The study on learning motivation, flow experience and learning satisfaction of design group students

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ABSTRACT

This study explored the relationship between learning motivation, flow experience, and learning satisfaction among students in the design group of technical high schools in northern Taiwan. The "Design Group Students' Learning Motivation, Flow Experience, and Learning Satisfaction Questionnaire" was developed, incorporating sections on "background information," "learning motivation," "flow experience," and "learning satisfaction." The study targeted second- and third-grade students from the New Taipei City Technical High School Design Group, enrolled in the 2019-2020 and 2020-2021 academic years. Out of approximately 2,717 students, 559 valid questionnaires were collected, representing 20.6% of the total student population. Descriptive statistics, Pearson product-moment correlation analysis, and multiple regression analysis were used to examine the relationships between the research variables.

The data analysis revealed that learning motivation significantly and positively predicted flow experience and learning satisfaction. Additionally, flow experience significantly and positively predicted learning satisfaction and partially mediated the relationship between learning motivation and learning satisfaction. These findings suggest that enhancing students' learning motivation before teaching can improve their learning satisfaction by fostering their flow experience.

Keywords: Vocational Senior High School, Design Group, Learning Motivation, Flow Experience, Learning Satisfaction

1. Introduction

The introduction provides a good background on the context and importance of the study. To improve focus, the introduction could be streamlined to highlight the specific research questions and objectives. Explicitly stating the research questions or hypotheses guiding the study at the end of the introduction would provide a clear framework for the research.

To implement the concept of creativity and innovation, the Education Bureau of the New Taipei City Government [1] collaborated with schools to organize various activities and competitions through the establishment of maker classrooms. Through the design group skill area course, the basic functions of design group students are cultivated to meet the needs of the workplace, enhance learning

motivation, stimulate students' potential and creative thinking, implement practical application, strengthen students' employment competitiveness, and enable them to integrate into industrial development trends, and create works with aesthetic sense and practical needs [2]. The National Development Commission [3] noted in the "Report on the Survey on the Supply and Demand Gap of Cultural and Creative Talents and Response Strategies" that the cultural and creative industries have highly volatile and diversified characteristics, and the gap between learning and application is widespread.

In response to the development of the 12-year national basic education curriculum, the Syllabus of the Design Group also adopts the three aspects of "self-directed action," "social participation," and "communication and interaction," with the principle of "core literacy" as the main axis [2]. Therefore, the design group curriculum should be linked to the practical needs of the industry, taking into account theory and practice, integrating information and digital technology to meet the requirements of the overall curriculum for learning and literacy, and strengthening the impact and perception of design on daily life, so that students can connect to the workplace and demonstrate their learning to create a better career path after graduation. Based on the literature's review of the curriculum, talent cultivation direction, and national industrial development pulse of the design group, this study aims to explore the relationship between the learning motivation of design group students in New Taipei City technical high schools with different backgrounds, their generation of flow experience during the creative process, and their learning satisfaction. Furthermore, the study will explore whether flow experience plays a mediating role in the relationship between learning motivation and learning satisfaction. Understanding the current learning situation of students can help them increase self-awareness to enhance their creative thinking abilities and respond to the changing trends of the cultural and creative industry, thereby shortening the gap between learning and application to keep pace with the rapid development of the design industry.

In view of this, the specific recommendations put forward by this study, including follow-up research recommendations on learning motivation, flow experience, and learning satisfaction, as well as future suggestions for teachers and authorities in the technical high school design group, can serve as a reference for those interested in engaging in related topics or conducting more in-depth qualitative research in the future. These recommendations can actually improve the overall learning environment of the design group and enhance teachers' ability to improve students' learning motivation and help students increase their learning satisfaction.

This study conducted a questionnaire survey of students in the design group of technical high schools in New Taipei City to verify the following: whether students' learning motivation has a significant predictive power on flow experience and learning satisfaction, whether flow experience has a significant predictive power on learning satisfaction, and whether flow experience has a mediating effect on the relationship between learning motivation and learning satisfaction.

2. Literature Review

2.1 The Learning Motivation

2.1.1. The definition

Motivation refers to the internal psychological drive that motivates individuals to produce positive behaviors and persist towards a certain goal [4]. Yilmaz, Sahin, and Turgut [5] define motivation as the belief that provides energy, guidance, and persistence for behavior, and includes expectations, values, perceptions, and actions related to things. According to Huang [6], learning motivation is the motivation of learners to continue learning-related behaviors or the need to succeed in the learning process. When an individual has a set of motivations arising from the need to learn, a complex state of mind arises once those needs are satisfied [7]. However, learning motivation plays a crucial role in promoting students' learning, and as long as students have a strong motivation to achieve their goals, their own learning is sufficient to accomplish their learning objectives [5]. Therefore, it is essential for teachers and students to stimulate students' learning motivation and cultivate their active exploration and lifelong learning.

According to El-Adl and Alkharusi [8], students who are motivated to learn and believe that the subject has value in learning can control their own learning, and therefore have confidence in their learning ability, making them more likely to complete their learning tasks on time and more efficiently than other students. In this study, the definition of learning motivation is summarized as the mental process of learners who put in the effort to set their own learning goals, learn, and motivate themselves when they choose to study in a technical high school design group.

2.1.2. The theoretical bases

Learning motivation is the behavior that promotes learners to learn spontaneously and actively participate in the learning process, which is closely related to individuals' learning and development [9]. The theoretical discussion on learning motivation is quite diverse, with both similarities and differences in the discourses of different schools of thought. The perspectives of educational psychology can be divided into four main orientations: behaviorism, cognitivism, humanism, and social learning.

