756
	CE7	1.014	0.061	16.533	0.000	0.771
Course Activities Engagement	CAE1	1.000	-	-	-	0.774
	CAE2	1.044	0.057	18.192	0.000	0.813
	CAE3	1.055	0.058	18.102	0.000	0.810
	CAE4	1.003	0.059	16.881	0.000	0.766
	CAE5	0.979	0.059	16.660	0.000	0.758
	CAE6	0.991	0.058	17.177	0.000	0.777
	CAE7	0.990	0.058	17.107	0.000	0.775
	CAE8	1.048	0.060	17.484	0.000	0.788
	CAE9	1.048	0.058	18.014	0.000	0.807
	CAE10	1.032	0.059	17.377	0.000	0.784
	CAE11	1.059	0.059	18.075	0.000	0.809
	CAE12	1.065	0.059	18.155	0.000	0.812

Table 4.19 Significance Test of Measurement Model (continued)

Latent variable	Visible variable	Non-standard load factor	SE	C.R.	p	Standard factor load
Instructors' Skills Engagement	CAE13	1.011	0.058	17.389	0.000	0.785
	CAE14	1.022	0.057	17.917	0.000	0.804
	CAE15	0.994	0.059	16.917	0.000	0.768
	CAE16	1.007	0.057	17.565	0.000	0.791
	ISE1	1.000	-	-	-	0.767
	ISE2	0.994	0.059	16.816	0.000	0.783
	ISE3	1.028	0.061	16.972	0.000	0.789
	ISE4	0.998	0.060	16.674	0.000	0.778
	ISE5	0.978	0.059	16.584	0.000	0.774
	ISE6	1.023	0.059	17.267	0.000	0.801
	ISE7	1.064	0.061	17.406	0.000	0.806
	ISE8	1.004	0.060	16.781	0.000	0.782
	ISE9	1.020	0.059	17.163	0.000	0.797

4.5 Statistics of Each Dimension and Project Description

Judging from Table 4.20, the mean values of Affective Engagement, Behavior Engagement, Cognitive Engagement, Course Activities Engagement, and Instructors' Skills Engagement were 3.380, 3.359, 3.340, 3.384, and 3.348, respectively, indicating general agreement.

This study showed that the respondents had moderate to high levels of Affective Engagement, Behavior Engagement, Cognitive Engagement, Course Activities Engagement, and Instructors' Skills Engagement.

Table 4.20 Describes the Statistics for Each Dimension

Dimension	N □	Minimum	Maximum	Mean	Std.Deviation
Affective Engagement	407	1.600	5.000	3.380	0.917
Behavior Engagement	407	1.375	5.000	3.359	0.962
Cognitive Engagement	407	1.429	5.000	3.340	0.961
Course Activities Engagement	407	1.625	5.000	3.384	0.944
Instructors' Skills Engagement	407	1.556	5.000	3.348	0.956
Students' Engagement	407	2.160	5.000	3.366	0.706

Judging from Table 4.21, the overall distribution result of the sample data was relatively uniform. The AE 1-AE 10 items had mean scores between 3.30 and 3.50, according the level of attitudes,affective engagement is Moderately Positive Attitude(MPA). The top four items scored were AE 5 (3.428), AE 6 (3.423), AE 3 (3.391), and AE 4 (3.388). The items with the bottom four scores were AE 8 (3.356), AE 10 (3.356), AE 7 (3.361), and AE 9 (3.364). Each item was at the above-average score level. This study showed the data distribution was relatively concentrated, with standard deviations between 1.10 and 1.30, reflecting a small dispersion of the data.

Table 4.21 Affective Engagement Description Statistics for Each Item

Project	N □	Minimum	Maximum	Mean	Std.Deviation
AE1	407	1.000	5.000	3.369	1.143
AE2	407	1.000	5.000	3.366	1.156
AE3	407	1.000	5.000	3.391	1.146
AE4	407	1.000	5.000	3.388	1.167
AE5	407	1.000	5.000	3.428	1.140
AE6	407	1.000	5.000	3.423	1.170
AE7	407	1.000	5.000	3.361	1.145
AE8	407	1.000	5.000	3.356	1.174
AE9	407	1.000	5.000	3.364	1.151
AE10	407	1.000	5.000	3.356	1.159

As could be seen from Table 4.22, the scores of the BE 1-BE 8 projects were between 3.3 and 3.4, indicating general agreement to agreement, according the level of attitudes,affective engagement is Moderately Positive Attitude(MPA).The scores of each project were above the middle level, and the data distribution was relatively concentrated, suggesting. This study design was reasonable and the research subjects had a high degree of recognition of the Behavior Engagement projects.

Table 4.22 Behavior Engagement Description Statistics for Each Item

project	N □	Minimum	Maximum	Mean	Std.Deviation
BE1	407	1.000	5.000	3.334	1.218
BE2	407	1.000	5.000	3.381	1.172
BE3	407	1.000	5.000	3.366	1.149
BE4	407	1.000	5.000	3.351	1.204
BE5	407	1.000	5.000	3.378	1.201
BE6	407	1.000	5.000	3.356	1.148
BE7	407	1.000	5.000	3.376	1.186
BE8	407	1.000	5.000	3.327	1.161

From Table 4.23, the mean values of CE1, CE2, CE3, CE4, CE5, CE6, and CE7 were 3.305, 3.329, 3.305, 3.317, 3.386, 3.329, and 3.410, respectively, scoring between 3.3 and 3.5. according the level of attitudes,affective engagement is Moderately Positive Attitude(MPA).This indicated that the project design was reasonable and the respondents had a high degree of recognition of the Cognitive Engagement projects.

Table 4.23 Cognitive Engagement Description Statistics of Each Item

Project	N □	Minimum	Maximum	Mean	Std.Deviation
CE1	407	1.000	5.000	3.305	1.132
CE2	407	1.000	5.000	3.329	1.157
CE3	407	1.000	5.000	3.305	1.210
CE4	407	1.000	5.000	3.317	1.162
CE5	407	1.000	5.000	3.386	1.194
CE6	407	1.000	5.000	3.329	1.164
CE7	407	1.000	5.000	3.410	1.154

From Table 4.24, the average scores of CAE 1-CAE 16 were between 3.30 and 3.50, indicating general agreement, with CAE 4 scoring the highest at 4.455, followed by CAE 9 (3.415), CAE 11 (3.400), CAE 13 (3.413), CAE 15 (3.408), and CAE 16 (3.420). according the level of attitudes,affective engagement is Moderately Positive Attitude(MPA).

This data distribution was concentrated, and the standard deviation of each item was between 1.10 and 1.30, reflecting a small dispersion of the data.

Table 4.24 Course Activities Engagement Description Statistics of Each Item

Project	N □	Minimum	Maximum	Mean	Std.Deviation
CAE1	407	1.000	5.000	3.359	1.172
CAE2	407	1.000	5.000	3.351	1.165
CAE3	407	1.000	5.000	3.369	1.181
CAE4	407	1.000	5.000	3.455	1.188
CAE5	407	1.000	5.000	3.356	1.172
CAE6	407	1.000	5.000	3.378	1.157
CAE7	407	1.000	5.000	3.344	1.160
CAE8	407	1.000	5.000	3.332	1.206

Table 4.24 Course Activities Engagement Description Statistics of Each Item (continued)

Project	N □	Minimum	Maximum	Mean	Std.Deviation
CAE9	407	1.000	5.000	3.415	1.177
CAE10	407	1.000	5.000	3.386	1.194
CAE11	407	1.000	5.000	3.400	1.187
CAE12	407	1.000	5.000	3.366	1.189
CAE13	407	1.000	5.000	3.413	1.169
CAE14	407	1.000	5.000	3.386	1.154
CAE15	407	1.000	5.000	3.408	1.175
CAE16	407	1.000	5.000	3.420	1.155

As could be seen from Table 4.25, the scores of the ISE 1-ISE 9 projects were between 3.3 and 3.5, indicating general agreement to agreement. according the level of attitudes,affective engagement is Moderately Positive Attitude(MPA).In the scores of each item, the data distribution was relatively concentrated, and the standard deviation of each item was between 1.10 and 1.30. The standard deviation reflected a small degree of dispersion of the data, indicating that the data had good stationarity.

Table 4.25 Instructors' Skills Engagement Description Statistics of Each Item

Project	N □	Minimum	Maximum	Mean	Std.Deviation
ISE1	407	1.000	5.000	3.319	1.192
ISE2	407	1.000	5.000	3.342	1.159
ISE3	407	1.000	5.000	3.334	1.190
ISE4	407	1.000	5.000	3.361	1.172
ISE5	407	1.000	5.000	3.369	1.154
ISE6	407	1.000	5.000	3.415	1.167
ISE7	407	1.000	5.000	3.383	1.206
ISE8	407	1.000	5.000	3.263	1.173
ISE9	407	1.000	5.000	3.342	1.170

4.6 Analysis of Variance

Judging from Table 4.26, an independent sample test was conducted to study the effect of gender on Affective Engagement, Behavior Engagement, Cognitive Engagement, Course Activities Engagement, and Instructors' Skills Engagement. As could be seen from the table, there was no significant statistical difference in Affective Engagement, Behavior Engagement, Cognitive Engagement, Course Activities Engagement, and Instructors' Skills Engagement based on gender ($p > 0.05$). This indicated that the study subjects showed a degree of identity in Affective Engagement, Behavior Engagement, Cognitive Engagement, Course Activities Engagement, and Instructors' Skills Engagement.

Table 4.26 T-Test for Independent Samples Based on Gender

Variable	Item	N	M	SD	*t* □	*df*	*p* □
	Male	191	3.46	0.88			
Affective Engagement	Female	216	3.31	0.95	1.671	405.000	0.095
	amount to	407	3.38	0.92			
	Male	191	3.37	0.97			
Behavior Engagement	Female	216	3.35	0.96	0.295	405.000	0.768
	amount to	407	3.36	0.96			
	Male	191	3.35	0.94			
Cognitive Engagement	Female	216	3.33	0.98	0.269	405.000	0.788
	amount to	407	3.34	0.96			
	Male	191	3.41	0.96			
Course Activities Engagement	Female	216	3.36	0.93	0.504	405.000	0.615
	amount to	407	3.38	0.94			
	Male	191	3.39	0.94			
Instructors’ Skills Engagement	Female	216	3.31	0.97	0.792	405.000	0.429
	amount to	407	3.35	0.96			

Table 4.26 T-Test for Independent Samples Based on Gender (continued)

Variable	Item	N	M	SD	*t* □	*df*	*p* □
Students' Engagement	Male	191	3.40	0.70	0.958	405.000	0.339
	Female	216	3.33	0.71			
	Amount	406	3.37	0.71			

As could be seen from Table 4.27, there was no statistically significant difference in Affective Engagement, Behavior Engagement, Cognitive Engagement, Course Activities Engagement, or Instructors' Skills Engagement based on different ages ($p > 0.05$). This indicated that the survey respondents of different ages showed some degree of identity in Affective Engagement, Behavior Engagement, Cognitive Engagement, Course Activities Engagement, and Instructors' Skills Engagement.

