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Influence of Anxiety and Learning Motivation on Course Satisfaction among Chinese Junior Middle School Students

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Abstract The anxiety in education is becoming increasingly prominent, yet specific research on the relationship between anxiety, motivation, and course satisfaction is limited. Given the critical roles these three factors play in student learning, the researchers employed a quantitative research method using a sample of 429 middle school students from Chongqing, China, and analyzed the data using SPSS, Mplus, and R. The study aims to explore the impact of anxiety on course satisfaction and the mediating role of motivation in this relationship, with a focus on the mediating effects of various dimensions of learning motivation, such as learning interest and learning goals. The results show that anxiety has a significant negative direct effect on course satisfaction ($r = -0.223$, $p < 0.001$), and it also has a complex indirect effect through learning motivation. Specifically, learning interest plays the most crucial mediating role ($r = 0.500$, $p < 0.001$), with higher levels of anxiety reducing students' learning interest, thereby lowering course satisfaction. In contrast, moderate anxiety can stimulate learning interest and enhance the clarity of learning goals, thus improving course satisfaction. Therefore, teachers should create a relaxed learning environment, reduce academic pressure, employ diverse teaching methods, help students clarify learning plans, guide them through phased tasks, assist in goal management, and timely address students' anxiety. This will help improve goal clarity and learning interest, enhancing students' course satisfaction and overall learning experience. This study fills a gap in existing literature, provides strategic guidance for educators to improve students' learning experiences, offers insights for student self-reflection, and contributes to the improvement of teaching ecology and the sustainable development of students' learning and psychological well-being.

Keywords Anxiety, Curriculum and Instruction, Information and Technology Outcomes, STEM

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1. Introduction

Anxiety in social competition is one of the most prominent and common emotions that affect mental health (Liu & Huang, 2011). There has been a substantial amount of research on the correlation between anxiety, motivation, and satisfaction, but studies specifically exploring the relationship between anxiety, motivation, and course satisfaction are nearly nonexistent, especially in the field of education. Previous studies often focus on other factors such as control (Rubin, 1993), online courses (Dirzyte et al., 2021), learning tools (Yu, 2024), and optimism, which affect anxiety, motivation, and course satisfaction. Some studies examine the relationships between specific variables, such as anxiety and course satisfaction (Azizi et al., 2022), anxiety and motivation, or motivation and course satisfaction (Goulímaris, 2015). Earlier research on anxiety, course satisfaction, and motivation has found that these factors significantly influence students' self-regulated learning, mental health, and academic performance. Given the importance of learning motivation, anxiety, and course satisfaction, there are clear limitations in the current research, prompting the need for further studies that examine the interplay among these three variables.

This study adopts a quantitative research method to explore the level and correlation between students' anxiety, learning motivation and course satisfaction, and determine the degree of correlation. In the quantitative research part, the researchers used IBM SPSS Statistics 27 to test the reliability and validity of the questionnaire; used R software to analyze the difficulty and discrimination of the questionnaire questions; used Mplus software to perform structural equation modeling, and analyzed the causal and mediating relationships between students' anxiety, learning motivation, and course satisfaction.

This study aims to understand the correlation between students' anxiety level, learning motivation and course satisfaction, and determine the degree of correlation. Specifically, this study aims to determine the relationship between students' anxiety level and course satisfaction; explore the components of learning motivation; and the mediating effect of learning motivation between anxiety and course satisfaction of middle school students. This study helps fill the research gap and also provides a reference for policy makers, educators, parents, and students to jointly understand the psychological and behavioral patterns of students in academic environments, thereby improving course satisfaction and promoting teaching implementation.

1.1. Conceptual framework for student learning

Bandura (1991) believes that human behavior, environment and individual cognitive factors interact with each other, among which self-efficacy is one of the core variables affecting motivation. Anxiety can reduce students' self-efficacy, leading to lack of motivation, which in turn has a negative impact on course satisfaction (Bandura, 1997). This theory emphasizes the role of anxiety on motivation and course satisfaction through self-efficacy, and points out that external feedback in the learning environment can affect students' motivation. The expectancy-value theory was proposed by Eccles and Wigfield (2002). The theory believes that an individual's expectations of tasks and perceptions of task value jointly determine their motivation. Anxiety may weaken students' expectations and value judgments of learning tasks, and more anxious students tend to think that the course is less valuable, thus affecting their motivation level and course satisfaction (Wigfield et al., 2020). The expectancy-value theory explains the role of anxiety between motivation and satisfaction from the perspective of value cognition. Motivation is a function of expectations and perceived value of success, and self-efficacy is the primary driving force of motivated behavior (Cook & Artino, 2016). Self-determination theory divides motivation into intrinsic motivation and extrinsic motivation. Intrinsic motivation refers to behaviors that individuals actively participate in because of interest or pleasure, while extrinsic motivation comes from external rewards or pressure (Deci & Ryan, 2013). The theory holds that optimal performance is generated by actions driven by integrated and internalized intrinsic interests or external values. This motivation is generated by satisfying basic social psychological needs such as autonomy, competence, and relevance (Cook & Artino, 2016). In educational contexts, if students feel autonomy, competence, and experience a good sense of social relationships in learning, they will show stronger intrinsic motivation for learning, thereby improving their satisfaction with the course (Ryan & Deci, 2017). Anxiety can weaken students' autonomy and sense of competence, leading to a decline in intrinsic motivation. This theory provides theoretical support for understanding how anxiety affects course satisfaction through learning motivation.

