



Learning Engagement as a Mediator Between Decision-Making Styles and Critical Thinking Among Nursing Students in Xi' an, China

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Date of Submission: 01-12-2024

Date of Acceptance: 09-12-2024

ABSTRACT: This study aims to explore the mediating role of learning engagement in the relationship between decision-making styles and critical thinking among nursing students in Xi'an, China. A stratified random sampling method was used to select 740 nursing students from various universities in Xi'an. The study employed structural equation modeling (SEM) to test the hypothesized relationships between decision-making styles, learning engagement, and critical thinking. The findings reveal that rational and intuitive decision-making styles are positively correlated with both learning engagement and critical thinking, while avoidant and impulsive decision-making styles negatively affect critical thinking. The study found that learning engagement partially mediates the relationship between decision-making styles and critical thinking. Specifically, learning engagement enhances the critical thinking abilities of nursing students, particularly those with rational and intuitive decision-making styles. The results highlight the important role of learning engagement as a mediator and provide valuable insights for nursing educators to foster critical thinking through decision-making style interventions and increased student engagement. This study underscores the importance of integrating decision-making style training and creating an engaging learning environment to improve critical thinking among nursing students.

KEYWORDS: Learning engagement; decision-making style; critical thinking

I. INTRODUCTION

A prosperous and well-functioning society requires individuals with critical thinking abilities (Straková & Cimermanová, 2018). Critical thinking, as an essential component of citizenship,

enables competent individuals to fully engage in democratic culture and become active members of society (Jónsson et al., 2021). However, university and high school graduates generally lack critical thinking skills (Okolie et al., 2020). Research by Shaw et al. (2020) indicates that individuals with higher levels of critical thinking report fewer adverse life events compared to those with lower critical thinking abilities. Moreover, there is a significant positive correlation between moral judgment and critical thinking skills (O'Reilly et al., 2022). Therefore, students must cultivate critical thinking to fully participate in democratic societies.

For nursing students, applying critical thinking allows them to evaluate, diagnose, and improve patient care (Falcó- Pegueroles et al., 2021). This underscores the need for critical thinking education throughout the entirety of nursing students' educational experience. There is often a disconnect between nursing students' classroom learning and practical clinical practice (Saifan et al., 2021). Critical thinking in nursing education is not merely about rote memorization of facts; it involves developing a thoughtful, analytical mindset that enables students to evaluate evidence, consider multiple perspectives, and make decisions that benefit patient outcomes. As such, integrating critical thinking into the curriculum is essential. It ensures that nursing students not only acquire technical skills but also develop cognitive agility to excel in an ever-evolving healthcare environment (Al-Hassan et al., 2023).

In nursing education, students' decision-making styles not only directly influence their behavior and decision-making processes in clinical settings (Ladjar et al., 2024) but also play a crucial role in fostering critical thinking. Different



decision-making styles can lead students to adopt various approaches when evaluating information, making decisions, and solving problems. For example, rational decision-makers may rely more on logic and systematic analysis, while intuitive decision-makers tend to prioritize personal experience and intuition (Kolbe et al., 2020). This diversity in practice contributes to team variation and fosters multiple levels of thinking. Additionally, cultivating critical thinking helps nursing students think more comprehensively and deeply, going beyond surface-level observations. This, in turn, enables them to better understand patient needs and develop more effective care plans (Nwosu & Reviews, 2024). Critical thinking fosters sensitivity to evidence, openness to diverse perspectives, and adaptability to complex situations. This is closely related to decision-making styles, as students need to consider various factors when making decisions and demonstrate critical thinking when processing information (Chang et al., 2020).

Learning engagement influences the development of critical thinking by moderating students' cognitive and emotional responses to learning tasks (Halif et al., 2020). Active engagement in the learning process not only enhances deep understanding of knowledge and information but also stimulates a willingness to think critically and question assumptions (Okolie et al., 2022). This proactive approach aligns with the core principles of critical thinking, which involves careful contemplation, analysis, and evaluation of information to form independent judgments. Furthermore, learning engagement can bridge the gap between students with different decision-making styles, enabling all students to benefit from the cultivation of critical thinking (Huang et al., 2022). Whether rational or intuitive decision-makers, students can expand their thinking by actively engaging in learning, thereby improving their ability to analyze and solve problems. Yoshimoto et al (2019) strong empirical evidence of the central role of self-motivation in students' scientific learning. Such engagement is likely a result of students' perceptions of their own abilities and the quality of teacher-student relationships. This study focuses on undergraduate nursing students, as critical thinking and decision-making skills are becoming increasingly important for nursing students and professionals.