Table 4.27 One-Way ANOVA Based on Age

Analysis items	Item	N	M	SD	*F* □	*p* □
Affective Engagement	18-19	82	3.34	0.84	1.032	0.378
	19-20	154	3.48	0.94		
	20-21	139	3.33	0.97		
	Others	32	3.25	0.77		
	amount to	407	3.38	0.92		
Behavior Engagement	18-19	82	3.40	0.98	0.609	0.609
	19-20	154	3.32	0.97		
	20-21	139	3.42	0.98		
	Others	32	3.19	0.79		
	amount to	407	3.36	0.96		
Cognitive Engagement	18-19	82	3.32	0.98	1.541	0.203
	19-20	154	3.41	0.99		
	20-21	139	3.36	0.93		

Table 4.27 One-Way ANOVA Based on Age (continued)

Analysis items	Item	N	M	SD	*F* □	*p* □
Affective Engagement	18-19	82	3.34	0.84	1.032	0.378
	amount to	407	3.34	0.96		
Course Activities Engagement	18-19	82	3.45	0.93	2.429	0.065
	19-20	154	3.50	0.92		
	20-21	139	3.29	0.96		
	Others	32	3.08	0.98		
	amount to	407	3.38	0.94		
Instructors' Skills Engagement	18-19	82	3.33	0.96	1.158	0.325
	19-20	154	3.43	0.97		
	20-21	139	3.31	0.96		
	Others	32	3.11	0.88		
	amount to	407	3.35	0.96		

Judging from Table 4.28, a one-way ANOVA was used to study the effect of Current Year of Study on Affective Engagement, Behavior Engagement, Cognitive Engagement, Course Activities Engagement, and the variability of Instructors' Skills Engagement. The analysis showed a significance level of 0.05 for Course Activities Engagement ($F = 3.027$, $p = 0.050$).

In conclusion, different Current Year of Study samples did not show significant differences in Affective Engagement, Behavior Engagement, Cognitive Engagement, and Instructors' Skills Engagement.

Table 4.28 One-way ANOVA Based on Current Year of The Study

Analysis items	Item	sample capacity	average value	standard deviation	F □	p □
Affective Engagement	2021	54	3.19	0.82	1.354	0.259
	2022	238	3.42	0.95		
	2023	115	3.38	0.90		
	amount to	407	3.38	0.92		
Behavior Engagement	2021	54	3.35	0.90	0.033	0.968
	2022	238	3.35	0.98		
	2023	115	3.38	0.96		
	amount to	407	3.36	0.96		
Cognitive Engagement	2021	54	3.21	0.87	0.593	0.553
	2022	238	3.35	0.95		
	2023	115	3.37	1.02		
	amount to	407	3.34	0.96		
Course Activities Engagement	2021	54	3.09	1.03	3.027	0.050
	2022	238	3.42	0.91		
	2023	115	3.44	0.95		
	amount to	407	3.38	0.94		
Instructors' Skills Engagement	2021	54	3.20	0.94	0.760	0.468
	2022	238	3.36	0.96		
	2023	115	3.39	0.96		
	amount to	407	3.35	0.96		

From Table 29, the results of the LSD post-hoc test for Course Activities Engagement indicated that 2022 was greater than 2021, and 2023 was greater than 2021.

Table 4.29 Based on the Current Year of The Study Post-hoc Multiple Comparison Results

	(I) name	(J) name	(I) average value	(J) average value	D-value (I-J)	p
Course Activities Engagement	2021	2022	3.091	3.422	-0.330	0.020*
	2021	2023	3.091	3.442	-0.350	0.024*
	2022	2023	3.422	3.442	-0.020	0.851

Note * p <0.05 * * p <0.01

As could be seen from Table 4.30, one-way ANOVA was used to study the effect of Universities' Name on Affective Engagement, Behavior Engagement, Cognitive Engagement, Course Activities Engagement, and the variability of Instructors' Skills Engagement. The analysis showed a significance level of 0.05 for Behavior Engagement (F = 3.579, p = 0.029). However, the different Universities' Names did not show significant differences for Affective Engagement, Cognitive Engagement, Course Activities Engagement, or the four items of Instructors' Skills Engagement (p > 0.05).

Table 4.30 One-way ANOVA Based on Universities' Name

Analysis items	Item	sample capacity	average value	standard deviation	*F* □	*p* □
Affective Engagement	Suzhou Polytechnic Institute of Agriculture (SPIA)	90	3.27	0.97	1.014	0.364
	Suzhou Art & Design Technology Institute (SADTI)	176	3.44	0.86		
	Suzhou Tourism and Finance Institute (STFI)	141	3.38	0.95		
	amount to	407	3.38	0.92		

Table 4.30 One-way ANOVA Based on Universities' Name (continued)

Analysis items	Item	sample capacity	average value	standard deviation	F □ p □
Behavior Engagement	Suzhou Polytechnic Institute of Agriculture (SPIA)	90	3.35	1.04	3.5790.029
	Suzhou Art & Design Technology Institute (SADTI)	176	3.23	0.95	
	Suzhou Tourism and Finance Institute (STFI)	141	3.52	0.91	
	amount to	407	3.36	0.96	
Cognitive Engagement	Suzhou Polytechnic Institute of Agriculture (SPIA)	90	3.39	1.05	1.2110.299
	Suzhou Art & Design Technology Institute (SADTI)	176	3.26	0.89	
	Suzhou Tourism and Finance Institute (STFI)	141	3.41	0.98	
	amount to	407	3.34	0.96	
Course Activities Engagement	Suzhou Polytechnic Institute of Agriculture (SPIA)	90	3.37	0.92	2.7320.066
	Suzhou Art & Design Technology Institute (SADTI)	176	3.28	0.97	
	Suzhou Tourism and Finance Institute (STFI)	141	3.52	0.92	
	amount to	407	3.38	0.94	
Instructors' Skills Engagement	Suzhou Polytechnic Institute of Agriculture (SPIA)	90	3.36	0.95	1.4770.229
	Suzhou Art & Design Technology Institute (SADTI)	176	3.26	0.97	
	Suzhou Tourism and Finance Institute (STFI)	141	3.45	0.94	
	amount to	407	3.35	0.96	

According to Table 4.31, the results indicated that the Suzhou Tourism and Finance Institute (STFI) was greater than the Suzhou Art & Design Technology Institute (SADTI).

Table 4.31 Universities' Name Post-hoc Multiple Comparison Results

	(I) name	(J) name	(I) average value	(J) average value	D-value (I-J)	*p*
Behavior Engagement	Suzhou Polytechnic Institute of Agriculture (SPIA)	Suzhou Art & Design Technology Institute (SADTI)	3.351	3.232	0.119	0.337
	Suzhou Polytechnic Institute of Agriculture (SPIA)	Suzhou Tourism and Finance Institute (STFI)	3.351	3.521	-0.170	0.189
	Suzhou Art & Design Technology Institute (SADTI)	Suzhou Tourism and Finance Institute (STFI)	3.232	3.521	-0.289	0.008**

Note * p <0.05 * * p <0.01

Qualitative Analysis

4.7 Constructing Analysis Dimensions

4.7.1 Determining Analysis Dimensions

This study aimed to explore the factors affecting the engagement of students majoring in Environmental Art Design at Suzhou Vocational University. After a thorough search and systematic review of relevant literature, and drawing on the research of domestic and international scholars on factors influencing student engagement, we had preliminarily established the analytical framework for this study. We analyzed the factors affecting the engagement of Environmental Art Design students from five dimensions: course activities, instructors' skills engagement, affective engagement, behavior engagement, and cognitive engagement. The engagement scores for each dimension were as follows: course activity engagement: 0.822; instructor skill engagement: 0.726; emotional engagement: 0.752; behavioral engagement: 0.699; cognitive engagement: 0.680. It could be seen that students' highest engagement was in the course activity dimension, while cognitive engagement

was relatively low.

Based on this, we had preliminarily established the following five analysis dimensions:

1) Course Activity Dimension: This dimension mainly examined the impact of course content arrangement and teaching methods on student engagement.

2) Instructors' Skills Dimension: This dimension focused on the effect of teachers' professional level, classroom organization, and management abilities on student engagement.

3) Affective Engagement Dimension: This dimension measured the influence of emotional factors such as students' learning interest and professional identity on engagement.

4) Behavior Engagement Dimension: This dimension examined the relationship between students' behavioral engagement performance, such as class attendance and homework completion, and their engagement.

Cognitive Engagement Dimension: This dimension focused on students' cognitive engagement in the learning process, such as critical thinking and knowledge mastery.

Table 4.32 Perspectives of Engagement of Environmental Art Design Students

	Primary Dimension	Secondary Dimension
Perspectives of Engagement of Environmental Art Design Students	Course Activities Engagement	Course Content Design
		Teaching Methods
	Instructors' skills Engagement	Teacher's Professional Level
		Teaching Skills
	Affective Engagement	Learning Interest
		Professional Identity
	Behavior Engagement	Classroom Attendance
		Assignment Completion Status
	Cognitive Engagement	Critical Thinking and Questioning
		Knowledge Mastery

To further enhance the scientific rigor and effectiveness of the research, and to ensure the construction of a scientific and reasonable analytical framework tailored to this study, the researcher sought opinions and suggestions from authoritative experts and senior scholars in the fields of educational management and student engagement.

The interview informants believed that this study should be based on the actual teaching context of the Environmental Art Design major, focusing on key factors affecting student engagement. To further improve the analytical framework, experts suggested refining the "course activity" dimension by breaking it down into sub-dimensions such as teaching content arrangement, teaching method application, and assessment and evaluation methods, to more accurately analyze the impact of course design and implementation on student engagement. At the same time, experts also suggested enriching the "instructors' skills engagement" dimension by incorporating teachers' information technology application abilities to meet the new requirements of professional teaching competence in the new era of education.

Furthermore, some experts proposed that when analyzing key factors affecting student engagement, full consideration should have been given to the important roles of students' emotional experiences and cognitive engagement, which were often easily overlooked. Students' professional interests, self-efficacy, critical thinking, and other factors could have a profound impact on their learning engagement. Therefore, this study incorporated "Affective engagement" and "Cognitive engagement" into the core analytical dimensions to obtain more comprehensive and multifaceted research findings.