Scholars of the behaviorist motivation theory have found that learning is a response caused by an external stimulus, and in order to trigger learners' motivation to learn, it is necessary to strengthen the connection between stimuli and responses, which can be achieved through the reinforcement principle of "stimulus-response-reinforcement." However, while individual learning behaviors can be effective in the short term under external incentives, in the long run, learners' learning motivation is reduced by environmental factors, and external motivation alone is not enough to sustain students' performance, which becomes easily unsustainable once the external motivations disappear or are removed [10]. Broadly speaking, learning can be seen from animal learning experiments that the timing and intervals of repetition and stimulus, response and reward are very important for effective learning. In other words, from human learning experiments, we know the importance of factors such as practice time distribution, number of repetitions, and memorization for learning [11].

Cognitivism emphasizes that learning motivation is mediated by the learner's own views or ideas about learning, which mediates the stimulation of the individual's learning environment and their behavioral response. This is due to the individual's need for knowledge arising from their learning

and perception of things [10]. The psychologist put forward the theoretical hypothesis of achievement motivation, indicating that the values, motivations, and attitudes of regional populations are important resources related to economic growth, technological innovation, and national development. He also emphasized that human achievement motivation is a psychological need to pursue superiority and achievement. Achievement motivation allows us to shape our finite, social, and personal goals, and the extent to which individuals can achieve specific life-related goals in the future depends on their own motivational formation and successive judgments and actions [11].

According to Atkinson [12], there is a close relationship between achievement and personal characteristics, and in the pursuit of achievement behavior, motivation is divided into two categories: success needs and failure avoidance. He pointed out that in order for students to build self-confidence in the learning process, they should avoid too many failures, but should be given a relative chance of success.

In 1972, the American psychologist Weiner proposed the attribution theory, which stated that the attribution process is the determinant of classroom learning and performance. The six major attributions are: physical and mental status, task difficulty, ability, effort, luck, and others [13]. Due to the nature of each factor, three important factors are regarded as affecting the success and failure of individuals [10]: 1. Locus of control: refers to the source of individual cognitive success or failure factors, such as ability, effort, or physical and mental conditions as personal conditions (internal control), versus external conditions such as the external environment (external control). 2. Stability: refers to whether the source of the factors that affect success and failure is stable and consistent in similar situations; for example, factors with high stability, such as the difficulty of the task itself and one's own ability, are not easy to change, while factors with low stability, such as luck, effort, and emotion, are more likely to change. 3. Controllability: refers to whether the factors that affect success or failure can be determined by personal will, such as the efforts within the six major attributions that can be controlled by personal will, versus factors such as luck, ability, physical and mental conditions, and task difficulty that are not controlled by personal will.

Humanism advocates that education is a key process for human beings to develop their inner potential, emphasizing that learning motivation is an intrinsic motivation in the growth process of human nature. From the humanistic perspective, the importance of intrinsic motivation in satisfying various human needs can be explored [10]. This study explores the hierarchy of needs theory proposed by the pioneering psychologist Maslow, which emphasizes that human needs are like a hierarchy, ranging from low to high, and divided into five levels: physiological, safety, belonging and love, esteem, and self-actualization [14]. After years of research and verification, Maslow's theory of the five levels of needs has been revised to supplement two additional levels: knowledge and aesthetics. That is, the five needs have been expanded to seven. The first four levels are considered basic needs, and the last three levels of growth needs cannot be met until these four basic needs are satisfied. Growth needs must be built upon the foundation of basic needs, and if the first four basic needs cannot be met, the last three growth needs cannot be fulfilled [15].

The discussion of learning motivation from the social learning orientation begins with the

concept of self-efficacy proposed by Bandura [16]. Self-efficacy is defined as an individual's assessment of their own ability to complete tasks in a specific domain, and these self-beliefs are the main factors affecting the strength of individual motivation. Self-efficacy will also influence the choice of tasks and the persistence of continuous effort [10].

Pintrich [17] proposed that in the learning process, the three main components that affect learning motivation are values, expectations, and emotions. An individual's learning outcomes will be affected by the strength of their learning motivation, which is shaped by these three key factors. In terms of related research, El-Adl and Alkharusi [8] explored the relationship between self-directed learning strategies and students' mathematics learning motivation and academic achievement. The results showed that there was a positive correlation between academic achievement and intrinsic motivation, extrinsic motivation, self-efficacy, beliefs, and values.

Kim [18] studied the relationship between learning motivation and learning satisfaction of Taiwanese high school students when facing foreign language learning. The findings indicated that gender and school background factors were positively correlated with students' motivation when learning a second foreign language, and the value and interest aspects of learning motivation had the most predictive effect on learning satisfaction. According to the research of Lee [19], among the four levels of emotion, value, expectation, and efficacy, the value level has the highest association with high learning motivation. The extrinsic motivation stimulated through a token system can indirectly improve students' learning motivation in mathematics.

Based on the above literature, it is found that there are a wide range of factors influencing learning motivation, including emotion, value, expectation, efficacy, interest, intrinsic motivation, and extrinsic motivation. Among these, "expectation" and "value" appear to be the most important aspects. Most of the research results also show a positive relationship between learning effectiveness and learning motivation. This study focuses on the psychological aspects of students' learning in the context of curriculum design, so the construction of the learning motivation scale is based on emotion, expectation, value, and efficacy.