1.2. Anxiety, learning motivation, course satisfaction, and their correlation

Previous studies have found many correlations. For example, in the relationship between anxiety and learning goals, mastery goals and approach performance goals are negatively correlated with anxiety, and avoidance performance

goals are positively correlated with anxiety (Song et al., 2015). Regarding the relationship between anxiety and learning interest, previous studies have consistently found that anxiety is negatively correlated with learning interest (Hong et al., 2017; Du et al., 2021; Zhou et al., 2022). Course satisfaction is significantly correlated with learning motivation (Yilmaz, 2017; Pinanos et al., 2022; Lu, G et al., 2023; Amoozegar et al., 2024). Differences in anxiety levels based on gender were found (Ahmetovic et al., 2020).

It also reveals many suggested methods, such as we can guide students to improve their goal orientation and take learning as the goal orientation (Sánchez-Cardona et al., 2021). Or by using the prediction-observation-explanation (POE) model technology to enhance learning (Hong et al., 2017), improve teaching strategies and focus on CT standard operating procedures for teaching (Chang et al., 2024) and other methods to enhance students' learning interest and motivation, reduce students' anxiety, help students establish correct goal orientation, improve students' course satisfaction, and promote sustainable development of teaching and learning.

However, there are large differences in many research results. For example, there is controversy over whether anxiety and learning motivation are positively correlated. Some support (Liu & Du, 2024), some oppose (Liu & Huang, 2011; Ahmetovic et al., 2020), and some partially support (Chang et al. 2024). In terms of the relationship between anxiety and satisfaction, although researchers unanimously agree that course satisfaction is negatively correlated with anxiety (Schroeder, 2002; Sun et al., 2008; Abdous, 2019; Kim et al., 2021), there is still controversy over whether the correlation is significant.

Previous related studies have only partially studied the correlation between ‘anxiety, motivation, and course satisfaction’, and there has been almost no research on the correlation between ‘course satisfaction and learning interest’, ‘anxiety, learning interest, course satisfaction’, and ‘anxiety, course satisfaction, and learning goals’.

The research on ‘anxiety, motivation, and course satisfaction’ is still insufficient in many aspects. However, anxiety, motivation, and course satisfaction are very important (Liu & Huang, 2011; Strelan et al., 2020; Kenwood et al., 2022; Ali et al., 2023). In view of the limitations of previous studies, the researchers conducted this study.

1.2.1. Anxiety, learning motivation and course satisfaction

Lack of motivation was the biggest predictor of anxiety, and lack of motivation was strongly negatively correlated with anxiety. The experience of stress affects students’ motivation and course satisfaction (Gibbons, 2023). Motivation and anxiety are critical to satisfaction. When high-anxiety learners used mobile AR tools to learn, the group using augmented reality (AR) had higher motivation, lower anxiety, higher satisfaction, and better outcomes than the group not using AR (Chen, 2019).

1.2.1.1. Anxiety

Anxiety is one of the most prominent and common emotions (Liu & Huang, 2011). For most people, negative life events are often accompanied by anxiety. For example, when the epidemic broke out, mental health problems increased sharply, and anxiety cases increased by 25.6%, while they were on a downward trend before and after the epidemic. This is an acute response to unexpected and unknown new crises (Daly & Robinson, 2022).