4.7.2 Establishing the Coding Framework

This study, through an in-depth literature review and consultation with research experts and scholars in the fields of educational management, family education, and school-family cooperation, modified and refined the analytical

dimensions of factors influencing the engagement of Environmental Art Design students. After multiple rounds of discussion and adjustment, the analytical dimensions for factors influencing the engagement of Environmental Art Design students were finally established, namely, the coding framework for schools to promote parental involvement. This framework covered various aspects including course activities, instructors' skills engagement, affective engagement, behavior engagement, cognitive engagement, and course activities engagement aiming to comprehensively analyze how schools could effectively promote factors influencing the engagement of Environmental Art Design students. The specific analytical dimensions were detailed in Table 4.33 below:

Table 4.33 Coding Framework for Factors Influencing the Engagement of Environmental Art Design Students

Primary Dimension	Secondary Dimension
Course Activities Engagement	Teaching Content Design
	Use of Teaching Methods
	Assessment and Evaluation Methods
Instructors' Skills Engagement	Professional Knowledge Level
	Teaching Organization Ability
	Teacher-Student Interaction Level
	Information Technology Application Ability
Affective Engagement	Professional Interest
	Learning Motivation
	Teacher-Student Relationship
	Self-Efficacy
Behavior Engagement	Classroom Participation
	Extracurricular Learning
	Practical Training
	Assignment Completion
Cognitive Engagement	Critical Thinking
	Innovation Ability
	Knowledge Mastery
	Metacognitive Ability

In the subsequent coding process of this study, letters were used to represent the indicators at each level of coding. The coding symbols were as follows: A represented course activities, A1 represented teaching content arrangement, A2 represented

teaching method application, A3 represented assessment and evaluation methods; B represented instructors' skills engagement, B1 represented professional knowledge level, B3 represented teacher-student interaction level; C represented affective engagement, C1 represented professional interest, C2 represented learning motivation, C3 represented teacher-student relationship; D represented learning behavior, D1 represented classroom participation, D2 represented extracurricular learning, D3 represented practical training, D4 represented homework completion; E represented cognitive engagement, E1 represented critical thinking, E2 represented innovation ability, E3 represented knowledge mastery. To further ensure the scientific validity and rationality of this study's coding framework, the research utilized coding comparison queries to analyze coding consistency. The results of running the coding comparison query were shown in the following Table 4.34.

Table 4.34 Coding Comparison Query Results

Node	Source Material	Agreement (%)	Disagreement (%)
A\A1	Interview Text	99.98	0.02
A\A2	Interview Text	99.16	0.84
A\A3	Interview Text	100	0
B\B1	Interview Text	99.69	0.31
B\B2	Interview Text	99.31	0.69
B\B3	Interview Text	98.99	1.01
C\C1	Interview Text	98.25	1.75
C\C2	Interview Text	99.87	0.13
C\C3	Interview Text	100	0
C\C4	Interview Text	98.25	1.75
C\C5	Interview Text	100	0
C\C6	Interview Text	100	0
C\C7	Interview Text	100	0
D\D1	Interview Text	99.66	0.34
D\D2	Interview Text	99.25	0.75
D\D3	Interview Text	100	0
D\D4	Interview Text	100	0
E\E1	Interview Text	99.89	0.11
E\E2	Interview Text	100	0
E\E3	Interview Text	100	0
E\E4	Interview Text	99.88	0.12
E\E5	Interview Text	98.97	0.23

As could be seen from the coding comparison query results in Table 3-3 above, the coding consistency of each coding dimension for factors influencing the engagement of Environmental Art Design students was above 98%. This result indicated that the coding framework established for analyzing school promotion of parental involvement had a high degree of consistency, which further demonstrated that the coding framework for factors influencing the engagement of students had high validity and rationality.

4.7.3 Coding Interpretation

The following combined specific interview examples to analyze the content of six dimensions of factors influencing the engagement of Environmental Art Design students: course activities engagement, instructors' skills engagement, affective engagement, behavior engagement, and cognitive engagement.

4.7.3.1 Content Analysis and Examples of Course Activities

Table 4.35 Definitions of Course Activities

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Teaching Content Design (A1)	Selection, organization, and arrangement of course content	Refers to whether the course content can stimulate students' interest in learning and participation, and whether it aligns with professional development and practical needs.	"We emphasize integrating cutting-edge concepts and practical cases of Environmental Art Design into the teaching content, allowing students to feel the value and significance of learning." — Dean of the School of Landscape Engineering, Suzhou Agricultural Vocational and Technical College
Use of Teaching Methods (A2)	Application of teaching strategies and methods	Involves whether the teaching methods used by the teacher help enhance students' classroom participation and promote active learning.	"We adopt a 'theory and practice equally important' teaching model. Understanding that design is not just theoretical but requires practical testing, we have designed a series of practical activities, such as organizing regular field trips to Suzhou gardens, museums, and other cultural sites." — Dean of the School of Craft Design, Suzhou Arts and Crafts Vocational and Technical College

Table 4.35 Definitions of Course Activities (continued)

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Assessment and Evaluation Methods (A3)	Methods of evaluating learning outcomes	Refers to whether the methods of evaluating students' learning outcomes are comprehensive and reasonable, and if they can promote continuous participation and effort.	"A diversified assessment approach is adopted, including regular assignments, project designs, and final exams, providing a comprehensive evaluation of students' learning processes and outcomes." — Dean of the School of Landscape Engineering, Suzhou Agricultural Vocational and Technical College

4.7.3.2 Analysis of Instructors' Skills Engagement and Cases

Table 4.36 Definitions of Instructors' Skills Engagement

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Professional Knowledge Level (B1)	The teacher's knowledge base and updates	Refers to whether the teacher has a solid foundation of professional knowledge, can provide high-quality learning content, and keeps professional knowledge up to date.	"The professional course teachers have rich practical experience, and their explanations always deepen our understanding of Environmental Art Design." — Feedback from a student at Suzhou Agricultural Vocational and Technical College
Teaching Organization Ability (B2)	Classroom management and teaching arrangement	Involves whether the teacher can effectively organize and manage classroom teaching, create a good learning atmosphere, and reasonably arrange teaching content and pace.	"The 'flipped classroom' model was introduced, allowing students to preview theoretical knowledge before class and engage more in discussions, sharing, and creation during class, significantly improving student participation and learning outcomes." — Dean of the School of Craft Design, Suzhou Arts and Crafts Vocational and Technical College

Table 4.36 Definitions of Instructors' Skills Engagement (continued)

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Teacher-Student Interaction Level (B3)	Communication and interaction between teachers and students	Refers to whether the teacher can communicate effectively with students, promote classroom interaction, and encourage active participation.	"Students are encouraged to speak and ask questions actively in class. Awards like 'Best Speaker' and 'Best Question' were established to recognize those who bravely express their views." — Department Head, Suzhou Tourism and Finance Vocational and Technical School
Information Technology Application Ability (B4)	Use of modern educational technology	Involves whether the teacher can skillfully use modern educational technologies, such as VR/AR, AI, etc., to enhance teaching effectiveness.	"Modern technology tools, such as online discussion platforms and interactive whiteboards, were also used to provide more opportunities for student interaction. These measures have significantly improved classroom participation." — Department Head, Suzhou Tourism and Finance Vocational and Technical School

4.7.3.3 Analysis of Affective Engagement and Cases

Table 4.37 Definitions of Affective Engagement

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Professional Interest (C1)	The level of students' interest in the Environmental Art Design major	Refers to students' enthusiasm for the major content and whether they actively explore and learn related knowledge.	"Only students who are genuinely interested in the content they learn will actively explore and study, leading to better learning outcomes." — Department Head, Suzhou Tourism and Finance Vocational and Technical School
Learning Motivation (C2)	The intrinsic drive behind students' learning	Involves students' purposefulness and persistence in learning, whether they have clear learning goals and motivation.	"Students with clear future career plans are often more proactive and enthusiastic in their studies." — Dean of the School of Landscape Engineering, Suzhou Agricultural Vocational and Technical College

Table 4.37 Definitions of Affective Engagement (continued)

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Professional Identity (C3)	The degree to which students recognize and value their major	Refers to whether students recognize the value of their chosen major and feel confident in their future career development.	"Hope is a beautiful vision and expectation for the future. During the learning process, students need to maintain hope and confidence in their future, believing they can overcome difficulties and achieve success." — Department Head, Suzhou Tourism and Finance Vocational and Technical School
Self-Efficacy (C4)	Students' confidence in their own learning abilities	Involves the level of students' confidence in their ability to complete learning tasks and solve problems.	"Gratitude helps students appreciate every learning opportunity and every piece of feedback. This attitude of gratitude helps them focus more intensely on their studies." — Dean of the School of Craft Design, Suzhou Arts and Crafts Vocational and Technical College

4. 7.3.4 Analysis of Behavior Engagement and Cases

Table 4.38 Definitions of Behavior Engagement

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Classroom Participation (D1)	The performance and level of engagement of students in the classroom	Refers to students' activeness in the classroom, including behaviors such as answering questions and participating in discussions.	"Students who actively answer questions and participate in discussions usually perform better in coursework and exams." — Dean of the School of Landscape Engineering, Suzhou Agricultural Vocational and Technical College
Extracurricular Learning (D2)	Students' self-study outside of class hours	Involves how students use their free time for self-study and knowledge expansion.	"We also focus on developing students' self-learning abilities and teamwork skills by organizing design competitions, exhibitions, and other activities to inspire creativity and team spirit." — Department Head, Suzhou Tourism and Finance Vocational and Technical School

Table 4.38 Definitions of Behavior Engagement (continued)

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Practical Training (D3)	Students' participation in practical projects and internships	Refers to the extent of students' involvement in actual design projects, school-enterprise cooperation, and internships.	"Actively cooperating with enterprises to carry out school-enterprise projects provides students with practical opportunities and employment channels; inviting industry experts to give lectures or workshops helps students stay connected with the industry's forefront and gain the latest design ideas and techniques." — Department Head, Suzhou Tourism and Finance Vocational and Technical School
Assignment Completion (D4)	The quality and timeliness of students' coursework completion	Involves students' attitude, quality, and efficiency in completing assignments and projects.	"Using diverse assessment methods, including regular assignments, project designs, and final exams, provides a comprehensive evaluation of students' learning processes and outcomes." — Dean of the School of Landscape Engineering, Suzhou Agricultural Vocational and Technical College