2.2 The Flow

2.2.1. The definition

The concept of flow experience was first proposed by Csikszentmihalyi [20], a professor of psychological management at the University of Chicago. Through interviews with hundreds of artists, athletes, chess players, and professionals in various fields who need to devote themselves to a certain work, Csikszentmihalyi found that the feelings mentioned by the different interviewees were very similar when they were engaged in their field and progressing smoothly. This emotional state of flow can generally be felt effortlessly and continuously. When the flow experience occurs, the individual's intrinsic psychological motivation also increases, which directly affects the degree of participation in the activity. The intensity and frequency of the flow experience can also vary [21].

The pursuit of happiness in life can only be achieved through self-conscious mastery. Each person holds a rather subjective feeling and emotion to define happiness differently. Therefore, the

relationship between the purpose pursued in life and self-consciousness needs to be maintained by an active attitude, in order to enhance the sense of self-control and improve life simultaneously [22]. Engrossed participation and enjoyment are key characteristics of the flow experience [23].

2.2.2. The models and structures

Skill and challenge are two important factors in the experience of flow. Flow occurs when the individual perceives these two factors to be in an optimal and balanced state [24]. Csikszentmihalyi [24] proposed a three-path pattern of flow, which includes anxiety, flow, and boredom, based on the two factors of skill and challenge. When an individual perceives that the challenge exceeds their own skills, they are in a state of high challenge and low skill, resulting in anxiety. Conversely, when an individual's skills surpass the difficulty of the challenge, they will be in a state of boredom. However, when the level of challenge is balanced with the level of skill, the individual's situation triggers the generation of flow, as shown in Figure 1.

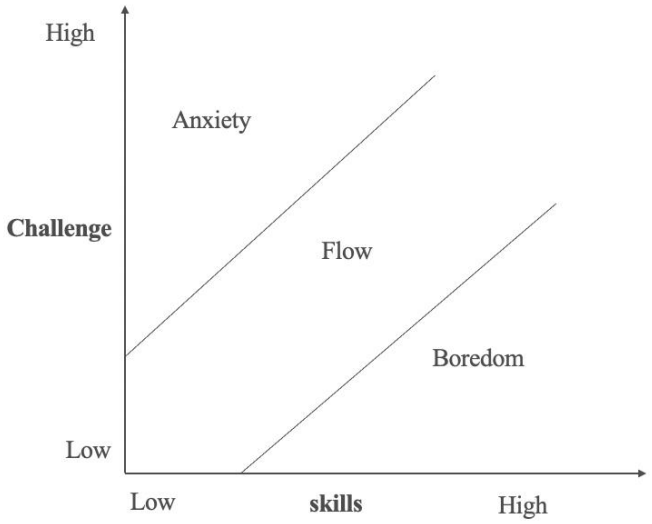

Figure 1. The original model of flow three approaches.
Source: Csikszentmihalyi, M. [24]. Beyond boredom and anxiety: The experience of. play in work and games (pp.197-199). San Francisco, CA: Jossey-Bass.

According to the follow-up research of scholars Massimini and Carli [25], the development process of flow theory does not fully occur when the individual is in a balance between skills and challenges. When the difficulty of the individual's perceived challenges and corresponding skills are lower than those experienced in daily life, the individual's skills cannot be fully utilized, and they will experience a state of apathy and indifference. Wu, Ji, and Jian [26] further elaborated that if individuals perceive their skills cannot be improved for a long time or only stay at a certain level, the goal of the challenge will not be enhanced. Thus, Massimini and Carli [25] corrected the three-path pattern of anxiety, flow, and boredom to a four-path pattern of anxiety, indifference, flow, and boredom, as shown in Figure 2.

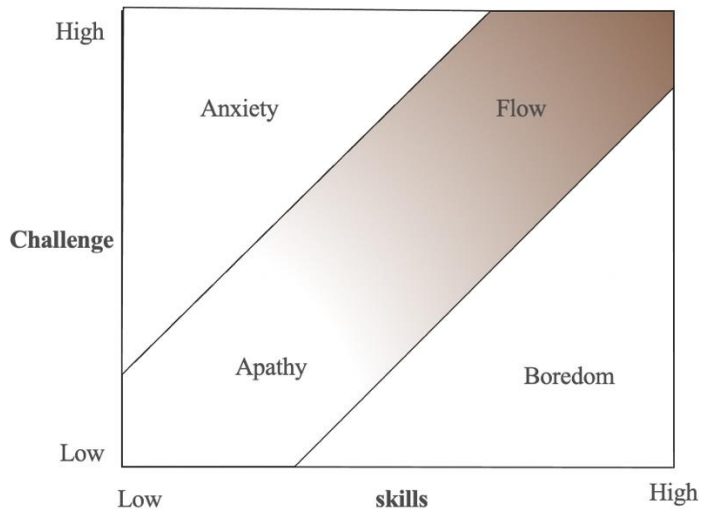

Figure 2. The model of flow four approaches.
Source: Massimini, F., & Carli, M. [25]. Optimal Experience: Psychological studies of flow in consciousness (pp.15-35). Cambridge University Press.

Csikszentmihalyi has also published research on the flow pattern with other scholars, further dividing the four-path model into eight and sixteen path patterns. However, these more complex models essentially do not depart from the spirit of the original four-path model. Based on the four-path model of flow experience, this study examines the flow state of individuals when they are creating or studying professional subjects, and then explores how individuals feel after experiencing flow. According to Jackson and Marsh [27], the study dimension of flow experience consists of nine characteristics:

A. Challenge-skills balance: The individual's flow can only be triggered when their skills are able to meet a high degree of challenge [22].

B. Action-awareness merging: When the participant experiences flow, they enter a state of complete concentration that synchronizes and unites their perception and action.