This study examines the complex relationships between these constructs in response to the complexities nursing students face in their

academic journeys. As the healthcare environment evolves, there is a growing demand for nurses with solid critical thinking skills, effective decision-making styles, and high levels of learning engagement.

Background and hypotheses

In recent years, the impact of critical thinking on decision-making styles and the relationship between critical thinking and learning engagement have attracted the attention of Chinese scholars (Zou et al., 2023). Learning engagement refers to students' behavioral and psychological involvement in their learning experience. Nurses with a rational decision-making style may be more likely to recognize the limitations of their knowledge during the learning process (Farčić et al., 2020) (Yu et al., 2021). Critical thinking ability, as a product of education and training, has become an important indicator of students' academic achievement (Hursen & Learning, 2021) (Almulla & Al-Rahmi, 2023). In the context of increased learning engagement, it may contribute to enhancing the critical thinking abilities of nurses with a rational decision-making style (Chang et al., 2020) (Baliton & Bascos, 2023). Therefore, the nursing discipline requires students to possess high levels of critical thinking to cope with increasingly complex healthcare situations. Additionally, active learning engagement helps students better understand and apply professional knowledge. As such, exploring the relationships between decision-making styles, learning engagement, and critical thinking is crucial for the quality of nursing education and student development.

Previous studies have shown that decision-making style can influence cognitive processes (Huang et al., 2022; Yusnaini et al., 2020). For example, Huang et al. (2022) explored the effects of a business simulation game (BSG) in a flipped classroom environment on student engagement, learning outcomes, and higher-order thinking skills (HOTS). The study was conducted in an undergraduate entrepreneurship course designed as a quasi-experimental study involving 48 students, in which the BSG was implemented for the experimental group within a flipped classroom framework. Both quantitative and qualitative analyses revealed positive effects, enhanced behavioural and cognitive engagement, improved learning outcomes, and the development of higher order thinking skills, including problem-solving, critical thinking, and creativity. A hypothesis was proposed that decision-making



style significantly affects the critical thinking ability of nursing students at a private university in Xi'an, Shaanxi Province. This hypothesis stems from the observation of a different sample, prompting an investigation of the specific dynamics in this academic environment.

H1: There is a significant relationship between decision-making style and critical thinking among nursing students at a private university in Xi'an, Shaanxi Province.

Existing research has shown that learning engagement significantly impacts students' critical thinking levels. For example, the findings of Rahmawati et al. (2022) indicate that the more engaged students are in their learning, the stronger their critical thinking abilities tend to be. In the study by Kim et al (2020), the subjects were undergraduate students from regular universities, and critical thinking levels and learning engagement were measured using the Critical Thinking Scale and the Learning Engagement Scale (Kim et al., 2020). The results revealed a statistical correlation between critical thinking and learning engagement. Based on the aforementioned literature, this study proposes.

H2: There is a significant relationship between learning engagement and critical thinking among nursing students in a private university in Xi'an, Shaanxi Province.

In previous studies, researchers often discussed the relationship between two variables but have not explored the relationship between learning engagement as a mediating variable, decision-making styles, and critical thinking. Therefore, this study aims to investigate the underlying factors that influence the relationship between decision-making styles and learning engagement on critical thinking based on a systematic and comprehensive literature review and empirical research. It will also validate whether learning engagement serves as a mediating factor between decision-making styles and critical thinking. This study focuses on third-year undergraduate nursing students and intends to use a mediating variable to examine the relationship between nursing students' learning engagement, decision-making styles, and levels of critical thinking, providing a scientific basis for enhancing critical thinking skills among nursing students. Based on this, the following research hypotheses are proposed.

H3: Learning engagement mediates the relationship between decision-making styles and critical thinking skills among nursing students in a private university in Xi'an, Shaanxi Province.