4.7.3.5 Analysis of Cognitive Engagement and Cases

Table 4.39 Definitions of Cognitive Engagement

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Critical Thinking (E1)	The ability of students to analyze and evaluate the knowledge they have learned	Refers to whether students can think deeply, question, and make independent judgments about the knowledge they have acquired.	"Critical thinking helps students develop independent thinking and problem-solving skills. In class, students are encouraged to question and analyze the knowledge learned, deepening their understanding of issues through discussion and debate." — Department Head, Suzhou Tourism and Finance Vocational and Technical School

Table 4.39 Definitions of Cognitive Engagement (continued)

Evaluation Dimension	Evaluation Content	Explanation of Evaluation Content	Interview Example
Innovation Ability (E2)	The innovative thinking and performance of students in the design process	Involves whether students can propose novel design ideas and use innovative methods to solve problems.	"In the field of environmental art design, inspiration is crucial for designers. Therefore, it is important to cultivate students' spirit of innovation and creativity." — Department Head, Suzhou Tourism and Finance Vocational and Technical School
Knowledge Mastery (E3)	The degree of students' understanding and application of professional knowledge	Refers to whether students can accurately understand and flexibly apply the professional knowledge they have learned.	"Case studies are a teaching method that combines theoretical knowledge with practical application. By analyzing and discussing real or representative design cases, students grasp design principles and methods through analysis." — Department Head, Suzhou Tourism and Finance Vocational and Technical School
Meta cognitive Ability (E4)	The ability of students to monitor and regulate their own learning process	Involves whether students are aware of their learning state and can effectively adjust their learning strategies.	"By analyzing information such as students' learning data and behavior habits, AI can provide customized learning plans and resource recommendations to help them master knowledge and skills more efficiently." — Department Head, Suzhou Tourism and Finance Vocational and Technical School

4.7.4 Research Subjects

This study aimed to deeply explore the influencing factors and improvement strategies for student engagement in Environmental Art Design majors at Suzhou higher vocational colleges. Therefore, this research selected three higher vocational institutions in Suzhou: an agricultural vocational college (School A), an art vocational college (School B), and a comprehensive higher vocational technical school (School C). The research subjects were the deans or department heads of these three institutions, all of whom were managers of Environmental Art Design-related majors in their respective schools and possessed rich teaching and management experience. To ensure the representativeness of the data, the research subjects came from different

types of higher vocational colleges, including agricultural, art, and comprehensive institutions. Through interviews with the above subjects, the study hoped to understand the specific practices of each school in improving student engagement, the key factors affecting student engagement, and effective strategies for enhancing student engagement. In addition, the research also focused on how teaching facilities, resources, and school-enterprise cooperation influenced students' learning engagement.

Table 4.40 Interviewee information form

ID	Organization	Position	Age	Education	Years of Experience
A1	Suzhou Agricultural Vocational and Technical College	Dean of the School of Landscape Engineering	48	Postgraduate	18 years
A2	Suzhou Arts and Crafts Vocational and Technical College	Dean of the School of Craft Design	49	Postgraduate	20 years
A3	Suzhou Tourism and Finance Vocational and Technical School	Department Head	39	Postgraduate	12 years

Table 4.41 Coding timetable

ID	Time Span	Content	Coding
14	1:30.1 - 2:02.3	Improving student engagement through practical teaching, field trips, and classroom discussions.	A2, B2, D1, E3
52	2:02.3 - 2:04.9	The most effective types of student engagement at the school are 'practical projects' and 'design competitions'.	A2, D3, E2
18	2:12.9 - 2:41.3	Challenges include time management issues among students and varying levels of professional awareness.	C2, C3, D2, E4
19	2:41.3 - 2:45.4	Teaching plans implemented using online learning platforms and regular classroom presentations.	A2, B4, D1, E2
58	8:34.9 - 8:41.5	The most effective types are 'teacher-student interaction' and 'participatory design'.	B3, D1, E2
59	8:41.5 - 8:44.1	Challenges include conflicts with learning tasks and limited understanding of modern design concepts by some students.	C3, D2, E3
101	13:17.0 - 13:30.0	Plans initiated through the creation of innovation studios, encouragement of self-study, and the introduction of industry cases.	A2, B3, D2, F2

Table 4.41 Coding timetable (continued)

ID	Time Span	Content	Coding
111	13:30.0 - 13:35.8	The most effective engagement types are 'school-enterprise cooperation' and 'student self-directed projects'.	A3, D3, F2
121	13:35.8 - 13:36.9	Challenges include students' time constraints and differing perceptions of professional requirements.	C2, C3, E4
125	25:37.7 - 25:43.7	Plans implemented through the development of teaching models suitable for Environmental Art Design and regular industry exchanges.	A2, B2, D3, F2
102	25:43.7 - 25:45.6	The most effective types are 'practical teaching' and 'innovation thinking cultivation'.	A2, E2
112	25:45.6 - 25:58.6	Challenges include some students' lack of initiative and limited practical resources.	C1, D2, F1
122	25:58.6 - 26:01.2	Starting with detailed course design and conducting regular teaching evaluations and feedback.	A1, A3, B2, E4
27	27:37.7 - 28:18.3	The most effective types are 'professional skills training' and 'innovation thinking cultivation'.	A2, B1, E2
28	28:18.3 - 28:22.7	Challenges include students' insufficient understanding of industry developments and the need to improve their innovation capabilities.	C3, E2, E4

4.8 Thematic Analysis

4.8.1 Theme Weight Correspondence

Through Figure 4.8, the word frequency bar chart and multivariate diagram, several main research themes were identified.

Firstly, course activity emerged as a core theme. The highest frequency of "design" in the bar chart indicated the primary position of design practice in course

activities. In the multivariate diagram, course activities engagement was located in the upper left position, further confirming the importance of this theme.

Secondly, cognitive engagement and behavior engagement were also important themes. The high frequency of "teaching" and "participation" in the word frequency chart reflected the key role of teaching methods and student participation in cognitive engagement. Meanwhile, cognitive engagement was centrally positioned in the multivariate diagram, indicating its core status in the research.

Lastly, affective engagement and instructors' skills engagement were also key themes in the research. Although they were positioned relatively low in the multivariate diagram, they remained important factors affecting student engagement.

The research themes revolved around course activities engagement,cognitive engagement,affective engagement, and instructors' skills engagement, with each theme having its unique core vocabulary and associations.

4.8.2.1 Course Activities Engagement

Course activities engagement played a crucial role in improving the engagement of Environmental Art Design students, emerging as the strongest among all influencing factors. By analyzing interview data from three managers of Environmental Art Design programs in Suzhou vocational colleges, it became clear that these institutions generally recognized the importance of designing reasonable course activities engagement and had adopted a series of targeted strategies to achieve this goal.

Regarding teaching content arrangement, these colleges emphasized the combination of theory and practice. Almost all interviewed administrators stated that they stressed the importance of practical teaching in their curriculum design. This approach not only provided Environmental Art Design students with a learning

environment that combined theory and practice but also helped improve students' practical operational skills. As the dean of the Landscape Engineering College at Suzhou Agricultural Vocational and Technical College stated, "Our college has always emphasized practical teaching, giving students the opportunity to get hands-on experience and truly engage in design. I remember once, we took students to a park for a field survey, allowing them to observe the natural environment and feel the layout of the space." This arrangement of teaching content provided Environmental Art Design students with a clear practice-oriented approach and a solid theoretical foundation for their learning.

In terms of teaching method application, these colleges generally adopted diversified teaching methods. They no longer limited teaching to traditional classroom lectures but cleverly integrated various teaching methods into their courses. For example, the dean of the College of Arts and Crafts Design at Suzhou Art & Design Technology Institute shared, "To further enhance classroom engagement, we introduced the 'flipped classroom' model, allowing students to preview theoretical knowledge before class, while spending more time in class on discussion, sharing, and creation." This method not only increased students' engagement but also made the learning process more interactive and meaningful, helping students connect theoretical knowledge with practical design.

Regarding assessment and evaluation methods, diversified evaluation became a common choice among these colleges. Most administrators emphasized that they used multiple methods to assess students' learning outcomes. As the dean of the Landscape Engineering College at Suzhou Agricultural Vocational and Technical College said, "We adopted diversified assessment methods, including regular assignments, project designs, and final exams, which could comprehensively evaluate students' learning processes and outcomes." This diversified evaluation approach not only increased the comprehensive assessment of students' abilities but also provided them with varied opportunities to showcase their skills, helping them demonstrate their

design abilities and innovative thinking from different perspectives.

4.8.2.2 Instructors' Skills Engagement

Instructors' skills engagement played a crucial role in enhancing the engagement of Environmental Art Design students, second only to course activity engagement. This data indicated that instructors' skills engagement had a significant impact on students' engagement. By analyzing interview data from three managers of Environmental Art Design programs in Suzhou vocational colleges, it became clear that these colleges highly valued the cultivation and improvement of instructors' skills engagement and had taken a series of measures to achieve this goal.

Regarding professional knowledge level, these colleges generally emphasized teachers' practical experience and professional quality. Almost all interviewed administrators stated that their teaching staff possessed solid professional knowledge and rich practical experience. This approach not only provided Environmental Art Design students with high-quality professional guidance but also helped students better understand the connection between theoretical knowledge and practical application. As the dean of the Landscape Engineering College at Suzhou Agricultural Vocational and Technical College stated, "Our professional course teachers all had rich practical experience; their explanations always led to a deeper understanding of environmental art design." This high level of professional knowledge provided students with reliable learning resources and professional guidance.

In terms of teaching organization ability, these colleges generally adopted diversified teaching organization methods. They were no longer limited to traditional classroom lectures but cleverly organized various forms of teaching activities. For example, the department head of Suzhou Tourism and Finance Vocational College shared, "Through project-based learning, case analysis, field investigations, and other methods, we let students learn in real or simulated environments, thereby stimulating

their learning interest and engagement." This diversified teaching organization method not only increased student engagement but also made the learning process more vivid and interesting, helping students better understand and master professional knowledge.

Regarding the level of teacher-student interaction, these colleges paid great attention to improving classroom interactivity. Most administrators emphasized that they encouraged active interaction between teachers and students. As the department head of Suzhou Tourism and Finance Vocational College said, "We encouraged students to actively speak and ask questions in class, and set up 'Best Speaker' and 'Best Question' awards to commend those students who courageously expressed their views." This high level of teacher-student interaction not only increased classroom liveliness but also provided students with opportunities for expression and communication, helping to cultivate their critical thinking and expression abilities.