C. Clear goals: The pursuit of goals can effectively focus individual attention and guide individual action [28].

D. Unambiguous feedback: Immediate feedback allows individuals to know their own performance through the information they receive during the activity, enabling them to think about maintaining or adjusting their current state to promote the next step of action [22].

E. Concentration: The flow experience is characterized by putting aside the unpleasantness of life and replacing it with a complete focus on the activity of the moment [22].

F. Sense of control: When an individual experiences flow, they have a sense of control over their abilities and activities in the moment, and can be prepared to respond to successive situations.

G. Loss of self-conscious: When an individual engages in an activity, they feel fully engaged and integrated with the environment in a state of self-forgetfulness [22].

H. Transformation of time: The individual's perception of the passage of time differs from their usual perception.

I. Autotelic experience: The activity itself is intrinsically rewarding, without any external motivations [29].

After reviewing the literature, it is found that there may be slight differences in the aspects of flow emphasized by different research subjects and activities. However, the majority of respondents described a state of flow during an activity in which they were aware of being focused on the goal and provided continuous feedback on the process. They then continuously adjusted the content of their actions based on this feedback [30]. In this study, most of the concepts from the nine dimensions of flow experience described by Csikszentmihalyi [22] and Jackson and Marsh [27] were used as the basis for the flow experience scale.

2.2.3. The related studies

According to the research of Beese and Martin [31], the flow state is inherently pleasurable. Participants mentioned feelings of slowing down and heightened consciousness. Focus group members shared how they felt during the process of learning art, through teachers giving them challenging tasks that were beyond their current abilities. As Csikszentmihalyi [32] assumed, the best moments often occur when a person's body or mind is stretched to the point where it voluntarily accomplishes something difficult and worthwhile. Regarding the change in the sense of time, music students pointed out that they felt out of consciousness when playing, and did not know how long it had actually been. The research concluded that the complexity of the challenge, the balance of technique, clear goal setting, growth, and feedback can all help improve the experience of flow, as well as enhance intrinsic motivation and sense of achievement. Jackson and Marsh [33] developed a flow state scale to assess the flow state of athletes during exercise. Their findings support the nine characteristics of flow identified by Csikszentmihalyi, and can also be used to understand flow state and its associated factors.

2.3 The Learning Satisfaction

2.3.1. The Definition

Learning satisfaction can be assumed to be a highly predictive factor in determining learning efficiency [34]. Learning is at the core of the academic experience, and understanding the factors that influence learning is important for facilitating positive student learning outcomes [21]. Learning is the process of acquiring knowledge, skills, or behaviors through experience or practice, and making them more lasting [35]. Learning satisfaction refers to the learner's personal inner feelings during the learning process [36]. Through the accumulation of experience, repetitive practice, or the emergence of specific stimuli, students can continue to influence and produce behavioral changes [37]. In summary, the definition of learning satisfaction can be encapsulated as the learner's ability to meet their needs in the learning process, thereby achieving the motivation for learning and continuous learning. In this study, the meaning of learning satisfaction is summarized as the learning process of learners' participation in various professional courses, as well as the learning aspects of creation in

the learning process of technical high school design groups, where they feel varying degrees of recognition and satisfaction.

2.3.2. The dimensions

Bolliger and Martindale [38] argue that in a traditional curriculum, student attributes, the quality of relationships with teachers, teacher curriculum and content, administrative support services, resources and facilities are all factors that affect student satisfaction. The relevant literature suggests that discussing students' learning satisfaction can help teachers improve their teaching methods, and can also increase students' learning effectiveness through the enhancement of campus environment and facilities. After discussion with teachers, this study considered the characteristics and educational goals of students in the design groups of technical high schools. The research aspects of students' learning satisfaction were identified as: teachers' teaching, environmental equipment, learning outcomes, and interpersonal relationships.

A. Teaching: Teachers' consistency in teaching tasks, real-time feedback, and clarity in explanation are the main predictors of student satisfaction, with teachers' feedback being the most important factor in students' perceptual teaching satisfaction [39]. According to Yilmaz et al. [5], teachers' knowledge of the subject area, classroom management skills, and teaching methods are the most obvious influencing factors on students' learning motivation. Teachers are not only facilitators of learning, but also motivators of students [38]. Especially for students in technical high school design groups, the definition of "professional teachers" according to the "Measures for the Selection of Professional and Technical Teachers in Senior Secondary Schools" [40] refers to teachers with practical experience and sufficient professional or technical skills to teach specialized professional or technical subjects. This study aims to explore students' satisfaction with teachers' professional curriculum planning, teaching methods, and content when learning design-related courses.

B. Facility and Environment: According to Costa and Steffgen [21], a modern campus environment and good teaching equipment can improve student learning satisfaction, and through the enhancement of classroom learning satisfaction, student satisfaction with teachers and teaching can be increased. Positive student learning outcomes can also occur when a place is adequately resourced and deployed in an engaging and fun way [41]. The discussion of environmental equipment includes students' software and hardware equipment for campuses and professional classrooms, the layout of learning spaces, and the creation of the curriculum environment, all of which will affect students' learning effectiveness. This study aims to explore students' satisfaction with the hardware and software equipment, as well as the overall learning environment and space provided by the school in the design-related curriculum.

C. Learning Outcomes: Learning is a necessary activity, and most people invest a lot of time in it. Some students gain a sense of accomplishment by helping others, while others are motivated by achieving their desired learning outcomes. However, students with high participation also get greater learning benefits [42]. This study aims to explore students' concepts and cognition of the curriculum, the improvement and performance of their skills, and the application and satisfaction

of their daily life after studying the relevant professional subjects.