Some researchers believe that anxiety is experienced in response to uncertain threats, which involve changes in a person's subjective state and behavior. Although anxiety is generally adaptive, when it is excessive and unregulated, it can lead to distress and avoidance of potential threats (Kenwood et al., 2022). People with personality anxiety overestimate the threat and fear of social evaluation. Over time, anxiety and avoidance will continue to deepen. They avoid socializing and may develop specific behaviors or obsessive-compulsive disorders, social anxiety disorder, and thus serious mental health problems (Knowles et al., 2020). Some researchers have found that students have moderate anxiety levels during online English classes, including high communication anxiety, test anxiety, fear of negative evaluation, etc. There is no significant difference in anxiety between male and female students (Apridayani et al., 2023). Students' mental health problems are becoming more and more common. In today's student-centered era, it is increasingly important to pay attention to students' anxiety, learning motivation, interest, course satisfaction, etc.

Some researchers have also found the impact of other factors on anxiety, such as a significant negative correlation between anxiety and optimism, and that students with severe anxiety have lower teaching response/effectiveness to COVID-19 (Biber et al., 2020). Academic support from parents and teachers can enhance performance goals, especially performance avoidance goals, thereby increasing test anxiety. Parental emotional support is conducive to

alleviating anxiety, and peer support can help reduce the impact of performance avoidance goals and indirectly alleviate test anxiety (Song et al., 2015).

1.2.1.2. Learning motivation

Motivation is a core element of teaching, which drives learners to achieve their learning goals. Learning success depends on whether learners are motivated to learn, and motivation drives learners to achieve their learning goals (Filgona et al., 2020). Motivation is defined as the process of initiating and maintaining goal-oriented activities. Goal-oriented theory suggests that learners' motivation tends to be engaged in tasks, master content (mastery goals) or do better than others or avoid failure (performance goals) (Cook & Artino, 2016).

In this study, the researchers measured students' learning motivation through four aspects: strong learning motivation, weak learning motivation, learning interest, and learning goals. Here, the researchers will mainly analyze from three aspects: learning motivation, learning interest, and learning goals.

The first is learning motivation. Motivation drives most human activities and is affected by a variety of internal and external factors [Ali et al., 2023). Compared with internal factors, external motivation contributes more to students' learning motivation. Giving students appropriate rewards or punishments and the teaching quality of lecturers are two main factors that improve students' learning motivation (Pranawengtias, 2022). Changing the form of learning can also affect motivation. For example, compared with traditional teaching, digital teaching has a significant positive effect on learning motivation and learning outcomes (Lin, M. H et al., 2017).

The second is learning interest. Interest plays a very important role in learning. It will bring motivation to learn and improve learning outcomes (Sutarto et al., 2020). Intrinsic motivation for learning is indirectly and positively related to academic performance through classroom participation (Froiland & Worrell, 2016). Lack of interest in learning is not conducive to students completing learning tasks. Many parents hope that there will be more interactive learning between students and teachers to increase students' interest in learning (Lau et al., 2021). The development of diverse technology-assisted learning media can also improve students' interest in learning.

For example, Vascak physics animation media provides visual animations and virtual physics laboratories for students to conduct simulation experiments, which is conducive to students' practice and review (Syifa, & Mastul, 2023. For example, VR self-efficacy is positively correlated with VR learning interest and negatively correlated with anxiety. The higher the self-efficacy of learners using VR, the higher their interest in learning using the VR system, and the stronger the sense of immersion generated by using VR (Tai et al., 2022).

Finally, there are learning goals. There is a positive correlation between learning goals and academic performance (Froiland & Worrell, 2016). People with high self-regulated learning (SRL) ability are able to plan, manage, and control their learning process, thereby accelerating their learning progress. Goal setting and strategic planning both fully predict the achievement of learning goals, while low goal achievement rates are related to seeking help (Kizilcec et al., 2017). Bloom emphasizes learning goals of high-level cognitive skills. Teachers can use Bloom's taxonomy to write learning goals to encourage students to learn in depth and apply knowledge and skills to more areas (Adams, 2015).

1.2.1.3. Course satisfaction

Students' evaluations will affect the absorption of new educational methods, so course satisfaction is an important factor (Strelan et al., 2020). In the past, most evaluations of course satisfaction were teaching-oriented, which was prone to problems. However, through a dialogue-based approach, evaluation is conducted with students' learning orientation, and students are allowed to participate in discussions, so that students' course satisfaction can be better measured and more conducive to improving teaching and learning. (Borch, 2020). Related studies have shown that the course satisfaction of students of different grades has different manifestations. There is no significant difference in satisfaction with teachers, but there is a significant difference in course satisfaction with course content and learning outcomes, and second-year students are more satisfied (Aherne et al., 2016. Other studies have shown that flipped classrooms have a positive impact on students' course satisfaction (Strelan et al., 2020). Students' learning style is closely related to the learning method of online participation, and the learning method of online participation is closely related to students' course satisfaction. Therefore, social interaction is also important for improving students' course satisfaction (Cheng & Chau, 2016). In addition to students, pre-service teachers are also very

satisfied with online courses (flipped classrooms) (İlic, 2021). Therefore, teachers can consider the innovation of teaching methods and teaching forms in the implementation of courses to improve students' course satisfaction.