In terms of information technology application ability, these colleges actively introduced modern educational technology. They recognized the important role of information technology in improving teaching effectiveness and student engagement. The department head of Suzhou Tourism and Finance Vocational College mentioned, "We also used modern technological means, such as online discussion platforms and interactive whiteboards, to provide students with more communication opportunities." This effective application of information technology not only enriched teaching methods but also provided students with more diversified learning and communication channels.

Overall, these vocational colleges demonstrated comprehensiveness and foresight in teacher skill cultivation. They not only focused on teachers' professional knowledge level and teaching organization ability but also strived to improve teacher-student interaction levels and information technology application ability. These measures collectively constructed a teaching environment conducive to improving the engagement of Environmental Art Design students.

4.8.2.3 Affective Engagement

Affective engagement played a crucial role in enhancing the engagement of Environmental Art Design students, ranking third, second only to teacher skill engagement. This data indicated that affective engagement had a significant impact on student engagement. By analyzing interview data from three managers of Environmental Art Design programs in Suzhou vocational colleges, it became clear that these colleges generally recognized the importance of stimulating students' affective engagement and had taken a series of targeted strategies to achieve this goal.

Regarding professional interest, these colleges generally focused on cultivating and stimulating students' interest in environmental art design. Almost all interviewed administrators emphasized that interest was the primary motivation for learning. This approach not only provided Environmental Art Design students with continuous motivation for learning but also helped improve their learning effectiveness. As the department head of Suzhou Tourism and Finance Vocational College stated, "Interest is the driving force of learning. Only students who are full of interest in what they are learning will actively explore and study, thus achieving better learning results. Therefore, in teaching, we should focus on stimulating students' learning interest and curiosity, making them develop a strong interest in what they are learning." This emphasis on professional interest provided students with an internal drive for continuous learning and in-depth exploration.

In terms of learning motivation, these colleges generally adopted various methods to stimulate and maintain students' learning motivation. They not only focused on students' current learning states but also emphasized cultivating students' expectations for the future. For example, the dean of the College of Arts and Crafts Design at Suzhou Art & Design Technology Institute shared, "Hope is like a bright lamp, illuminating the path forward for students, allowing them to maintain firm beliefs and unremitting efforts when facing difficulties and challenges." This method not only enhanced students' learning motivation but also helped them establish

long-term learning goals, contributing to their sustained efforts in the learning process.

Regarding teacher-student relationships, these colleges placed great importance on establishing good relationships between teachers and students. Most administrators emphasized that a good teacher-student relationship was an important factor in improving student engagement.

As the dean of the Landscape Engineering College at Suzhou Agricultural Vocational and Technical College said, "Teachers also praised students who made obvious progress in class, giving everyone the motivation to improve and making learning feel like a very rewarding experience." This positive teacher-student relationship not only increased students' learning enthusiasm but also provided emotional support for students, helping to establish a positive learning atmosphere.

In terms of self-efficacy, these colleges focused on cultivating students' confidence and sense of capability. They recognized the important influence of self-efficacy on student engagement. The dean of the College of Arts and Crafts Design at Suzhou Art & Design Technology Institute mentioned, "Gratitude made students appreciate every learning opportunity and every piece of feedback, and this grateful mindset helped them focus more on learning." This cultivation of self-efficacy not only improved students' learning confidence but also promoted their initiative and persistence in the learning process.

Overall, these vocational colleges demonstrated comprehensiveness and depth in cultivating students' affective engagement. They not only focused on stimulating students' professional interests and learning motivation but also strived to establish good teacher-student relationships and improve students' self-efficacy. These measures collectively constructed a learning environment conducive to enhancing the affective engagement of Environmental Art Design students, thereby promoting the overall improvement of student engagement.

4.8.2.4 Behavior Engagement

Behavior engagement was a direct manifestation of Environmental Art Design students' engagement, which, although lower than affective engagement, remained an important influencing factor. This data indicated that behavior engagement had a significant impact on student engagement. By analyzing interview data from three managers of Environmental Art Design programs in Suzhou vocational colleges, it became clear that these colleges highly valued students' behavior engagement and had taken a series of measures to promote students' positive learning behaviors. Regarding classroom participation, these colleges generally adopted various strategies to improve students' classroom engagement. Almost all interviewed administrators emphasized that classroom participation was key to learning outcomes. As the dean of the Landscape Engineering College at Suzhou Agricultural Vocational and Technical College stated, "Their participation in class was truly outstanding! Our college had always emphasized practical teaching, giving students opportunities to gain hands-on experience and truly engage in design." This classroom model, which emphasized practice and interaction, not only increased students' enthusiasm for participation but also enhanced their understanding and application of professional knowledge.

In terms of extracurricular learning, these colleges generally encouraged students to engage in self-directed and expanded learning. They recognized the importance of extracurricular learning in consolidating and expanding classroom knowledge. For example, the dean of the College of Arts and Crafts Design at Suzhou Art & Design Technology Institute shared, "We also focused on cultivating students' self-learning abilities and teamwork skills, stimulating students' creative enthusiasm and team spirit through organizing design competitions and exhibitions." These extracurricular learning activities not only expanded students' learning scope but also cultivated their self-learning abilities and innovative spirit. Regarding practical training, these colleges placed great importance on providing practical opportunities for students. Most administrators emphasized that practical training was key for

Environmental Art Design students to improve their professional skills. As the department head of Suzhou Tourism and Finance Vocational College said, "We actively cooperated with enterprises to carry out school-enterprise cooperation projects, providing students with practical opportunities and employment channels; we invited industry experts to give lectures or conduct workshops, keeping students closely connected with industry frontiers and acquiring the latest design concepts and techniques." This learning model, which focused on practice, not only enhanced students' practical operation skills but also helped them better understand industry needs and development trends.

In terms of assignment completion, these colleges adopted diversified assignment forms to improve students' completion rate and quality. They recognized the importance of assignments in consolidating learning content and cultivating practical abilities. The dean of the Landscape Engineering College at Suzhou Agricultural Vocational and Technical College mentioned, "We adopted diversified assessment methods, including regular assignments, project designs, and final exams, which could comprehensively evaluate students' learning processes and outcomes." This diverse form of assignments not only improved students' enthusiasm for completing assignments but also promoted their comprehensive development in various aspects. Overall, these vocational colleges demonstrated comprehensiveness and innovation in promoting students' active learning behaviors. They not only focused on improving students' classroom participation but also strived to promote students' extracurricular learning, practical training, and assignment completion. These measures collectively constructed a learning environment conducive to the comprehensive development of Environmental Art Design students, thereby effectively enhancing students' overall engagement.

4.8.2.5 Cognitive Engagement

Cognitive engagement played a crucial role in enhancing the engagement of Environmental Art Design students, though it was the weakest among all

influencing factors. Despite this, the data still indicated that cognitive engagement had a significant impact on student engagement and could not be ignored. By analyzing interview data from three managers of Environmental Art Design programs in Suzhou vocational colleges, it became clear that these colleges highly valued students' cognitive engagement and had taken a series of measures to promote students' critical thinking, innovative abilities, knowledge mastery, and metacognitive skills.

Regarding critical thinking, these colleges generally emphasized cultivating students' ability to think independently and analyze problems. As the department head of Suzhou Tourism and Finance Vocational College stated, "Critical thinking can help students develop the ability to think independently and solve problems. In class, we encouraged students to question and analyze the knowledge they had learned, deepening their understanding of issues through discussion and debate. This teaching method not only enhanced students' thinking abilities but also cultivated their innovative awareness and critical spirit." This emphasis on critical thinking provided students with opportunities for in-depth thinking and problem analysis.

The cultivation of innovative ability was also a focus of these colleges. The department head of Suzhou Tourism and Finance Vocational College emphasized, "In the field of environmental art design, inspiration is crucial for designers. Therefore, we needed to focus on cultivating students' innovative spirit and creativity, enabling them to keenly capture beautiful moments in life and transform them into design inspiration." This emphasis on innovative ability not only cultivated students' creativity but also helped them maintain competitiveness in their future careers.

In terms of knowledge mastery, these colleges emphasized the combination of theory and practice. The dean of the College of Arts and Crafts Design at Suzhou Art & Design Technology Institute stated, "We knew that design was not just theoretical but required practical validation. We designed a series of practical activities, such as regularly organizing students to visit Suzhou gardens, museums, and

other cultural sites for field investigations, allowing them to experience the collision of ancient and modern design concepts firsthand." This method of combining theory with practice helped students understand and master professional knowledge more deeply.

The cultivation of metacognitive ability also received attention. The department head of Suzhou Tourism and Finance Vocational College mentioned, "AI technology can serve as an intelligent assistant to provide students with personalized learning suggestions and feedback. By analyzing students' learning data and behavioral habits, AI can provide customized learning plans and resource recommendations, helping them master knowledge and skills more efficiently." This method of using modern technology to cultivate students' metacognitive abilities helped students better understand their learning status and needs, thereby allowing them to manage their learning process more effectively.

Overall, these vocational colleges demonstrated comprehensiveness and innovation in promoting students' cognitive engagement. They not only focused on cultivating students' critical thinking and innovative abilities but also strived to help students better master knowledge and improve their metacognitive abilities. These measures collectively constructed a learning environment conducive to the comprehensive development of cognitive abilities for Environmental Art Design students, thereby effectively enhancing students' overall engagement.

4.9 Case Analysis

4.9.1 Case 1 - School A

4.9.1.1 Course Activities: Leading Student Engagement

Among the many factors affecting the engagement of Environmental Art Design students in School A, the case analysis reflected School A's outstanding

performance in course activity design. By carefully designing and organizing various teaching activities, such as project practices, field surveys, and design competitions, School A effectively stimulated students' learning interest and participation enthusiasm. Meanwhile, looking at the specific values of student engagement, which ranked first among all factors, it was evident that high-quality course activities engagement played a key role in improving student engagement.

4.9.1.2 Instructors' Skills Engagement: Professional Guidance

The instructors' skills engagement ranked second among all factors. This indicated that School A had a high-level teaching staff, and teachers' professional quality and teaching skills were widely recognized by students. In the teaching process, teachers effectively improved student engagement by guiding students to conduct inquiry-based learning and organizing classroom discussions and exchanges. Second only to course activity engagement, it could be seen that teachers' professional guidance was crucial for stimulating students' learning enthusiasm and participation motivation.

4.9.1.3 Behavior Engagement: Low engagement

Ranking third among all factors, the initiative and investment of School A students in classroom participation, extracurricular learning, and team collaboration needed further improvement. Relatively low compared to other factors, this reflected that School A students' participation performance in the learning process was not ideal enough, and their learning initiative and self-discipline needed to be strengthened.