D. Interpersonal Relationships: Emotional support and good friendships promote academic success, while peer relationships can also have a negative impact on academic achievement when they are relatively difficult [41]. According to Chen [43], through satisfactory interpersonal relationships, peers can not only learn to help each other, unite and have a sense of honor, but also improve learning satisfaction through the process of mutual cooperation and improvement. This study aims to understand the actual feelings and satisfaction of students in interpersonal relationships such as praise and encouragement, assistance and help, respect and interaction.

2.3.3. The related studies

Topală and Tomozii [44] pointed out that the Students' Learning Satisfaction Questionnaire (SLSQ) contains five components: material conditions and learning equipment, teacher teaching, learning outcomes, learning environment, and peer relationships, which are an effective and reliable measure of student learning satisfaction. Siming, Gao, and Xu [45] noted that student learning satisfaction is highly correlated with teacher-student relationship, teacher teaching readiness, student experience, and campus services and facilities. In the online teaching environment, teacher teaching is the most important factor affecting students' learning satisfaction, and the learning equipment conditions of students, learning fields, and the interactive relationship of online discussions are important conditions to explain learning satisfaction [38].

Based on the literature, it is found that there are many factors influencing students' learning satisfaction, with "teacher teaching" and "interpersonal relationships" being the most significant. Most of the research results also confirm that different variables, curriculum input, perceived teacher teaching, school context, and other factors have an impact on satisfaction. There are quite a lot of research results on learning motivation, flow experience, and learning satisfaction in China, but the number of studies using these three variables to study the students of technical high school design groups as the research object is relatively low.

3. Research Design

3.1 Methods

This study used the survey research method, drawing from the literature and relevant topics, to compile the "Design Group Students' Learning Motivation, Flow Experience and Learning Satisfaction Questionnaire." The survey objects were second and third-grade students of the New Taipei City Technical High School Design Group enrolled in the 2019th and 2020th school years. Descriptive statistical correlation analysis and multiple regression analysis were used to explore the causal relationships among the research variables.

3.2 Framework

The variables in this study include the effects of "learning motivation" and "flow experience" on "learning satisfaction", and the relationship between these variables is shown in Figure 3.

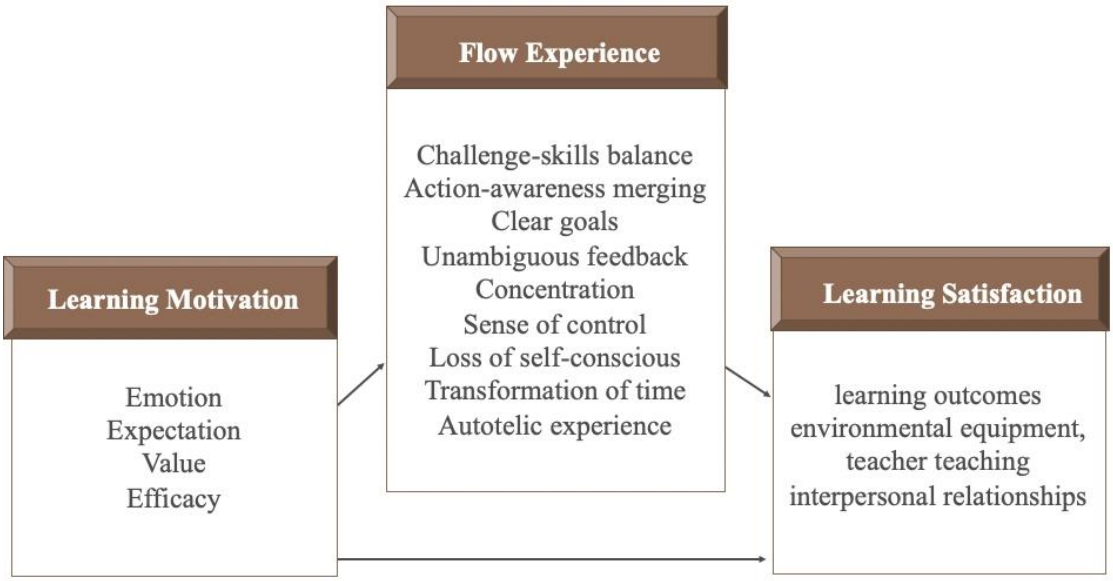

Figure 3. The research framework.

Source: By authors.

3.3 Participants

This study takes the second and third-grade students of the New Taipei City Technical High School Design Group who enrolled in the 2019th and 2020th school years as the target population. The analysis also includes students who have studied in the New Taipei City Technical High School Design Group over the past five years. Currently, there are 8 technical high schools in New Taipei City with design group subjects, including advertising design, multimedia design, art engineering, art and craft, interior space design, and ceramic engineering, for a total of six subjects [46]. According to the enrollment statistics for the 2020th and 2019th academic years, the total enrollment across these six design group subjects in New Taipei City is approximately 2,717 students. This study analyzes the relevant data results obtained through statistical methods for students enrolled in these six design group subjects at the New Taipei City Technical High School during the 2019th and 2020th academic years.

3.3.1. The pilot study

In this study, 1-2 students from each of the three subjects (advertising design, multimedia design, and art engineering) in the second and third-year design groups of a technical high school in New Taipei City were selected using the convenience sampling method. A total of 190 pre-test questionnaires were issued, and 182 were recovered, resulting in a recovery rate of 95%.