1.2.2. Anxiety and course satisfaction

Some researchers believe that course satisfaction is significantly negatively correlated with anxiety (Kim et al., 2021). Schroeder (2002) also proved this point after the skill training of the course, which showed that students' satisfaction increased and anxiety decreased. Other studies believe that learners' anxiety about computers, the quality of online learning courses, perceived usefulness, and the diversity of evaluation are key factors affecting course satisfaction. He also agrees that anxiety is significantly negatively correlated with course satisfaction (Sun et al., 2008). Abdous (2019) believes that anxiety is closely related to course satisfaction, but in terms of significance, he believes that the correlation between the two is not significant. He also emphasized that age and satisfaction with online learning do not predict online students' anxiety, but gender does.

1.2.3. Learning motivation and course satisfaction

Many previous studies have found the correlation between learning motivation and course satisfaction, and the correlation between learning goals and course satisfaction, but there is almost no research on the correlation between learning interest and course satisfaction.

Many researchers believe that there is a strong and significant relationship between course satisfaction and learning motivation level (Yilmaz, 2017; Pinanos et al., 2022; Amoozegar et al., 2024). Previous related studies have also confirmed that the distance between seats and the center point can predict students' contextual participation in smart classrooms, and autonomous motivation at the beginning of the course can strongly predict students' contextual participation in subsequent activities. Contextual participation is an important predictor of student course satisfaction and fully mediates the correlation between autonomous motivation and satisfaction (Lu et al., 2023). Student satisfaction and its sub-dimensions "communication and availability", "teaching process", "teaching content" and "interaction and evaluation" are important predictors of student engagement and motivation (Karaoğlan, 2022). Student motivation explains a small part of the difference in grades, while student motivation explains a large part of the difference in satisfaction (Cho & Heron, 2015). Motivation is an important predictor of course satisfaction, but not anxiety. Academic optimism can significantly predict anxiety (Zong et al., 2021).

It is worth noting that in the practice of promoting motivation and student course satisfaction, although gamification, the application of game elements to non-game environments, has become increasingly popular as a way to increase student class engagement. However, some common mechanisms used in classroom gamification, such as competitive environments, badges, and leaderboards, can also have a negative impact on student motivation levels and course satisfaction, so the use of certain gamification mechanisms in educational settings should be considered with caution (Hanus & Fox, 2015).

Previous studies have also found that students' course satisfaction depends on the degree of match between students' self-motivation and learning goals, emphasizing the core role of learning goals. When students' course experience is consistent with their learning goals, course satisfaction will be higher; if the course experience does not meet students' learning goals, course satisfaction will be lower (Landrum & Rhame, 2021). Researchers believe that goal orientation is directly related to course satisfaction and student performance. Students with goal-oriented learning can continue to work hard, thereby improving course satisfaction and academic performance. Therefore, students' course satisfaction can be improved by improving their psychological factors (Sánchez-Cardona et al., 2021).

1.2.4. Anxiety and learning motivation

1.2.4.1. The relationship between anxiety and learning motivation

Some researchers believe that learning motivation is significantly positively correlated with anxiety, and anxiety and learning motivation can significantly predict academic performance (Liu & Du, 2024). However, some researchers refuted this view and believed that anxiety is significantly negatively correlated with learning motivation. But they all affirmed the significant correlation between anxiety and student performance. Liu and Huang (2011) believed that classroom anxiety, intrinsic motivation, instrumental motivation, fear of being negatively evaluated, and interest in the course are all strong predictors of student performance. Most students have moderate or strong motivation and

interest in learning English because they can interact with people from multiple cultures. Anxiety is the strongest and most negative predictor of student performance. This suggests that teachers and students need to take measures to alleviate anxiety levels. As learning motivation increases, students will be more active in using English in various situations, which may reduce students' learning anxiety. Different from their views, some researchers believe that some learning motivation is positively correlated with anxiety and some learning motivation is negatively correlated with anxiety. He believes that motivation is divided into intrinsic motivation and extrinsic motivation, intrinsic motivation is negatively correlated with anxiety, and extrinsic motivation is significantly positively correlated with classroom anxiety. In terms of gender differences, he believes that there is not much difference in motivation between men and women, but anxiety is seriously affected by gender, and the important factor affecting students' performance should be intrinsic motivation. He also mentioned the important role of anxiety, which is negatively correlated with students' performance (Ahmetovic et al., 2020).