Methodology

Research Design

Quantitative correlational design is highly effective in analyzing group characteristics and identifying shared differences among members (Mohajan & People, 2020). Compared to qualitative methods, it is particularly suitable for exploring variable relationships and predicting outcomes (Mohajan & People, 2020). This study explores how the decision-making styles of lower-year nursing students at Yan'an University School of Nursing affect critical thinking abilities, with learning engagement as a mediating variable.

There are four main reasons for employing a quantitative research approach. First, systematic data collection through standardized questionnaires and tools allows for more comprehensive data analysis, revealing causal relationships and mediating effects (Ciampi et al., 2021). Second, precise mediating analysis methods, such as structural equation modeling (SEM) or regression analysis, enable accurate estimation of mediating effects and their significance, clarifying the role of learning engagement. Third, a key advantage of quantitative research is objectivity; standardized tools reduce researcher bias, ensuring the objectivity and accuracy of results (Pandey & Pandey, 2021). Moreover, empirical data validate theoretical models, enhancing understanding of variable relationships (Yang et al., 2021). This study employs a correlational predictive design and mediating analysis to assess the relationship between decision-making styles (such as rational and intuitive) and critical thinking (such as systematicity and curiosity), as well as the mediating role of learning engagement. This design avoids active intervention while predicting the levels of standard variables based on measurements of predictor variables (Chekroud et al., 2021). Given the existing correlations in prior research, this method is highly suited to explore the mechanisms influencing these relationships.

Population and Sampling

The subjects of this study are third-year undergraduate nursing students from the School of



Nursing at Yan'an University in Xi'an, Shaanxi Province, China. The main reasons for selecting this group as the study's target population are as follows:

First, the appropriateness of the academic stage. In their third year of undergraduate nursing education, students have completed core nursing courses, including basic nursing, medical-surgical nursing, pediatric nursing, and nursing care in various specialties. As they are about to enter the clinical practice phase in healthcare settings, these future nurses will face numerous real-world issues that require critical thinking and effective decision-making. Therefore, they are ideal subjects for exploring the development of critical thinking skills.

Second, the maturity of knowledge and skills. Chinese undergraduate nursing education follows a four-year curriculum. After two years of theoretical learning and practical training, third-year nursing students are relatively mature in applying knowledge and skills. Studying the development of their critical thinking abilities at this stage helps to reveal the factors that influence their critical thinking skills.

Third, a key period for professional preparation. The third year represents a critical stage for nursing students to prepare for clinical practice and entry into the nursing profession. Assessing the critical thinking abilities of students at this stage can help nursing educators understand the current state of their professional competence, thereby improving nursing teaching methods and training programs to enhance students' clinical judgment and decision-making abilities.

Fourth, an evaluation of the effectiveness of the educational model. These students have already undergone two years of nursing theory education and practical training. Studying their critical thinking abilities allows for an assessment of the effectiveness of the current nursing education model and methods, helping to identify shortcomings in nursing talent development and providing recommendations for improvement.

Abdel Wahab et al (2023) points out that a larger sample size can reduce sampling error. According to Knief and Forstmeier (2021), drawing a larger sample from the population increases the likelihood that the sample will approximate a normal distribution (Levy & Lemeshow, 2013). In

this study, following the recommendation of Yang et al. (2020), a larger sample size was used to ensure higher precision, with a total sample of 746 nursing students. It is important to emphasize that using the sample sizes from previous studies as a reference for determining the sample size provides a solid foundation for comparing the results of this study with those of prior research.