3.3.2. The survey

According to the suggestion [47], based on a tolerance margin of less than 5% of the sample, in order to make the sample characteristics closer to the parent population, 322 students need to be sampled when the parent population is 2,000 people, and 341 students need to be sampled when the parent group is 3,000 people. Given that the parent group in this study is approximately 2,717 students,

with a total of 34 classes in the 2019th academic year and 1,345 students, and 34 classes in the 2020th academic year with 1,345 students, a sample size of 543 students, representing about one-fifth of the total, was studied. Hens and Tiwari [48] proposed that according to the concept of stratified proportional sampling, random or systematic sampling can be used in each stratum to reduce the sampling error and improve the representativeness of the sample. The students in the design group enrolled in the 2019th and 2020th academic years were selected according to the proportion of the number of students in each subject at each school. A total of 682 questionnaires were sent out in April 2022, of which 6 schools collected a higher total number of samples than the target sample size, while 2 target schools were not included in the study sample as they were unable to respond within the scheduled period. A total of 645 questionnaires were collected for formal testing, with a recovery rate of 95%. After excluding 86 invalid questionnaires, a total of 559 valid questionnaires were obtained, with an effective recovery rate of 82%. The actual sample recovery is shown in Table 1.

Table 1. The sampling distribution quantities

Name of the school	Sections	A sample of 108 people is expected	A sample of 109 people is expected	Actual 108 people recycled	Actual 109 Number of people recycled
Ger Jyh Senior High School	Dept. of Advertisement Dept. of Multimedia Design	0 4	2 4	0 2	2 2
Fu-Hsin Trade & Arts School	Dept. of Advertisement Dept. of Arts and Crafts	68 98	67 94	68 78	67 69
Ku-Pao Home Economics & Commercial High School	Dept. of Multimedia Design	15	16	25	25
Chih-Kuang Vocational High School of Business & Technology	Dept. of Multimedia Design	9	8	4	4
Neng Ren Home Economic And Commercial Vocational High School	Dept. of Advertisement Dept. of Multimedia Design	3 3	3 4	Not collected within the deadline	
Yu Chang Technical & Commercial Vocational Senior High School	Dept. of Advertisement	5	0	Not collected within the deadline	
New Taipei Municipal Jui-Fang Industrial High School	Dept. of Interior Design	7	7	10	10
New Taipei Municipal Yingge Vocational High School	Dept. of Arts and Crafts Dept. of Ceramic Engineering Dept. of Advertisement	13 21 28	13 22 29	18 49 28	18 51 29
Subtotal of the number of students		274	269	282	277

Source: By authors.

3.4 The Instrument

The scores of each aspect of the questionnaire are based on a Likert five-point scale, with each question divided into five levels: "strongly agree" (5 points), "agree" (4 points), "neutral" (3 points), "disagree" (2 points), and "strongly disagree" (1 point). The higher the score, the more consistent the subject's situation is with the question, and the lower the score, the greater the difference between the subject's description and the question. To ensure the appropriateness of the content validity and the quality of the questionnaire, the investigators submitted the questionnaire to a total of seven experts who assisted in the review.

3.4.1. The learning motivation scale

The self-developed group students' learning motivation scale was based on the learning motivation scale developed by Lai [49,50]. The measurement questionnaire compiled from this scale can arouse students' interest in learning and maintain and strengthen the factors of learning in the learning process.

3.4.2. The flow experience scale

The scale is based on the Flow State Scale (FSS) developed by Jackson and Marsh [28] and the Flow Experience Scale developed by Wang [51]. It explores the nine aspects of the performing arts curriculum in junior high schools, with a total of 36 items, as a measure of the degree to which students are engaged in the learning activity.

3.4.3. The learning satisfaction scale

Referring to various measurement tools, a self-compiled student learning satisfaction scale for the design group was adapted from the Multiple Elective Learning Satisfaction Scale compiled by [52] and the Student Learning Satisfaction Scale compiled by [52]. A total of 20 questions were measured based on four levels: learning outcomes, environmental equipment, teacher teaching, and interpersonal relationships.

3.4.4. The validity and reliability test

The purpose of item analysis is to check the relevance of each item on the students' learning motivation scale. In this study, the decision value (CR value) and the total score of each question were analyzed. The CR value is the decisive value of each question item. After summing up the scores of each item in the pre-test questionnaire, the high group (the top 27%) and the low group (the bottom 27%) were selected according to the score rank. An independent sample t-test was then performed to test the significance of the mean difference between the items in the high group and the low group, which determines the CR value of each item. If the CR value is greater than 3.0 and the significance level (p<.05), the question item is retained. If the item is not significant, it means it is difficult to identify the response degree of each respondent, and it can be deleted [53]. In addition to the CR value, the correlation coefficient between the question and the total score is another criterion for item selection. If the correlation coefficient between the item and the total score reaches a significant level

and is greater than 0.3 (p<.05), the item should be retained. In this study, there were 15 items on the Learning Motivation Scale, 30 items on the Flow Experience Scale, and 15 items on the Learning Satisfaction Scale.

Factor analysis is used to examine and verify the validity of the scale construction. Each scale will be analyzed by items and then by factor analysis. According to Wu and Tu [86], the KMO value of the scale should be above .80, and if the KMO value of the scale is below .60, it is not suitable for factor analysis. The KMO values of the Learning Motivation Scale, Flow Experience Scale, and Learning Satisfaction Scale were 0.932, 0.958, and 0.916, respectively, and the Bartlett's sphericity test of the three scales all reached the .000 significance level, indicating that there were common factors among the items of the three scales, which was suitable for factor analysis. The factor analysis was conducted using the maximum variation method as the oblique axis of rotation, and the eigenvalue of the principal component greater than 1 was used as the retention criterion, as suggested by Wu [54]. Additionally, according to Hair et al. [55], the items with factor loadings greater than .50 were retained.