4.9.1.4 Cognitive Engagement: Lowest engagement

In School A, ranking second to last among all factors, this indicated that School A students' engagement in higher-order cognitive activities such as deep thinking and innovative exploration needed to be strengthened. The lowest among all

factors, this reflected insufficient cognitive investment by School A students in the learning process, and their abilities in analyzing and solving problems needed improvement.

4.9.1.5 Affective Engagement: Lowest coverage rate

The lowest among all factors, this indicated that School A students' emotional factors, such as professional interest and learning motivation, still had large room for improvement. Ranking third, there was still a significant gap compared to other factors. This reflected that School A students' emotional experiences in the learning process were not positive enough, and their learning enthusiasm and professional identity needed further stimulation and cultivation.

In summary, the factors influencing the engagement of Environmental Art Design students in School A showed significant differential characteristics. Course activities engagement and instructors' skills engagement played important leading roles, while learning behavior, cognitive engagement, and emotional engagement factors were relatively weak, with large room for improvement.

4.9.2 Case 2 - School B

4.9.2.1 Behavior Engagement: Highest engagement

Among the five factors affecting the engagement of Environmental Art Design students in School B, behavior engagement was the highest. It fully reflected the excellent performance of School B students in classroom participation, extracurricular learning, team collaboration, and other areas, demonstrating strong learning initiative and self-discipline. Through active participation in various learning activities, students made significant progress in knowledge understanding, skill mastery, and ability improvement. It could be said that good behavior was an important reason for the high engagement of School B students.

4.9.2.2 Cognitive Engagement: Deep thinking

Ranking second among all factors, this indicated that School B students were fully cognitively engaged in the learning process, able to actively conduct deep thinking and exploratory activities. Through higher-order cognitive activities such as analyzing and solving problems, students' innovative awareness and practical abilities were effectively exercised. This reflected the positive results School B had achieved in cultivating students' cognitive abilities and innovative spirit.

4.9.2.3 Affective Engagement: High involvement

In School B, the coverage rate for emotional engagement was 16.29, ranking third. This reflected that School B students showed high professional interest and learning enthusiasm in the learning process. Through participation in various professional practices and innovative activities, students' professional identity and self-efficacy were continuously strengthened. It could be said that positive emotional experiences were an important driving force for School B students to maintain high engagement.

4.9.2.4 Course Activities Engagement: Scientifically designed

Ranking fourth among all factors, this data indicated that School B had made good explorations and practices in course activity design. Through optimizing teaching content and innovating teaching methods, it effectively stimulated students' learning interest and participation enthusiasm. However, compared to other factors, there was still room for improvement in the contribution of course activities engagement to enhancing student engagement.

4.9.2.5 Instructors' Skills Engagement: Lowest Engagement

The lowest among all factors, this indicated that there was still room for improvement in the professional quality and teaching skills of School B teachers. Although teachers had made some efforts in guiding students to conduct inquiry-based learning and organizing classroom interactions, their performance in stimulating student participation enthusiasm and promoting student ability development was not outstanding enough. This suggested that School B needed to increase teacher training and teaching research efforts to continuously improve teachers' professional level and teaching abilities.

In summary, the factors influencing the engagement of Environmental Art Design students in School B showed relatively balanced characteristics, with the contribution of each factor to student engagement being relatively close. Among them, learning behavior, cognitive engagement, and emotional engagement factors performed more prominently, while course activities and instructors' skills engagement factors still had room for further improvement.

4.9.3 Case 3 - School C

4.9.3.1 Cognitive Engagement: Highest participation

Among the five factors affecting the engagement of Environmental Art Design students in School C, cognitive engagement had the highest coverage rate at 19.16. This data fully reflected the outstanding performance of School C students in higher-order cognitive activities such as deep thinking and innovative exploration. Through active participation in professional practice, innovation, and entrepreneurship activities, students' abilities to analyze and solve problems were significantly improved. It could be said that high-level cognitive engagement was a key factor in maintaining high engagement among School C students.

4.9.3.2 Behavior Engagement: Self-directed learning

Ranking second among all factors, this indicated that School C students performed excellently in classroom participation, extracurricular learning, team collaboration, and other aspects, demonstrating strong learning initiative and self-discipline. Through active participation in various learning activities, students made significant progress in knowledge understanding, skill mastery, and ability improvement. This reflected the positive results School C had achieved in cultivating students' self-directed learning abilities.

4.9.3.3 Course Activities Engagement: Precisely designed

In School C, this reflected the school's precise exploration and practice in course activity design. Through optimizing teaching content, innovating teaching methods, and enriching practical activities, School C effectively stimulated students' learning interest and participation enthusiasm. It could be said that high-quality course activity design was an important guarantee for improving student engagement in School C.

4.9.3.4 Instructors' Skills Engagement: Relatively high level

In School C, ranking fifth among all factors, this indicated that School C teachers had a relatively high level of professional quality and teaching skills. Through guiding students to conduct inquiry-based learning, organizing classroom interactions, and providing personalized guidance, teachers effectively promoted student participation and development. However, compared to other factors, there was still room for further improvement in instructors' skills engagement to enhance student engagement.

4.9.3.5 Affective Engagement: Lowest Engagement

The lowest among all factors, this indicated that there was still room for improvement in School C students' Affective engagement in the learning process. Although students generally had high professional interest and learning enthusiasm, their experiences in self-efficacy and sense of achievement were not strong enough. This suggested that School C needed to further strengthen students' emotional guidance and motivation, helping them establish career ideals and enhance professional identity. In summary, the factors influencing the engagement of Environmental Art Design students in School C showed distinct characteristics, with cognitive engagement and behavior engagement standing out, while instructors' skills engagement and emotional engagement had room for further improvement.

The research revealed multiple factors affecting the engagement of Environmental Art Design students and conducted an in-depth discussion on the mechanisms of these factors through preliminary research and interview analysis. The preliminary research showed that course activity engagement scored the highest, while cognitive engagement scored the lowest, indicating that course activities engagement had the most significant impact on improving student engagement, while cognitive engagement was relatively weak. Interview data further confirmed and deepened this finding, revealing the roles of course activities, instructors' skills engagement, Affective engagement, learning behavior, and cognitive engagement in students' engagement experiences and participation enthusiasm.

Course activities engagement played a core role in improving student engagement. Suzhou vocational colleges designed courses through a combination of theory and practice, diverse teaching methods, and multi-dimensional evaluation methods, effectively stimulating students' learning interest and initiative. These colleges emphasized the design and implementation of course activities, helping students better understand and apply professional knowledge through practical teaching, thereby validating the fundamental contribution of course activities engagement to student engagement.

Instructors' skills engagement also played an important role in promoting student engagement, with instructors' skills engagement in the preliminary research ranking second only to course activities. Interviews showed that teachers' professional quality, teaching organization ability, level of teacher-student interaction, and information technology application skills had a positive impact on students' engagement. High-level teachers could not only provide professional guidance but also create a good learning atmosphere, further enhancing students' level of engagement.

Affective engagement, as a key influencing factor of student engagement, also received widespread attention in the preliminary research. Interview data revealed that Suzhou vocational colleges focused on cultivating Affective engagement by stimulating students' professional interests, maintaining learning motivation, establishing good teacher-student relationships, and enhancing students' self-efficacy, thereby creating a positive learning atmosphere and promoting better student participation in learning. Moreover, although the influence of behavior engagement and cognitive engagement on student engagement was relatively weak, it could not be ignored. Interview results indicated that Suzhou vocational colleges guided students' behavior engagement by promoting classroom participation, encouraging extracurricular learning, strengthening practical training, and optimizing homework design, while also focusing on cultivating students' critical thinking, innovation ability, knowledge mastery, and metacognitive skills. These measures effectively improved students' learning initiative and cognitive depth.

In conclusion, this study systematically revealed multiple factors affecting the engagement of Environmental Art Design students through a combination of preliminary research and interview data analysis. The mechanisms of course activities, instructors' skills engagement, Affective engagement, behavior engagement, and cognitive engagement in students' engagement were comprehensively interpreted.

Chapter 5

Discussion and Conclusion

This chapter provided further data analysis and a summary of the discussion based on the research findings. It summarized the practical significance of the study through the analysis of data. Finally, the limitations and shortcomings of the study were outlined, and directions for further research were proposed.

5.1 The Review and Summary of the Research Objectives

In this section, two main objectives of the study were detailed and summarized.

5.1.1 Objective 1: To verify the factor structure of a set of observed variables that revealed the relationship between five factors of constructs of students' engagement in Environmental Art Design Courses in the vocational colleges in Suzhou.

In general, the achievement of the first goal confirmed the highly significant relationships among variables of students' learning engagement in environmental art design measurement.

The findings revealed that the five factors were positively significant by measuring the path coefficient in the model with high P values, indicating the good quality of each item in the model. According to linear statistical analysis, age, gender, grade, and school did not show significant differences in the student engagement analysis, while the scores of the last five factors with student participation aligned according to the degree of close relationship from the most significant to the least: 1) Course Activities Engagement; 2) Instructors' Skills Engagement; 3) Affective Engagement; 4) Behavior Engagement; and 5) Cognitive Engagement, respectively.

In conclusion, in terms of validation, CFA results showed that there was a significant path relationship between the five factors, and the contribution of each factor to student engagement was verified, further supporting the critical roles of curriculum activities and instructors' skills engagement as priorities, with behavior engagement in third, and cognitive engagement and emotional engagement in fourth and fifth, respectively.

5.1.2 Objective 2: To gain perspectives of the administrators to confirm five-factor constructs and enhance students' engagement in Environmental Art Design Courses in the vocational schools in Suzhou.

The second goal of this study was achieved. While the CFA model was confirmed through the interviews, the perspectives of the administrators regarding the five key factors of student engagement were obtained to improve Environmental Art Design courses in vocational colleges in Suzhou.

After analyzing interview data from three Directors of Environmental Art Design Programs in Suzhou Vocational Colleges, it became clear that these institutions generally recognized the importance of designing reasonable course activities engagement and had adopted a series of targeted strategies to achieve this goal. This was evident as all the schools emphasized cultivating and improving teachers' skills through the development of a series of measures.

To sum up, the two objectives of this study appeared to complement each other. Through the survey design with the CFA analysis coupled with the semi-structured interview analysis of student engagement in Environmental Art Design courses, the validation of internal consistency in the relationships of the five factors of student engagement was obtained. Additionally, there was confirmation of the potential agreement in the applicability of the student engagement model to enhance Environmental Art Design education in vocational colleges in Suzhou. By applying theoretical concepts to the composition of the student engagement model,

arranged from most to least significant constructs—course activities engagement, instructors' skills engagement, behavior engagement, cognitive engagement, and affective engagement—the optimization and intervention of learning engagement for students majoring in Environmental Art Design courses in Suzhou Vocational Colleges could be expected to improve and develop the overall quality of education and learning experiences in real-life situations.