Some studies on the correlation between anxiety and learning motivation support the research hypothesis H1 of this study, some oppose the research hypothesis H1 of this study, and some partially support the research hypothesis H1. This reveals the complex relationship between anxiety and learning motivation and also provides the necessity of this study. But they all unanimously emphasize that improving learning motivation and reducing learning anxiety are conducive to improving learning outcomes. In terms of specific practices, Chang et al. (2024) believe that it can be carried out through CT-centered teaching. The standard operating procedure of CT contains five training steps: finding problems, formulating steps to solve problems, organizing summaries, drawing flowcharts, and writing programs. Compared with group learning through traditional teaching, it can clearly explain the logical sequence, improve learning motivation, reduce learning anxiety, and thus improve learning outcomes.

1.2.4.2. The relationship between anxiety and learning interests

Previous related studies tend to be more theoretical rather than empirical. But they all agree that anxiety is negatively correlated with learning interest. For example, Zhou et al. (2022) believe that anxiety is negatively correlated with learning interest. Students who use smartphones inappropriately have higher anxiety, lower learning interest and math scores, and boys have more problems than girls. Anxiety and learning interest, smartphone use and math scores play a mediating role. Standardizing students' use of smartphones, alleviating their math anxiety, and increasing their interest in math may improve their math scores. Du et al. (2021) believe that math anxiety and self-efficacy can predict students' future learning interest. Hong et al. (2017) believe that students with higher learning interest have lower cognitive anxiety. In terms of promoting learning efficiency and reducing anxiety, he designed a scientific inquiry learning model, the prediction-observation-explanation (POE) model. Enhancing learning through the use of technology can motivate students to learn.

1.2.4.3. The relationship between anxiety and learning goals

Song et al. (2015) found that mastery goals focus on the process rather than the results, and are negatively correlated with test anxiety. Approach performance goals focus on getting better grades than others, which is positively correlated with motivation and negatively correlated with anxiety. Avoidance performance goals focus on avoiding performing worse than others, which is positively correlated with anxiety.

1.3. The current study

Improvements in anxiety and motivation are expected to make learning more effective for students, especially those with a background in information technology (Goulímaris, 2015; Azizi et al., 2022; Kenwood et al., 2022). However, past studies have produced mixed results on the relationship between anxiety, motivation, and course satisfaction (Abdous, 2019; Ahmetovic et al., 2020; Liu & Du, 2024). Nonetheless, these studies have tested the correlation between anxiety, motivation, and course satisfaction. To address this shortcoming, this research aims to access the level and correlation between students' anxiety, learning motivation and their course satisfaction and determine the degree of correlation. Specifically, the study aims to determine the relationship between students' anxiety level, learning motivation and course satisfaction; assess the impact of anxiety level on junior middle school students' course satisfaction through their learning motivation; identify the differences in anxiety level and learning motivation among junior middle school students in terms of genders. The guiding theoretical framework of the study is shown in Figure1.