The learning motivation scale had 15 items, and the reliability coefficient values were .879, .847, .900, and .881, respectively, with a total Cronbach's α of .955. The original quantitative scale had four main components, and the total cumulative explanation variance was 78.449%, indicating that the items of each factor had good explanatory power. However, after the initial factor analysis, the factor loadings were different from the original planned scale, so a second factor analysis was conducted to extract three main components. After the second factor analysis, the total explanatory variance was 73.837%, and the 12th question was deleted because the factor loadings on factors 1 and 3 were similar. The remaining 14 items showed that the KMO value of the scale was .931, the Bartlett's sphericity test was significant at .000, and the total explanatory variance was 74.92%. The factor loadings reached the standard, and the scale demonstrated good construct reliability. All 14 questions were retained as the final questionnaire.

The flow experience scale had 30 items, and the reliability coefficient values were .903, .879, .862, .942, .822, .898, .794, .878, and .943, with a total Cronbach's α of .980. The total cumulative explanation variance was 78.721%, indicating that the items of each factor had good explanatory power. However, the factor loadings of the items differed from the original plan: Questions 3, 12, 14, 18, 20, 23, 27, and 30 were deleted because the factor loadings on multiple factors were similar. Questions 1, 2, 19, and 20 were also deleted because the number of questions was too few to constitute a single factor. Using the Flow Experience Scale developed by Jackson and Marsh [28] and the scale compiled by Wang [56] with nine levels as the main axis, a total of 17 questions at four levels were reconstructed and extracted according to the results of the factor analysis. The KMO value of the scale was .955, the Bartlett's sphericity test was significant at .000, and the total explanatory variance was 80.449%. The factor loadings were satisfactory and met the standard, indicating good construct reliability. All 17 questions were retained as the final questionnaire.

The learning satisfaction scale had 15 items, and the reliability coefficients for each level ranged from .875 to .932, with a total Cronbach's α of .951. To assess the reliability and stability of the scale,

Cronbach's α values were used as a reference. According to Devellis [57], Cronbach's α values above .90 are considered excellent, between .90 and .80 are very good, .80 to .70 are good, and .70 to .65 are the lowest acceptable range.

3.4.4. The questionnaire

The survey items and dimensions were listed in Table 2.

Table 2. The items and dimensions of developed questionnaire

Factors	Dimensions	Item No. of pre-test	Item No. of the survey	Cronbach's α
Learning Motivation	Emotional responses	1,2,3,4	1,2,3,4	.955
	Expected value	5,6,7,9	5,6,7,8	
	Self-efficacy	8,10,11,13,14,15	9,10,11,12,13,14	
Flow Experience	Focus on action and goal recognition	6,7,8,15	1,2,3,4	.980
	Unity of knowledge and action and effective control	4,16,17,18	5,6,7,8	
	Immediate feedback and clarity of ideas	9,10,11,13	9,10,11,12	
	The change and experience of the sense of time	21,24,25,26,29	13,14,15,16,17	
Learning Satisfaction	Learning Outcomes	1,2,3,4	1,2,3,4	.951
	Environmental Facilities	5,6,7,8	5,6,7,8	
	Teachers teach	9,10,11,12	9,10,11,12	
	interpersonal relationship	13,14,15	13,14,15	

Source: By authors.

3.4 The Ethics

As a researcher, it is the responsibility to report and present the research results truthfully, without fabricating data or figures. The discussion should be limited to the content of the data, and the conclusions should be drawn accordingly, to avoid misuse of the research findings [58]. In this study, the data will be presented truthfully based on the aggregated information, without fabricating or falsifying the data due to failure to achieve expected results. The original files, such as questionnaires, will be properly stored and maintained.

4. Results and Discussion

4.1 The Demographic Variables

Among the 559 participants, 68.9% were female and 31.1% were male. A total of 282 (50.4%) were in their second year, and 277 (49.6%) were in their third year. The academic majors were distributed as follows: Dept. of Advertisement (36.9%), Dept. of Ceramic Engineering (24.2%), Dept. of Interior Design (17.9%), Dept. of Multimedia Design (11.1%), and Dept. of Arts and Crafts (6.4%), with the smallest proportion being 3.6%. In the past year, 278 (49.7%) participants had participated in 1-3 competitions, 40 (7.2%) had participated in more than 4 related design competitions, and 241 (43.1%) had no competition experience. Regarding the participants' family backgrounds, 83.9% of

the students' family members were not engaged in design-related work, while only 16.1% of the students' family members were employed in design-related fields.

4.2 The Correlation between Variables

The three levels of learning motivation were highly and positively correlated with the four levels of flow experience, with a significant correlation coefficient of r = .893. This indicates that higher levels of learning motivation were associated with greater perceived flow experience, while lower levels of learning motivation were associated with lower perceived flow experience, as shown in Table 3.

Table 3. The correlation between variables (n=559)

Factors	Dimensions	Learning Motivation		
		Emotional responses	Expected value	Self-efficacy
Flow Experiences	Focus on action and goal recognition	.813***	.716***	.827***
	Unity of knowledge and action and effective control	.696***	.723***	.819***
	Immediate feedback and clarity of ideas	.706***	.683***	.746***
	The change and experience of the sense of time	.753***	.669***	.749***
Learning Satisfaction	Learning Outcomes	.811***	.666***	.819***
	Environmental Facilities	.510***	.461***	.550***
	Teachers teach	.597***	.570***	.615***
	interpersonal relationship	.635***	.574***	.646***

Source: By authors.

