

## Grit and Problem-solving Ability in Nursing Students: The Mediating Role of Distress Tolerance and Self-directedness

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**Objectives:** This study aimed to identify the mediating effects of distress tolerance and self-directedness on the relationship between grit and problem-solving ability in nursing students. **Methods:** Participants were 335 nursing students in two universities between September to December 2018. The data were analyzed using a t-test, one-way ANOVA, and Person's correlation coefficients. In addition, Baron and Kenny's method was used to analyze mediating effects of distress tolerance and self-directedness between grit and problem-solving ability. **Results:** Significant correlations were found between grit and problem-solving ability ( $r=0.57, p<0.001$ ), between grit and distress tolerance ( $r=0.38, p<0.001$ ), and grit and self-directedness ( $r=0.46, p<0.001$ ). There were the mediating effects of distress tolerance ( $z=5.37, p<0.001$ ) and self-directedness ( $z=7.25, p<0.001$ ) on the relationship between grit and problem-solving ability. **Conclusions:** It is necessary to develop and apply the programs that strengthen distress tolerance and self-directedness to improve nursing students' problem-solving ability.

**Key words:** Distress tolerance, Grit, Nursing students, Problem-solving ability, Self-directedness

### INTRODUCTION

Nursing students are under increasing pressure to prepare for professional and independent work in a rapidly changing health care environment [1]. They are especially exposed to strange situations such as clinical practice and are likely to experience unstable emotions in an environment where they need to establish new relationships [2]. They also need to learn problem-solving processes to effectively find problems and suggest solutions in various clinical situations [3]. For nursing students, clinical performance was influenced by problem-solving ability based on critical thinking [4]. Nursing students with higher grit showed higher self-efficacy, major satisfaction, and lower academic stress [5].

Grit is a characteristic of people who have achieved successful accomplishments in their field [6]. It is the patience and passion to achieve long-term goals and means challenges regardless of failure and adversity [7]. Students with higher grit set successful goals and achieved satisfacto-

ry academic achievement based on consistent passion and dedication. The higher the grit, the more effectively he controlled his will to overcome obstacles [8]. Grit is a concept that includes guts, resilience, initiative, and tenacity [9]. It helps to engage in activities for social relations and physical health for his goals and positively impacts life satisfaction and happiness [10]. Grit was found to improve academic achievement, academic satisfaction, and the relationship between professors and students [11]. The grit of university students was high in maladaptive obsession and low in optimistic harmony and meaning [12]. In particular, the grit of nursing students was affected by clinical practice. Nursing students with intense grit showed lower academic stress, higher self-efficacy, and major satisfaction [5].

Distress tolerance means the ability to endure negative experiences. People with distress tolerance have been reported to have high life satisfaction and lead positive growth and healthy life through continuous interpersonal relationships [13]. It is the ability to withstand negative expe-

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periences without avoiding them [14]. Distress tolerance cognitively handles the perception of subjective pain. Low distress tolerance shows low coping ability because the pain control is inefficient [15]. Distress tolerance has increased positive emotions and experiences and improved quality of life without avoiding life uncertainty and dissatisfaction [16].

Self-directedness for nursing students is a strategic self-management ability that allows them to develop their nursing skills in a complex nursing environment [17]. It is the ability to engage in learning with self-control and responsibility to achieve their goals actively [18]. It is not a passive attitude toward the situation but rather an active one, setting goals and solving problems with an open attitude toward new learning situations [19]. Self-directedness is emphasized in the process of nursing students integrating diverse knowledge and practice in humans [20,21].

Problem-solving ability is one of the skills that nursing students need to provide appropriate care to various clinical situations and subjects [22]. In addition, it reduces negative thoughts such as suicide by controlling stress [23]. In particular, nurses can provide accurate and prompt nursing care to their clients by developing a high level of problem-solving ability in students [17].

Therefore, this study aimed to identify the mediating effects of distress tolerance and self-directedness on the relationship between grit and problem-solving ability.

## METHODS

### Study design and participants

This study was descriptive research attempting to determine the mediating effects of distress tolerance and self-directedness on the relationships of grit and problem-solving ability. Participants were 340 nursing students, consisting of 281 females and 53 males.

### Data collection and ethical considerations

This study was obtained from the Institutional Review Board of Chung Cheong University (IRB No.: 002\_20180913\_1). The researchers explained the purpose, the anonymity of the research participants, and the possibility of refusal or withdrawal from the study. Therefore, participants' identification information was excluded from the questionnaire. Data were gathered from 340 nursing students at Chung-Cheong University and Gyeongbuk College of Health from September to December 2018. Of these, 335 responses (98.5%) were used for the final analysis, ex-

cept for five incomplete data.