5.2 Discussions of the Findings

Quantitative: To Answer Objective 1

In terms of the findings, the results of the research revealed that the most highly to the least significant factors were: 1) Course Activities Engagement; 2) Instructors' Skills Engagement; 3) Behavior Engagement; 4) Cognitive Engagement; and 5) Affective Engagement, respectively. The following provided a discussion of the rationale for the findings in accordance with previous research in the field of student engagement.

5.2.1 Course Activities Engagement

The findings of this study revealed that course activities engagement turned out to be the most crucial factor influencing the engagement of students majoring in Environmental Art Design in Suzhou vocational colleges. This could be explained by applying previous research to the nature of Environmental Art Design students, as they needed to be regularly effective in fulfilling their tasks with diverse topics and participation through the best maximum levels of interactive and constructive learning engagement based on problem- and/or project-based learning activities (Knudsen, 2023). Effective course activities engagement helped energize both mental and physical involvement in the process of learning engagement in the Environmental Art Design classes (Chen, 2020). Accordingly, the more the students

perceived highly interactive courses to be favorable for fulfillment, the more interactive engagement and learning outcomes became (Tsai & Ku, 2021). Moreover, it was stated that the more effective the course activities, the higher the skill levels in different aspects would be established (Adunlin, 2024).

5.2.2 Instructors' Skills Engagement

The second most significant factor of students' engagement found was instructors' skills engagement. In terms of instructors' skills engagement, it was consistently noted in previous research that instructors' skill effectiveness had a positive impact on students' engagement while interacting in classes. As Sandstrom (2023) had observed, the more students were exposed to effective and skillful instructors, the more likely they were to develop intellectual learning engagement. Similarly, it was highlighted that a crucial role of teachers was to create and maintain student engagement in their teaching and learning, thereby encouraging a well-established impact on their students' positive learning outcomes (Pedler et al., 2020).

5.2.3 Affective Engagement

Finally, the third significant factor of students' engagement found was affective, or sometimes called emotional engagement. While it was posited that emotionally engaged students felt good and enjoyed their involvement with learning activities, such as working enthusiastically (Reeve et al., 2019), in this case, Environmental Art Design students did not necessarily experience positive interactions at all times. The students might have experienced both positive and negative engagement, indicating a need for more support during their interactive participation. As it was argued, less experience led to less effective engagement (Henry, 2023). Studies had shown that individuals' levels of determination could affect their behavior and emotional engagement in learning a subject, and this relationship was

influenced by emotional balance and affective engagement (Hasdina, 2024).

5.2.4 Behavior Engagement

The fourth significant factor of students' engagement found was behavior engagement. This factor was consistent with other related research that sometimes referred to it as learning engagement, particularly concerning the challenges of new behaviors needed during the learning process. Behavior engagement was reported to be related to the levels of skill development required to fulfill the tasks at hand, as shown in studies exploring students' engagement in game design. It appeared that the range of player engagement and behavior, which involved techniques for designing game environments, mechanics, and challenges, could be better developed through effective interactions with other players (Hidayat, 2019; Zhang, 2022). If the right kinds of behavior engagement were applied to studying Environmental Art Design, it could be expected that the relationship between educational success and student engagement in professional courses related to career readiness in interior design would positively improve academic achievement, highlighting how valuing engagement could lead to productive behavior engagement and better academic performance (Hartzog, 2024).

5.2.5 Cognitive Engagement

Finally, the fifth significant factor of students' engagement found was cognitive engagement. The findings of the study on instruments for college engineering courses could be used to explain the cognitive engagement of Environmental Art Design students, which related to the mental processes involved in knowing, learning, and understanding. By using scales that represented students' perspectives on engagement in contemporary and digital contexts, it could be observed that this generation viewed cognitive engagement as an investment and a tool for gaining knowledge and understanding. In return, they could apply what they learned (Barlow, 2018). It was posited that the more positive the emotional value of the

content learned, the greater the cognitive engagement, which could significantly influence effective learning activities and participation (Schreiner et al., 2021).

5.3 Qualitative Analysis Findings

The qualitative research part provided an in-depth understanding and background support for the quantitative data through interviews with three professional leaders. The interview content was analyzed as follows:

Design of Course Activities: In the interview, all respondents agreed that the design of course activities engagement was critical to student engagement. "We put a lot of emphasis on practicality and interactivity when designing courses, which could effectively stimulate students' interest," said one of the administrators. This view echoed the results of the questionnaire survey and emphasized the importance of curriculum activities being better applied in courses.

The Impact of the Instructors' Skills Engagement: Respondents generally believed that teachers played an indispensable role in student participation. A professional administrator mentioned, Instructors' communication skills and classroom management skills directly affected students' affective engagement and behavior engagement." This view reflected the significant correlation between instructors' skills engagement and student engagement found in the quantitative analysis.

The Importance of Emotional Support: Respondents noted that affective engagement was closely related to students' learning experiences. "When students received emotional support, their engagement was significantly higher," one leader stressed. This was consistent with the positive correlation between affective engagement and overall engagement found in the quantitative analysis, highlighting the importance of emotional factors in learning.

Behavior Engagement: In interviews, professional administrators emphasized the importance of motivating students to actively participate in class discussions and collaborative learning. "Students' sense of engagement and achievement is enhanced through group work and class discussion," they said. This corroborated with the positive effects of behavior engagement in quantitative results.

Cognitive Engagement: Respondents also mentioned that teachers can promote cognitive engagement by designing deep learning tasks. For example, setting challenging projects can make students think deeply and increase their motivation to learn. This was consistent with the positive correlation between cognitive engagement and engagement in quantitative analysis.

In summary, while the quantitative provided a macro view of the factors that influence student engagement, qualitative interviews delved into the reasons and mechanisms behind these factors. Evidently, quantitative results revealed the relevance and importance of each factor, while qualitative analysis provided concrete case and background support for these results. Thus, combined results of qualitative and quantitative analysis, in this study, provided important insights into the engagement of students majoring in environmental art and design at Suzhou Vocational College. Through the in-depth analysis of five influencing factors, the study clarified the key role of course activities engagement, instructors' skills engagement, affective engagement, behavior engagement and cognitive engagement in enhancing student engagement. This research not only provided rich support for theoretical research but also practical suggestions for the improvement of practical educational practice, so as to promote the all-round development of students and enhance the learning experience

5.4 Research Recommendations

5.4.1 For educational administrators

Promote interaction and cooperation: Course activities should encourage interaction and cooperation among colleges in doing the research/ training / Curriculum/ course assessment methods that allow instructors to join and collaborate in a team to better Environmental Art Design Programs and Courses. Promote professional development of teachers: Colleges can provide professional development opportunities for instructors, such as participating in educational seminars, observing the classes of other outstanding teachers, or conducting collaborative teaching across disciplines and/or colleges. This ongoing professional development will help teachers renew their teaching concepts and enhance their teaching capabilities, thereby increasing student engagement.

5.4.2 For Improvement of Instructors' Skills

The role of teachers in student learning is crucial, so upgrading instructors' skills should be one of the priorities of educational institutions.

Strengthen communication skills: Teachers should improve their communication skills in order to be able to communicate more effectively with students. Regular training workshops are held to help teachers learn how to better listen to students' needs, provide timely feedback, and promote students' emotional engagement.

Strengthening classroom management: Teachers' classroom management ability directly affects students' learning experience. Teachers should learn effective classroom management skills to maintain a good learning atmosphere. This includes establishing clear classroom rules, actively addressing classroom discipline issues, and dealing with conflicts between students.

5.4.3 For Establishment of Students Engagement Skills

Build teacher-student relationships: Teachers should build good relationships with students and pay attention to their emotional state. By understanding students' interests, puzzles, and needs, teachers are able to support students' learning more effectively. For example, teachers can have regular one-on-one communication with students to understand their feelings and challenges in learning.

Encourage positive learning engagement environments: Colleges should strive to create a supportive and inclusive learning engagement environment where students feel safe and respected. In the classroom, teachers should encourage students to express their own views and accept different opinions, so as to enhance the positive sense of engaging, participation and belonging.

5.5 Future Research

Although this study has made some achievements in analyzing the learning engagement of students majoring in environmental art and design in Suzhou Vocational College, there are still some limitations, which are worthy of further discussion and improvement in future studies.

5.5.1 Future research could use the five factor-model developed in this study to collect data in different regions and other specialties to gain a broader perspective and more representative results of students' engagement.

5.5.2 Future research could do the higher statistics such as SEM with the Model adopted from this study with different groups of students in other regions so to fully understand the relationships of latent variables influencing students' engagement.

5.5.3 Longitudinal studies can provide insight into the dynamics of learning engagement. By following the same students over the course of different semesters or academic years, researchers were able to explore the long-term factors that influence student engagement and their changing trends. This will facilitate the development of targeted educational interventions to enhance the learning experience of students.

5.6 Conclusion

This study conducted the study of engagement of students majoring in environmental art and design in Suzhou Vocational College. Through a combination of quantitative and qualitative research, it revealed the influence of five key factors on students' participation, including course activities engagement, instructors' skills engagement, affective engagement, behavior engagement and cognitive engagement. Based on these findings, this section concluded:

5.6.1 Optimization of Course Activities

The design of course activities has been found to be one of the important factors affecting student participation. Therefore, education administrators and teachers should pay attention to the diversity and interactivity of course activities.

Increase hands-on activities: It is recommended to incorporate more hands-on activities into the curriculum, such as project making, site visits and workshops. This kind of activity can not only enhance students' hands-on ability, but also enable students to deepen their understanding of theoretical knowledge in practical operation. For example, in the Environmental Art and Design program, students can experience the learning content through field trips to urban environments or participation in community design projects.

5.6.2 Improvement of Instructors' Skills

Strengthening classroom management: Teachers' classroom management ability directly affects students' learning experience. Teachers should learn effective classroom management skills to maintain a good learning atmosphere. This includes establishing clear classroom rules, actively addressing classroom discipline issues, and dealing with conflicts between students.

5.6.3 Motivation of Behavior Engagement

Active behavior engagement is another key factor in student engagement, so it is crucial to motivate students to actively participate in learning activities.

Set clear learning goals: Teachers should help students set clear learning goals and provide specific steps and strategies to achieve them. This can help students stay motivated and improve their learning efficiency.