There was a moderate positive correlation between the four levels of flow experience and the four levels of learning satisfaction (r = .791). This indicates that students with higher levels of flow experience were more likely to perceive higher levels of learning satisfaction, while conversely, lower levels of flow experience were associated with lower levels of learning satisfaction, as shown in Table 4.

Table 4. The correlation between learning satisfaction and flow experience (n=559)

Factors	Dimensions	Learning Satisfaction			
		Learning Outcomes	Environmental Facilities	Teachers teach	Interpersonal relationship
Flow Experiences	Focus on action and goal recognition	.817***	.524***	.584***	.626***
	Unity of knowledge and action and effective control	.721***	.535***	.556***	.605***
	Immediate feedback and clarity of ideas	.744***	.496***	.565***	.605***
	The change and experience of the sense of time	.756***	.530***	.574***	.606***

Source: By authors.

4.3 The Test of Hypothesis Model

According to Baron and Kenny [59], the conditions for establishing a mediated variable must meet three tests: (1) the independent variable can explain the mediator variable, (2) the mediator variable can explain the dependent variable, and (3) when controlling for the first two explanatory conditions, the relationship between the independent variable and the dependent variable becomes insignificant. If these conditions are met, the hypothesis of the mediated variable is valid. If the addition of a mediator variable can only explain part of the effect, it is called partial mediation. If the relationship between the independent variable and the dependent variable becomes insignificant after adding the mediator variable, it is called complete mediation. In this study, learning motivation and flow experience had a significant effect ($\beta = 0.893$, $p < .001$), with an explanatory power of $R^2 = .797$. Flow experience and learning satisfaction also had a significant effect ($\beta = 0.791$, $p < .001$), with an explanatory power of $R^2 = .628$, as shown in Figure 4.

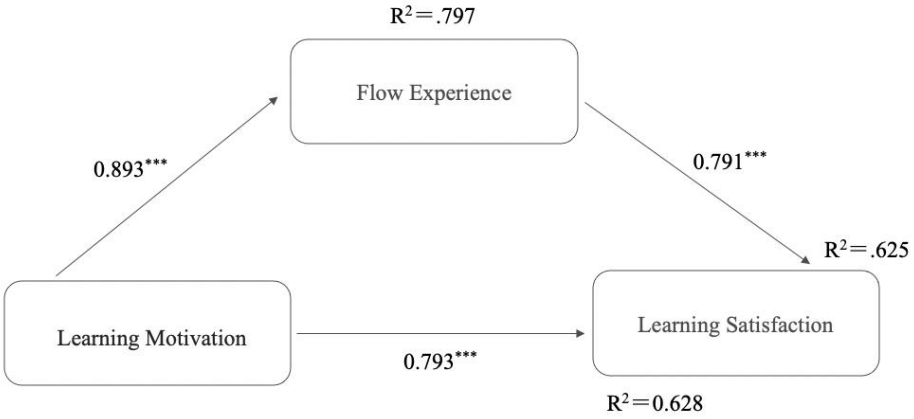

Figure 4. The research framework.
Source: By authors.

After analysis, it was found that in the first stage, learning motivation accounted for 62.8% of the variance in learning satisfaction ($R^2 = .628$), indicating that learning motivation had a 62.8% predictive power for learning satisfaction. The regression coefficient of learning motivation on learning satisfaction was $\beta = 0.793$ ($p < .001$). In the second stage, the addition of the flow experience variable increased the explained variance in learning satisfaction by 3.4% ($R^2 = .662$). The standardized regression coefficient of learning motivation decreased to $\beta = 0.428$ ($p < .001$). This indicates that flow experience had a partial mediating effect on the relationship between learning motivation and learning satisfaction, as shown in Table 5.

In summary, the direct effect of learning motivation on learning satisfaction was weakened when both learning motivation and flow experience were included in the regression analysis. This indicates that flow experience had a significant mediating effect on the relationship between learning motivation and learning satisfaction. This result is consistent with the findings of Chu, He, Zeng, and

Xu [60], which suggests that learning motivation has a positive impact on learning satisfaction. Specifically, higher levels of perceived learning motivation facilitate the generation of flow experience, which in turn improves learning satisfaction.

Table 5. The summary of standardized regression analysis coefficients (n=559)

	Factors	R	R^2	Adjusted R^2	F values	(b)	Beta(β)
1	Learning Motivation	.793	.628	.628	942.166***	.810	.793***
2	Learning Motivation	.814	.662	.661	545.421***	.437	.428***
	Flow Experience					.402	.409***

Source: By authors.

In summary, the direct effect of learning motivation on learning satisfaction was weakened when both learning motivation and flow experience were included in the regression analysis. This indicates that flow experience had a significant mediating effect on the relationship between learning motivation and learning satisfaction. This result is consistent with the findings of Chu, He, Zeng, and Xu [60], which suggest that learning motivation has a positive impact on learning satisfaction. Specifically, higher levels of perceived learning motivation facilitate the generation of flow experience, which in turn improves learning satisfaction.

5. Conclusions

According to the results of this study, there was a positive and significant correlation among the three variables of learning motivation, flow experience, and learning satisfaction. Furthermore, flow experience was found to have a partial mediating effect on the relationship between learning motivation and learning satisfaction.

This indicates that stronger learning motivation among students in design-related majors is associated with higher motivation for learning and creation, more frequent flow experience, and increased satisfaction with learning design and creation. In other words, learning motivation is an important factor in the production of flow experience, and the improvement of flow experience also helps to increase learning satisfaction.

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