### Instruments

Grit is the key to ultimately achieving success and predicting success in the face of failure and frustration to achieve long-term goals [9]. It was measured using the Original Grit Scale (Grit-O) [6], translated in Korea [24]. This measurement tool contains 12 questions and is rated on a 5-point Likert scale. The tool consists of perseverance of effort (6 items) and consistency of interests (6 items). The original author reported Cronbach  $\alpha$  of 0.78, whereas Cronbach  $\alpha$  of this study was 0.76. A higher score indicates more persistence and enthusiasm for long-term goals.

Distress tolerance is the willingness to withstand and avoid difficult and negative emotional situations [13]. It was measured using the Distress Tolerance Scale (DTS) [15], translated in Korea [25]. This measurement tool contains 15 questions and is rated on a 5-point Likert scale. The original author reported Cronbach  $\alpha$  of 0.89, whereas Cronbach  $\alpha$  of this study was 0.91. A higher score indicates a higher to endure pain.

Problem-solving ability is a creative and adaptive ability to achieve goals with a balance of prompt action and willingness in internal and external challenges [26]. It was measured using the problem-solving Inventory (PSI) [26], translated into Korea [23]. This measurement tool contains 32 questions and is rated on a 6-point Likert scale. The tool consists of problem-solving confidence (11 items), approach-avoidance (16 items), and personal control (5 items). The original author reported Cronbach  $\alpha$  of 0.90, whereas Cronbach  $\alpha$  of this study was 0.92. A high score indicates excellent problem-solving ability.

Self-directedness is the ability of students to enthusiastically learn through active will, autonomy, and openness in setting and achieving goals for themselves [19]. It was measured using the Self-Directed Learning Readiness Scale (SDLRS) [19], translated in Korea [21]. This measurement tool contains 21 questions and is rated on a 6-point Likert scale. It consists of a love of learning (7 items), self-confidence in the ability to learn (6 items), openness to learning opportunities (4 items), and acceptance of responsibility for one's learning (4 items). The original author reported Cronbach  $\alpha$  of 0.91, whereas Cronbach  $\alpha$  of this study was 0.91. A higher score indicates higher efficacy, aggressiveness, accountability for learning activity, and superior ability to continue voluntary learning.

### Data analysis

The data were analyzed using SPSS 22.0 (IBM Co., Armonk, NY,

USA) program. Pearson's correlation coefficient was used to analyze the correlation between distress tolerance, self-directedness, grit, and problem-solving ability. The mediating effects of distress tolerance and self-directedness on the relationship between grit and problem-solving ability were confirmed using the mediator effect test proposed by Baron and Kenny [27]. In the first step, the independent variable should have a significant effect on the dependent variable. In the second step, the independent variable should have a significant influence on the parameter. In the third step, the parameter should have a significant effect on the dependent variable. In the last step, in a regression equation involving parameters, the effect of the independent variable on the dependent variable should be less than in the second step. The significance of the mediating effect was analyzed by the Sobel test.

**Table 1.** General characteristics and difference in problem-solving ability according to the characteristics (n=335)

Characteristic	Categories	n (%)	Problem-solving ability	
			Mean ± SD	t or F (p)
Age (y)	19-20	122 (36.4)	3.83 ± 0.04	1.17 (0.311)
	21-22	118 (35.2)	3.90 ± 0.05	
	≥ 23	95 (28.4)	3.93 ± 0.06	
Grade	1st	38 (11.3)	3.96 ± 0.47	0.45 (0.721)
	2nd	106 (31.6)	3.88 ± 0.53	
	3rd	98 (29.3)	3.84 ± 0.51	
	4th	93 (27.8)	3.89 ± 0.57	
Religion	Yes	113 (33.7)	3.91 ± 0.59	0.68 (0.498)
	No	222 (66.3)	3.87 ± 0.50	
Exercise (more than once a week)	Yes	186 (55.5)	3.94 ± 0.53	2.31 (0.021)
	No	149 (44.5)	3.81 ± 0.52	

SD, standard deviation.

**Table 2.** Correlations among variables (n=335)

Variables	Mean ± SD	1	2	3
		r (p)	r (p)	r (p)
1. Grit	2.96 ± 0.46			
2. Distress tolerance	3.28 ± 0.67	0.38 (<0.001)		
3. Problem-solving ability	3.88 ± 0.53	0.57 (<0.001)	0.51 (<0.001)	
4. Self-directedness	3.93 ± 0.69	0.46 (<0.001)	0.29 (<0.001)	0.65 (<0.001)

SD, standard deviation.