Data Collection Instruments

The questionnaire used in this study comprises four sections: a demographic questionnaire, the Critical Thinking Disposition Assessment (CTDA), the Utrecht Work Engagement Scale-Student Version (UWES-S), and the General Decision-Making Style (GDMS) scale. The demographic questionnaire collects basic information such as gender, age, scholarship history, and student leadership experience. The CTDA, developed by Sun Yat-sen University in Taiwan, assesses critical thinking through three dimensions—Systematic and Analytical Thinking (8 items), Curiosity (6 items), and Maturity and Doubt (5 items)—using a 5-point Likert scale. Higher scores indicate stronger critical thinking abilities, with reliability (Cronbach's $\alpha = 0.91$) and structural validity confirmed through confirmatory factor analysis (CFA). The UWES-S evaluates learning engagement across three dimensions—Vigor (6 items), Dedication (5 items), and Absorption (6 items)—also using a 5-point Likert scale, with strong internal consistency (Cronbach's $\alpha = 0.86$) and validated structural validity. Lastly, the GDMS identifies five decision-making styles—Rational, Intuitive, Dependent, Avoidant, and Impulsive—through 25 items rated on a 5-point Likert scale. The scale demonstrates good internal consistency (Cronbach's $\alpha = 0.85$) and structural validity, effectively distinguishing among different decision-making styles. All instruments used in this study exhibit high reliability and validity, making them suitable for assessing the respective constructs.

Statistical Analysis

In this study, data analysis began with data cleaning and preparation. The initial dataset contained 746 questionnaire responses, of which 6 were deleted due to incomplete responses, leaving 740 valid responses. Missing values were dealt with by mean filling and outliers by the Winsorization method to minimize their effect on the results.



Descriptive statistics were first calculated using SPSS 27.0 to summarize the demographic characteristics of the sample, including mean age and gender distribution. The first of the primary analyses used stratified linear regression to examine the relationships between decision-making style and learning engagement, decision-making style and critical thinking, and learning engagement and critical thinking. Critical thinking was used as the dependent variable, while rational, intuitive, dependent, and avoidant decision-making styles were used as independent variables. Before running the regression model, multicollinearity was tested by variance inflation factor (VIF) to ensure that all VIF values were below a threshold of 5, indicating that there was no significant multicollinearity between the independent variables. The goodness of fit of the model was subsequently tested by R-squared and adjusted R-squared values.

In addition, a factor analysis was conducted to validate the dimensional structure of the learning engagement scale. The results confirmed the expected three-factor structure, with each factor loading above 0.6. Next, a robustness test was conducted to verify the stability of the regression coefficients by bootstrapping, which showed that these coefficients were consistent across the different subsamples.

Finally, structural equation modelling was used to test whether learning engagement had a mediating effect between decision-making style and critical thinking. Critical thinking was used as the dependent variable, while rational, intuitive, dependent, and avoidant decision-making styles were used as independent variables, and learning engagement was used as a mediating variable. Before running the structural equation model, the data were assessed for normal distribution by skewness and kurtosis to ensure that the model fit and parameter estimates were not affected by non-normal data. The analysis was conducted using SPSS 27.0 and AMOS 26.0 software, and all scripts and procedures were recorded to ensure the reproducibility of the study.

II. Results

This study uses Confirmatory Factor Analysis (CFA) to evaluate the measurement model. Given the complexity of the relationships between the independent variables and critical thinking, separate CFA analyses were first conducted for each construct, followed by a combined CFA analysis. The purpose of CFA is to test the unidimensionality, validity, and reliability

of the model (Hancock et al., 2020). After validating all the latent constructs, Structural Equation Modeling (SEM) was used to build the structural model, which involved testing the model fit, hypothesis testing, and examining the mediation effects (Thakkar & Practice, 2020). The measurement model of the learning engagement structure indicates that the factor loadings of all 17 items are greater than 0.70, and no items need to be deleted. The confirmatory factor analysis (CFA) of the UWES-S structural model shows that the model fit is good: $\chi^2=138.265$, $P<.001$, $CMIN/DF=1.192$, $CFI=0.997$, $TLI=0.996$, $RMSEA=0.018$, $SRMR=0.032$. All standardized factor loadings are significant ($P<.001$) and above 0.70, indicating that there is a strong relationship between the observed variables and their respective latent factors.

The measurement model of the decision-making style construct indicates that the factor loadings of all 25 items are greater than 0.70, so there is no need to delete any items. It shows that the confirmatory factor analysis (CFA) of the GDMS structural model indicates that the model fit is good: $\chi^2 = 408.714$, $P < .001$, $CMIN/DF = 1.542$, $CFI = 0.987$, $TLI = 0.987$, $RMSEA = 0.030$, $SRMR = 0.040$. All standardized factor loadings are significant ($P < .001$) and above 0.70, indicating that there is a strong relationship between the observed variables and their respective latent factors.