Use incentives: Reward systems can be designed to encourage students to speak up, participate in discussions, and complete assignments in class. For example, teachers can motivate students to actively participate through a point system, recognizing outstanding students, or offering small prizes.

Promote self-regulation: Teachers should cultivate students' self-regulation learning ability and help them learn effective time management and learning strategies. Enhance students' engagement by providing learning tools and resources that support their own choices and adjustments in their learning.

Design deep learning tasks: Teachers should design challenging learning tasks that promote deep thinking and inquiry in students. For example, project-based learning allows students to solve practical problems and increase their cognitive engagement through independent research or group work.

Provide feedback and guidance: Teachers should give students timely feedback to help them understand their progress and areas for improvement. Effective feedback can promote students' deep understanding of the learning content and improve their cognitive engagement.

Develop critical thinking: Through classroom discussion and debate, teachers should develop students' critical thinking skills and encourage them to analyze and evaluate different points of view. This enhancement of thinking ability will enhance students' cognitive involvement in learning content and promote their active participation in learning.

To sum up, the practical significance of this study is to provide specific suggestions for educational administrators, teachers and curriculum designers to enhance the learning engagement of students majoring in environmental art design. By optimizing curriculum activities, improving instructors' skills engagement, establishing and stimulating positive learning engagement behaviors for effectively improve the learning experience of students and enhance the quality of instruction as for ultimate quality of Environment Art Design in Suzhou, expectedly all across China in the near future. These practical strategies will not only enhance students' engagement, but will also have a positive impact on their learning outcomes and overall development, providing a feasible direction for future education reforms.

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Appendices

Appendix A

Questionnaire

Questionnaire

This questionnaire contains 2 parts:

Part 1: Respondent's demographic information.

Part 2: 35 items of Students ' Engagement in Environment Art Design Courses in Suzhou Vocational College.Your answers are valuable in terms of understanding the overall picture and situations pertaining this topic.Accordingly,the researcher would like to show great appreciation and gratitude for your valuable time in answering this questionnaire.

Part 1: Demographic Information

	Items	Expert Review				
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	**Gender**					
	□ Male					
	□ Female					
2	**Age**					
	□ 18-19					
	□ 19-20					
	□ 20-21					
	□ Others					
3	**Current Year**					
	□ 2021					
	□ 2022					
	□ 2023					
4	**Universities' Name**					
	□ Suzhou Polytechnic Institute of Agriculture (SPIA)					
	□ Suzhou Art & Design Technology Institute (SADTI)					
	□ Suzhou Tourism and Finance Institute (STFI)					

Part 2: The Relationship of Factors Influencing Intention to Participate in Suzhou Vocational College that the students majoring in Environmental Art Design.

Please answer foe the following question by ticking √ in the block which are given according to the degree to which you agree as follows:

1 = Strongly Disagree
2 = Disagree
3 = Neither agree nor disagree
4 = Agree
5 = Strongly agree

Factors Influencing the Students' Engagement Intention	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.I always feel active while participating in my Environmenta Design classes.					
2. I am happy while participating in my Environmental Art D classes.					
3. I am happy to do all the activities, both on and off campus, while taking my Environmental Art Design classes.					
4. I am happy with my performance while my taking Environmental Art Design classes.					
5. I am happy to engage myself in any learning activities in my Environmental Art Design classes.					
6. I feel proud to be the part of my Environmental Art Design classes.					
7. I feel joyful while participating in my Environmental Art Design classes.					
8. I feel enthusiastic while participating in my Environmental Art Design classes.					
9. I feel challenging to do better while participating in my Environmental Art Design classes.					
10. I feel that it a good experience for me to participate in my Environmental Art Design classes.					
11. I am regularly happy to go to my Environmental Art Design classes.					
12. I do not mind to participate in class discussion in my Environmental Art Design classes.					

13. I can complete all of the class assignments well in my Environmental Art Design classes.					
14. I study well in my Environmental Art Design classes.					
15. I can do my class projects well in my Environmental Art Design classes.					
16. I can do class exercises well in my Environmental Art Design classes.					
17. I can do any good practice of design in my Environmental Art Design classes.					
18. I am motivated through learning engagement to achieve my goals in my Environmental Art Design classes.					
19. I believe deep thinking can help raise my participation in Environmental Art Design classes.					
20. I believe that effective academic task engagement will help achieve my goals in Environmental Art					
21. I think it is the right choice for to engage myself in Environmental Art Design classes.					
22. I believe that effective study engagement will help me study better in Environmental Art Design classes.					
23. I believe that effective engagement strategies will help fulfill my academic tasks in my Environmental Art Design classes.					
24. I trust that effective study engagement will lead me to succeed well in Environmental Art Design classes					
25.I notice that effective engagement is necessary for being a good major student in Environmental Art Design classes.					
26. 1 engage myself well in leaning a Madel Design course.					
27. I collaborate well in Case-Based Analysis classes.					
28. I participate well in A Drawing from Nature classes.					
29. I can engage well in the 3D Max, Photo Shop, and CAD classes.					
30. I can participate well in Interior Design Practicum classes.					
31. I can participate well in Interior Design competitions.					
32. I can participate well in preparing Interior Design Exhibitions.					
33. I can do well in participating in Problem-based Learning in Environment Art Design classes.					

34. I can do well in Face-to-Face Interaction in my Environment Art Design classes.					
35. I can do well in any Individual Assignment in my Environment Art Design classes.					
36. I can do well in either Interpersonal or Small Group activities in Environment Art Design classes.					
37. I can do well with Critical Thinking skills in my Environment Art Design classes.					
38. I can do well with Problem-Solving skills in my Environment Art Design classes.					
39. I can do well with Appreciation Ability skill in my Environment Art Design classes.					
40. I can do well with Spatial Imagination skills in my Environment Art Design classes.					
41. Overall, I believe that an effective study engagement will help raise my academic performance and outcomes in my Environment Art Design classes.					
42. I think that effective Environment Art Design instructors should engage themselves well while teaching the Interior courses.					
43. I think that effective Environment Art Design instructors should utilize various course strategies to engage students in Interior courses.					
44. I think effective Environment Art Design instructors should possess positive personalities while engaging in course teaching and learning.					
45. I think effective Environment Art Design instructors should be intellectual open-minded while engaging in course teaching and learning.					
46. I think effective Environment Art Design instructors should be good at self-regulation skills while engaging in course teaching and learning.					
47. I think effective Environment Art Design instructors should be good at building positive professional relationship with their students while engaging in course teaching and learning.					
48. I think effective Environment Art Design instructors should be flexible while engaging in course teaching and learning.					
49. I think effective Environment Art Design instructors should be adaptable while engaging in course teaching and learning.					
50. I think effective Environment Art Design instructors should be capable of excellent course completion while engaging in course teaching and learning.					

Appendix B

Interview Protocol

The outline of the interview

Interview Objective:

This research is to fulfill the dissertation for Doctor of Education Program in Educational Studies, Sryadhep Techers College, Rangsit University. Its topic is "Factors Influencing Student's Engagement: Environmental Art Design Students at Suzhou Vocational Colleges."

Interview Duration: Estimated 35 to 40 minutes

Interview Participants:

Full-time Administrators from vocational colleges in, each with over five years of work experience.

The answers will be beneficial for understanding the overall picture and situations pertaining this topic from the administrators' perspectives. The interview information from the administrators, thus, will be used to analyzed as to gain the guidelines to better students' learning participation majoring in Environmental Art Design in Suzhou Vocational Colleges.

Accordingly, the researcher would like to show great appreciation and gratitude for your valuable answers and time to validate this research, significance

Shen Yuetian

Researcher

Part 1: Background Information

Could you please introduce yourself including your name, age, work unit, educational levels, current position, years of working experiences.

Part 2: Investigation on the factors affecting the participation of students majoring in environmental art design in higher vocational colleges in Suzhou Vocational Colleges.

Please answer the questions according to your real thoughts and feelings regarding the Environmental Art Design actual situations at your work place so that it can help better the participation of students majoring in environmental art design in higher vocational colleges in Suzhou.

THE QUESTIONS FOR THE INTERVIEWS

1. In your opinion, do you think that the Environmental Art Design students at your college are effective in class engagement and participation?
   Why and how? Please give some examples. (5 minutes)

2. In your opinion, what are the three kinds of teaching skills and/or methods are the most critical to increase the students' engagement, class attendance, and task completion in Environmental Art and Design students: Critical Thinking, Class Discussion, Collaboration, Case Studies, Problem-Based Learning, Simulations and Gamification, and Peer Teaching.
   Please briefly explain why and how those three are most crucial. (5 minutes)

3. Please rate the most three crucial positive emotional responses of the students in the Environmental Art Design classes that you expect them to have the most: Gratitude, Interest, Hope, Pride, Inspiration, Amazement.

Please briefly explain why and how those three are the most crucial
(5 minutes)

4. How and why, it is important to use technologies such as VR/AR, AI -- as the assisting design tools-- to improve teaching outcomes and student engagement in Environmental Art and Design classes?
   Please briefly explain why and how those three are the most crucial
   (5 minutes)

5. As the administrators, what measures at your college, do you take, to help the instructors to promote learning engagement atmosphere in Environmental Art Design classes?
   Please identify and explain the activities and/or approaches taken.
   (5 minutes)

6. How do the teaching facilities, resources and school-enterprise cooperation can help further increase student engagement?
   Please give some examples and briefly explain.
   (5 minutes)

7. Please recommend any specific suggestions and/or projects that can be done at your college or with collaboration among Vocational Colleges in improving overall student engagement in the Environmental Art Design classes for Suzhou Vocational Colleges?
   What are they, please explain. (5 minutes)

Appendix C

Index of Item Objective Congruence: IOC

An IOC for A Survey Research

Topic: Factors Influencing Student's Engagement: Environmental Art Design Students at Suzhou Vocational Colleges

Dear Expert:

This research is to fulfill the dissertation for Doctor of Education Program in Educational Studies, Sryadhep Techers College, Rangsit University. Its topic is "Factors Influencing Student's Engagement: Environmental Art Design Students at Suzhou Vocational Colleges."

This questionnaire is part of a quantitative method to investigate the current situation of learning engagement and participation in Environmental Art Design courses at Suzhou Vocational and Technical College and the information obtained will be used to write interview questions to determine Confirmatory factor analysis (CFA) supports the five-factor model of students' learning participation in order to promote the learning participation of students majoring in Environmental Art Design in Suzhou.

Your answers will be valuable in terms of validating the information containing in this questionnaire which will be beneficial for understanding the overall picture and situations pertaining this topic.

Accordingly, the researcher would like to show great appreciation and gratitude for your valuable time and comments for the validity of this research instrument.

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Biography

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