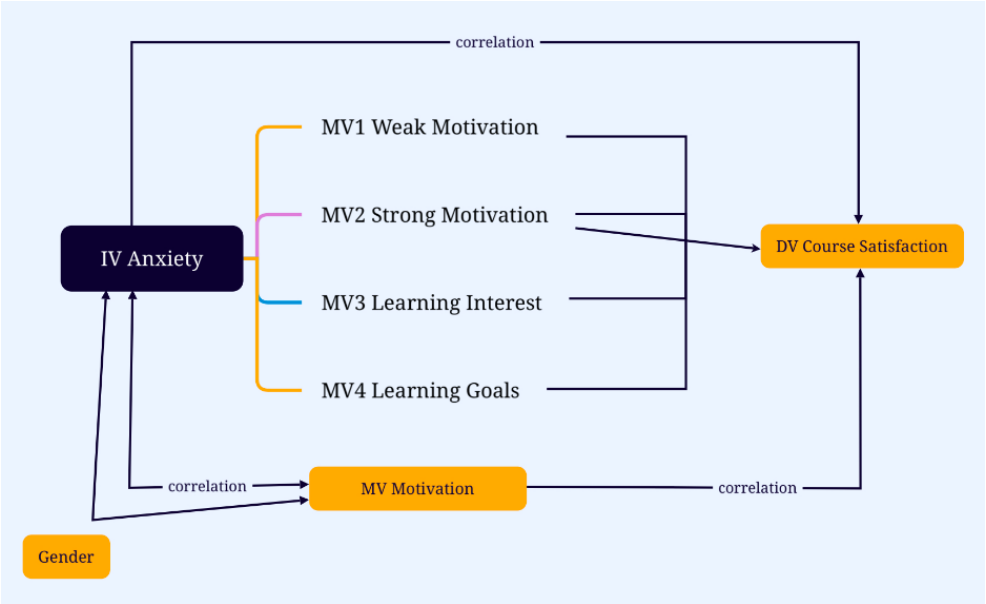

Figure 1 : Theoretical Framework

2. Method

2.1. Sample

The target population of this study is 1.0875 million junior high school students in Chongqing, China (Chongqing Municipal Bureau of Statistics & Chongqing Survey Team of National Bureau of Statistics, 2023). In order to select a universal and representative sample, this study used a random sampling design based on the Yamane formula, $n = N/(1+N*e^2)$. The researchers selected 454 seventh-grade students of different genders and family backgrounds from Tongnan District, Yongchuan District and Bishan District of Chongqing, deleted 25 repeated or extreme answers, and left 429 valid samples for this study.

2.2. Variables

In this study, the independent variable IV is student anxiety, the intermediate variables MV1-MV4 are learning motivation (divided into four dimensions: weak learning motivation, strong learning motivation, learning interest, and learning goals), and the dependent variable is course satisfaction, and gender and whether or not the child is an only child are covariates.

2.3. Measure

In the qualitative research part, the researchers conducted a literature review of studies related to anxiety, learning motivation, and course satisfaction in the past decade (2014-2024). The specific steps of literature cleaning, screening criteria, and collection process can be referred to the PRISMA flowchart, and IBM SPSS Statistics 27 was used for result analysis.

In the quantitative research part, international experts from the field of education created and developed these instruments, which were translated back and forth by the researchers and used computer-based tests. This study used the Middle School Student Learning Motivation Scale (MSMT) and the Self-Rating Anxiety Scale (SAS), as well as secondary indicators of course satisfaction, to measure anxiety, learning motivation, and course satisfaction. The researchers used IBM SPSS Statistics 27 to preprocess the data and evaluate the reliability and validity of the questionnaires, and used the Item Response Theory (IRT) model in R software to evaluate the quality of the questionnaires. This section summarizes the testing of the instruments.

2.3.1. Anxiety

The anxiety scale has 20 items (1-4 points), of which items 5, 9, 13, 17, and 19 are reverse test questions. The researchers used IBM SPSS Statistics 27 to reverse score items 5, 9, 13, 17, and 19 for specific items, changing 1 point to 4 points, 2 points to 3 points, and so on. The 20 items in the anxiety scale were used as independent variables (IV), the four aspects of learning motivation were used as mediating variables (MV1-MV4), and course satisfaction was used as the dependent variable (DV). The variables were named and constructed, and the anxiety scale was tested for reliability and validity.

Reliability analysis showed that Cronbach's Alpha was 0.776, indicating good internal consistency. The validity KMO value was 0.891, indicating that the sample was suitable for SEM analysis. Bartlett's sphericity test showed that the chi-square value was 2516.160 and the p value was 0.000 (<0.05), indicating that there was a significant correlation between the variables and that it was suitable for SEM analysis.

2.3.2. Learning motivation and course satisfaction

The measurement quality of the mediating variable (learning motivation) and the dependent variable (course satisfaction) was evaluated using the Item Response Theory (IRT) model in R. The learning motivation scale uses four variables, achievement goals, academic self-efficacy, academic attribution, and achievement motivation, as measurement indicators of learning motivation. The scale is divided into four subscales: weak motivation, strong motivation, learning interest, and learning goals. Each subscale consists of five binary questions (yes/no). Course satisfaction is measured with a single binary item (yes/no).

The researchers analyzed the difficulty and discrimination of the questions to ensure the validity of the questionnaire. The results showed that most of the questions under the learning motivation item showed a certain degree of discrimination. The discrimination values (a) of some questions were positive and relatively high, such as MV1_2 (0.488), MV1_5 (0.577), MV4_4 (0.436), and MV4_5 (0.480); the discrimination values of some questions were low but positive, such as MV3_3 (0.296); the discrimination values of some questions were very low, close to zero, indicating limited discrimination ability, such as MV1_4 (0.069), MV2_4 (0.002), and MV3_4 (0.016); the discrimination values of some questions were negative, indicating that the discrimination was weak and might affect the validity of the model, such as MV1_1 (-0.686) and MV2_1 (-0.497).

The item difficulty distribution varies, ranging from negative values(easy) to positive values(difficult). Some items are of low difficulty, such as MV1_3 (-1.092), while other items are of high difficulty, indicating different applicability to respondents with different abilities, laying the foundation for the subsequent structural equation model analysis.