**Table 3.** The mediating effect of distress tolerance (n=335)

Path		B	β	R <sup>2</sup>	F	p
Step 1.	Grit → Distress tolerance	0.55	0.38	0.14	55.10	<0.001
Step 2.	Grit → Problem-solving ability	0.50	0.44	0.43	124.47	<0.001
Step 3.	Distress tolerance → Problem-solving ability	0.27	0.35	0.32	159.57	<0.001
Sobel test				z (p): 5.37 (<0.001)		

## RESULTS

### General characteristics and difference in problem-solving ability in nursing students

General characteristics of the subjects and differences in problem-solving ability according to characteristics of respondents were presented in Table 1. Over one-third of respondents were 19-20 years old, and a second-year grade was high (31.6%), and 66.3% of respondents did not have religion. There were no significant differences in problem-solving ability by participants' general characteristics (Table 1).

### Correlations among variables

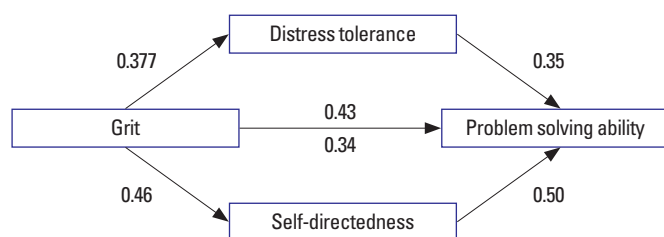
Grit has positive correlation with distress tolerance ( $r = 0.38, p < 0.001$ ), problem-solving ability ( $r = 0.57, p < 0.001$ ), and self-directedness ( $r = 0.46, p < 0.001$ ) (Table 2).

### The mediating effect of distress tolerance and self-directedness

The mediating effects of distress tolerance on the relationship between grit and problem-solving ability are shown in Table 3. The effect of grit on distress tolerance ( $\beta = 0.38, p < 0.001$ ), the effect of grit on problem-solving ability ( $\beta = 0.44, p < 0.001$ ), and the effect of distress tolerance on problem-solving ability ( $\beta = 0.35, p < 0.001$ ) were significant. Sobel test indicated that mediating effect was significant ( $Z = 5.37, p < 0.001$ ) (Table 3, Figure 1). The mediating effects of self-directedness on the relationship between grit and the problem-solving ability of respondents are shown

**Table 4.** The mediating effect of self-directedness (n=335)

	Path	B	$\beta$	R <sup>2</sup>	F	p
Step 1.	Grit → Self-directedness	0.68	0.46	0.21	88.40	<0.001
Step 2.	Grit → Problem-solving ability	0.39	0.34	0.52	159.57	<0.001
Step 3.	Self-directedness → Problem-solving ability	0.38	0.50	0.52	178.49	<0.001
Sobel test				z (p): 7.25 (<0.001)		



**Figure 1.** Mediating effect of distress tolerance and self-directedness between grit and problem-solving ability.

in Table 4 and Figure 1. Sobel test indicated that mediating effect was significant ( $Z=7.25, p < 0.001$ ) (Table 4).

## DISCUSSION

This study aimed to investigate the mediating effects of distress tolerance and self-directedness on the relationship between grit and problem-solving ability in nursing students.

In this study, grit positively correlated with distress tolerance, problem-solving ability, and self-directedness. It was found to affect the problem-solving ability directly and affect problem-solving ability by distress tolerance and self-directedness indirectly. Grit is a positive psychological feature required in nursing practice. It enabled successful nursing capacity through excellence, determination, and compassion [28]. Lee and Park [29] found that nursing students with higher grit had a positive academic life with low-stress levels by effectively coping with difficult situations. Similar to the fact that the grit of nursing students was an essential variable for problem-solving ability and academic performance in this study, Kim et al. [12] also showed that it was an essential variable for academic achievement and adjustment to college life. Therefore, it is required the ability to turn nursing students into opportunities for growth through grit that continues to work toward goals. This study showed that the grit of nursing students directly influenced self-directedness and raised problem-solving ability. This finding was similar to the study [30], indicating that the higher the grit of nursing students, the higher their

self-esteem, and that they successfully achieved nursing by challenging them without avoiding complex tasks. Therefore, it is necessary to operate and develop various educational programs to form high-quality grit for nursing students who experience high pressure and stress due to intense tasks and the educational process.

This study showed that the high distress tolerance of nursing students increased problem-solving ability. This result was the same as the study [31] presented that high emotional distress tolerance reduced anxiety by increasing endurance to uncertainty. The study [32] found that persistent stress situations reduced the ability to deal with pain. In addition, the study [33] showed that distress tolerance affected the quality of life and happiness by effectively controlling negative emotions. This result indicated that distress tolerance improved coping with painful situations and controlled negative emotions such as anger.