This study explores three structures to test the six main hypotheses proposed in the research. Learning engagement serves as the mediating structure, moderating the two independent variables: decision-making styles and critical thinking. The dependent variable structure in this study is critical thinking. Figure 1 illustrates the analysis process where learning engagement mediates the relationship between decision-making styles and critical thinking. The mediation analysis results indicate that learning engagement (NLE) partially mediates the relationship between decision-making styles (DS) and critical thinking (CT).

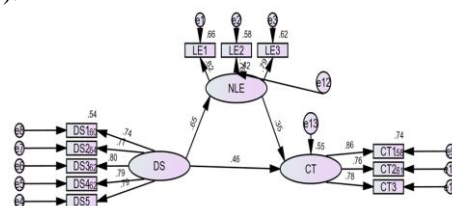


Figure 1 Standardized Path Coefficients between Constructs in the Structural Model



Based on the fitness indexes of the structural model results (Table 1), this study established that the proposed structural model met the required goodness of fitness (Chisq/df=2.877 < 3, RMSEA=0.060 < 0.08, CFI=0.975 > 0.85, TLI=0.967 > 0.85, and IFI=0.975 > 0.85) Therefore, the proposed structural model is utilized for further analysis that is hypotheses testing.

Table 1 Model Fit Indexes for the Structural Model

Name of Index	Level of Acceptance	Structural Model	Remarks (Final Model)
Chi-Square	P-value > 0.05	0.00 (N=741)	0.00 (N=741)
RMSEA	< 0.08	0.06	Achieved
TLI	TLI > 0.90	0.967	Achieved
CFI	CFI > 0.90	0.975	Achieved
Chi-Square /df	Chisq/df < 3.0	2.877	Achieved

As shown in Table 1, this study aims to evaluate the effect of learning engagement as a mediating variable on the decision-making style (GS) and critical thinking (CT) patterns of nursing students at Yan'an University in Xi'an, Shaanxi Province, China. With learning engagement (NLE) as a mediating variable, the following results are hypothesized.

The indirect effect is $0.668 \times 0.371 = 0.248$, and the total effect is $0.506 + 0.248 = 0.754$. The path coefficient of the direct effect (GS → CT) is 0.506, and it is significant ($P < 0.001$). The path coefficient of the indirect effect (GS → NLE → CT) is 0.248. Since the direct effect of GS on CT is still significant after including the mediating variable (NLE) ($P < 0.001$), it proves that there is a mediating effect between the independent variable and the dependent variable, and the direct effect hypothesis test is significant, so the mediation type is partial mediation. Therefore, hypothesis H3 was accepted. The decision-making style of nursing students at Yan'an University, Xi'an, Shaanxi positively affects their critical thinking.

Using the CCTDI and the decision-making style scale among 326 nursing students (Hoorijani & Heidari Tabrizi, 2023). The

results indicated that rational decision-making style was positively correlated with critical thinking disposition, consistent with the findings of this study. In Zemeleaga's research, school administrators were studied using the CCTDI and GDMS, revealing a positive correlation between rational decision-making style, intuitive decision-making style, and critical thinking disposition, and a negative correlation between avoidant and impulsive decision-making styles and critical thinking, which aligns with this study's results (Zemeleagă et al., 2023). In Batweel and BinOthaimen's study, rational decision-making style was measured using the Rational Experience Scale, conducted in a cross-sectional study of undergraduate pharmacy students. The results showed that students with rational decision-making style scored higher on learning engagement, a result similar to that of this study.

Rational decision-makers typically exhibit comprehensive and systematic information gathering, problem identification, and in-depth reflection before making decisions. They tend to be more rigorous and scientific in their decision-making, resulting in a lower probability of errors and reinforcing the cycle of good decision-making, which in turn influences critical thinking skills. This may be because rational decision-makers are able to confront and fairly deal with negative emotions, thoughts, beliefs, or opinions. Individuals with strong systematic critical thinking skills can articulate well-considered viewpoints on complex issues from different perspectives, foresee potential problems and consequences, emphasize rationality and the use of evidence, approach complex problems in an organized manner, and value evidence and argumentation.