2.4 Analysis

This study aims to examine the correlation between anxiety, learning motivation, and satisfaction with information technology courses. Since the mediating variable (i.e., learning motivation) is a latent structure measured by four indicators (i.e., weak learning motivation, strong learning motivation, learning interest, and learning goals), the researchers used Mplus version 8.0 to establish a structural equation model (SEM) to analyze the causal and mediating relationships between anxiety, learning motivation, and course satisfaction. The analysis focuses on how the independent variable (IV), anxiety, directly and indirectly affects course satisfaction through the four dimensions of the mediating variable, learning motivation.

The indirect effects are calculated by multiplying the path coefficients along the paths connecting the independent variable (IV) to the dependent variable (DV) through the mediating variables (MV1–MV4). Specifically, each indirect effect (IV → MV → DV) is computed as: Indirect Effect (IV → MV → DV) = (Path Coefficient IV → MV)* (Path Coefficient MV → DV). By substituting the coefficients for the four mediating paths, the indirect effects for each path can be calculated. The total indirect effect is the sum of the indirect effects of the four paths, and the total effect (IV → DV) is the sum of the direct effect (IV → DV) and the total indirect effect.

After running Mplus version 8.0, the standardized results for the indirect effects and total effects of anxiety on IT course satisfaction through learning motivation can be obtained from the specific SEM path diagram.

3. Results

Figure 2 shows the direct effect of anxiety on middle school students' course satisfaction, the effect of anxiety on various aspects of learning motivation, and the indirect effect of anxiety on course satisfaction through learning motivation.

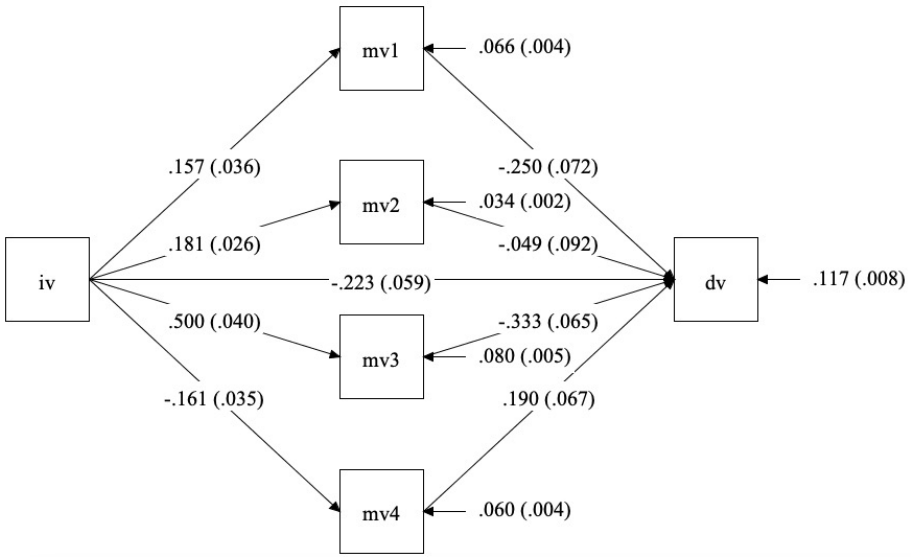

Figure 2: SEM path diagram of the mediating effect of learning motivation on the relationship between anxiety and course satisfaction

3.1 The Direct Effect of Anxiety (IV) on Course Satisfaction (DV)

This study found that anxiety has a significant negative impact on course satisfaction ($r = -0.223$, $p < 0.001$). This means that as anxiety levels increase, students' course satisfaction tends to decrease. These results suggest that higher levels of anxiety may weaken students' positive perceptions and experiences of the course.

3.2 The Effect of Anxiety on Learning Motivation

This study found that anxiety is significantly positively correlated with weak learning motivation ($r = 0.157$, $p < 0.001$) and strong learning motivation ($r = 0.181$, $p < 0.001$), but the effects are small. This indicates that the relationship between anxiety and learning motivation is complex. In some cases, anxiety may stimulate students' motivation to learn (e.g., by encouraging them to work harder under pressure), while in other cases, it may reduce their motivation. Therefore, teaching strategies should include creating a more relaxed and enjoyable environment and reducing students' academic pressure to adjust anxiety levels according to students' specific circumstances, thereby enhancing their learning motivation.

Anxiety is significantly positively correlated with learning interest (MV3) ($r = 0.500$, $p < 0.001$), with a relatively strong correlation. This means that moderate anxiety might enhance students' interest in learning by triggering focus or a sense of urgency.

Anxiety is significantly negatively correlated with learning goals (MV4) ($r = -0.161$, $p < 0.001$), with a weak correlation. This indicates that higher levels of anxiety may lead to less defined learning goals for students, affecting their long-term planning or goal management related to learning tasks.

Overall, the effect of anxiety on learning motivation is diverse and complex. Students with high anxiety levels may perform weaker in defining learning goals but exhibit stronger learning interest. This "reverse incentive effect" may result from anxiety prompting students to focus on immediate tasks or discover the enjoyment of learning. However, excessive anxiety may negatively affect the long-term dimensions of learning motivation, such as goal clarity.

3.3 The Indirect Effects of Anxiety on Course Satisfaction through Learning Motivation

Anxiety has a significant indirect effect on course satisfaction through weak learning motivation ($r = -0.039$, $p = 0.007$), though the effect is minimal. Anxiety's indirect effect on course satisfaction through strong learning motivation is not significant ($r = -0.009$, $p = 0.599$), indicating that the weak learning motivation (MV1) and strong

learning motivation (MV2) is not an important mediating variable in the relationship between anxiety and course satisfaction.

Anxiety's indirect effect on course satisfaction through learning interest is -0.167 ($p < 0.001$), indicating that learning interest serves as a significant and negative mediator between anxiety and course satisfaction. Specifically, anxiety reduces learning interest, which in turn significantly lowers students' course satisfaction.

Anxiety's indirect effect on course satisfaction through learning goals is -0.031 ($p = 0.016$), which is significant but relatively weak. This suggests that learning goals partially mediate the effect of anxiety on course satisfaction, though the overall contribution is small.

The total indirect effect of anxiety on course satisfaction through overall learning motivation (MV) is -0.245 ($p < 0.001$). This shows that anxiety significantly influences students' course satisfaction through multiple dimensions of learning motivation, with the negative mediation effect through learning interest playing the most critical role.

4. Results and Discussion

In conclusion, this study found that anxiety has a multidimensional impact on course satisfaction, including a significant direct negative effect and complex, significant indirect effects mediated through various dimensions of learning motivation, particularly learning interest and learning goals. Among these, the mediating role of learning interest is the most critical.

Therefore, anxiety levels play a crucial role in shaping students' course experiences. Both excessively high and excessively low levels of anxiety can negatively impact course satisfaction. Moderate levels of anxiety, on the other hand, may stimulate students' learning interest and enhance the clarity of their learning goals, thereby effectively improving course satisfaction and optimizing the overall learning experience. However, excessive anxiety may reduce learning interest and weaken the clarity of learning goals, ultimately diminishing course satisfaction and the overall quality of the learning experience. Consequently, managing anxiety appropriately, fostering learning interest, and clarifying learning goals are key strategies for enhancing course satisfaction and improving the learning experience.

Based on these findings, the following practical recommendations are proposed:

1) For students with high anxiety and low learning interest

- Teachers should create a relaxed and enjoyable learning environment to alleviate students' academic pressure.

- Diverse teaching methods, such as interactive classrooms and engaging activities, should be adopted to enhance students' learning interest and reduce their anxiety levels.

2) For students with weak goal-management skills

- Teachers should provide clear guidance on learning plans and help students set specific learning goals.

- Tasks can be divided into phases to improve students' sense of control over the learning process and, in turn, their course satisfaction.

This study employed a combination of quantitative survey analysis and qualitative literature review, utilizing multiple tools such as SPSS, Mplus, and R to ensure scientific rigor. By exploring the influence of learning motivation on anxiety and its subsequent impact on middle school students' course satisfaction, this research addresses a rarely studied topic in prior research. The findings contribute to filling this gap in the literature and enriching theoretical frameworks. Furthermore, they offer actionable teaching strategies to enhance students' course satisfaction and overall learning experiences.

Additionally, the findings can serve as a self-reflective tool for students. By fostering self-awareness, students can better define their learning goals, increase their interest in learning, strengthen their motivation, reduce anxiety, and ultimately improve their course satisfaction. This, in turn, supports sustainable development in their mental well-being, learning processes, and academic performance.

Despite its contributions, this study has several limitations. Due to constraints in time and resources, the data collection was restricted to Chongqing, China, with a limited sample size, which may affect the generalizability of the findings. Future studies could expand the data collection scope and increase sample sizes to enhance

representativeness. Additionally, this study focused on students in the first year of middle school. Future research could adopt stratified sampling across multiple grade levels to improve the applicability of the conclusions to the broader middle school student population.

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