In accordance with the [Watson-Glaser] three-factor model of critical thinking, which involves identifying assumptions, evaluating arguments, and drawing conclusions (the RED model), avoidant and impulsive decision-making styles in nursing students may be influenced by emotional factors. Emotional levels could affect their ability to objectively and accurately evaluate arguments when assessing evidence, leading to negative predictions for their critical thinking levels. This may be because nursing students with a rational decision-making style can closely align their learning goals with their personal decision-making style, promoting the development of critical thinking skills. This is crucial for enhancing critical thinking levels and improving nursing



service quality, which is essential for effective patient care and patient safety.

Nursing students invest a significant amount of time and energy into their learning process, especially during decision-making. Nursing students with a rational decision-making style can separate their thoughts from emotions and needs, recognizing that their thoughts do not automatically translate into actions, preventing unnecessary emotions from affecting their decisions. They can gain insight into their psychological processes and critically examine their thinking, thus promoting the development of critical thinking skills. By enhancing nursing students' learning engagement, the relationship between rational decision-making style and critical thinking can be improved, thereby fostering an increase in critical thinking levels. Consequently, learning engagement plays a crucial role in promoting critical thinking in nursing students with a stable rational decision-making style.

This result indicates that schools and educational departments should provide sufficient learning engagement environments for nursing students, fully recognizing the importance of decision-making styles, learning engagement, and critical thinking for nursing students. Efforts should be made to create a learning environment that supports students' learning engagement, thus enhancing nursing students' learning engagement. By creating a conducive learning environment and improving individual students' critical thinking, the overall critical thinking levels of the class and school will improve, leading to better nursing service quality, the development of nursing competencies, and the sustainable development of hospitals and the healthcare sector.

Learning engagement in nursing students is reflected in their attitudes towards learning tasks, concern for others' emotions, and sense of belonging to the school. It includes nursing students' ability to adapt to school rules and management, as well as their long-term commitment to learning content and subjects, reinforcing individual participation in learning and various activities. Nursing students with rational decision-making styles have more room for improvement in trusting their rational judgments and using evidence and reasoning to analyze and solve nursing problems. Universities could consider establishing nursing-centered teaching models, incorporating problem-based learning (PBL), case-based learning (CBL), and team-based

learning (TBL) models, enhancing the cyclic interaction between students and teachers. This will promote nursing students' learning engagement, improving the relationship between rational decision-making style and critical thinking. Curriculum reforms should focus on the depth and breadth of course content, its theoretical and forward-looking nature, and foster deeper communication and exchange between students and teachers. By consciously mentoring nursing students, greater participation and engagement can be encouraged. Universities should enhance meaningful inquiry interactions between nursing students and teachers, improving the quality and efficiency of these interactions. It is essential to strengthen the continuous assessment of nursing students' critical thinking throughout their development cycle, providing consistent support for their entire professional development.

It is worth noting that this process refers to the development of nursing students' critical thinking, which exhibits different characteristics at various stages such as pre-education, basic education, higher nursing education, and continuing nursing education. The critical thinking scale should align with the laws of human physical and mental development to continuously track and provide feedback on nursing students' critical thinking development levels.

Critical thinking, as an output variable, plays a decisive role in university students' independent thinking, reflection, and reasoning abilities. It promotes nursing students' cognitive abilities, meets their needs, and fosters a strong sense of self-control, ensuring the sustainable growth of learning engagement. Additionally, nursing students with strong critical thinking abilities are more focused on controlling their learning goals, personal development, and growth, while reflecting on their emotional and psychological needs. In the learning process of nursing students, those with higher learning engagement are more proactive in facing and solving problems, timelier in finding new solutions, and this helps enhance critical thinking abilities in rational decision-makers, maintaining stable psychological and learning states. Nursing students with rational decision-making styles are responsive, open to new knowledge, skilled in communicating and collaborating with peers, increasing classroom learning engagement, and thereby improving critical thinking skills.



III. CONCLUSION

In conclusion, this study emphasizes the partial mediating role of learning engagement in the relationship between decision-making style and critical thinking. The perspectives proposed in this study hold significant implications for future research and organizational practices.

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