In this study, the high self-directedness of nursing students was found to have a direct effect on efficient problem-solving ability. The attitude of self-directed nursing students was thought to have a positive effect on the development of creative intervention plans for the problem. In particular, highly self-directed nursing students confirmed their responsibility and presence through active participation in extracurricular activities. Also, nursing students with high self-directedness had a higher social maturity, which considered interactions with members rather than a self-centered attitude in social relations. They also had a higher professional self-concept that shows self-esteem as a professional [34]. Cho [35] showed that self-directed students had higher satisfaction with nursing science and clinical practice. These results suggested that nursing activities improving self-directedness needed to be expanded to provide a high satisfaction curriculum to nursing students. The self-directedness of nursing students had a significant influence on the goal setting and performance of problem-solving. It was thought that it affected the responsibility for nursing. Therefore, nursing students need to be more self-directed to look at the subjects and problems from new perspectives and have a positive impact on their problem-solving ability.

Problem-solving ability is a helpful strategy for better nursing and is

an integral part of the nursing curriculum [36]. The problem-solving ability of nursing students is a process that includes diagnostic reasoning, prognostic judgment, and decision-making for solving the health problems of subjects when providing nursing care [37]. These results were similar to previous studies, which showed that the better the academic performance, the better the interpersonal ability, the more satisfied the nursing science, the better the health status, and the higher the problem-solving ability [2,22]. Gulsum [36] also found that nursing students with higher problem-solving ability had higher self-efficacy to manage stress efficiently. Kim et al. [38] showed that the higher the self-directed learning ability, the higher the problem-solving. In particular, Kim and Shim [17] confirmed that the problem-solving ability of nursing students was highly correlated with self-directed disposition. Nursing students need practical problem-solving ability in complex clinical settings to provide skilled nursing care after graduation [2]. Bulfone et al. [37] found that nursing students who participated in various strategic educational tutorial strategies improved their problem-solving ability. Therefore, it is necessary to make substantial efforts to improve nursing students' problem-solving ability to develop a nursing curriculum.

This study found that distress tolerance and self-directedness had a mediating effect on the relationship between grit and problem-solving ability of nursing students. In other words, the higher the grit, the greater the ability to endure threatening and difficult situations, and the higher the distress tolerance of positive coping. In addition, self-directed response was found to be responsibly based on self-understanding and challenging spirit of problem situations. This distress tolerance and self-directedness have been found to solve problems efficiently without escaping problems through self-confidence and self-control.

The results of this study are as follows: First, it was found that grit was closely related to problem-solving ability, and the absence of grit could be a vulnerable factor in the problem-solving ability of nursing students. This indicates the need for grit in nursing studies to provide nursing students with appropriate care for a variety of health problems. Grit is a differentiated individual that is consistently motivated and unyielding, even in difficult and desperate situations and is resilient, patient, and passionate about achieving its goals [39]. Second, this study showed that the problem-solving ability of nursing students is effective in distress tolerance to perceive pain objectively and self-directedness in achieving their goals in problem situations. Third, this study was conducted for nursing students preparing high-quality nursing care for their mental,

physical and social health. Therefore, it is considered that repeated studies and follow-up studies will be necessary for nursing students to acquire problem-solving ability by actively establishing grit, distress tolerance, and self-directedness to provide quality nursing care to the subjects.

## CONCLUSION

The purpose of this study was to examine the mediating effects of distress tolerance and self-directedness on the relationship between grit and problem-solving ability of nursing students and provide primary data for improving the grit of nursing students. This study suggests the following: First, this study was conducted to target nursing students in a specific area. Therefore, further research will need to collect data from a wider area and analyze it with sufficient samples to confirm the results. Second, this study proposes a follow-up study that builds a structural model of grit, distress tolerance, and self-directedness influencing the problem-solving ability of nursing students. Third, this study suggests qualitative research and grit promotion program research to explore nursing students' problem-solving abilities. In addition, it is necessary to develop the problem-solving ability and apply curriculum to strengthen the problem-solving ability of nursing students.

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## 국문초록

간호대학생의 그릿과 문제해결능력의 관계에서 고통감내력과 자기주도성의 매개효과

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목적: 본 연구는 간호대학생의 그릿과 문제해결능력과의 관계에서 고통감내력과 자기주도성의 매개효과를 규명하기 위함이다.

방법: 간호대학생 335명을 대상으로 일반적 특성과 측정변수들은 기술통계를 이용하였고, 변수 간 상관관계는 Pearson 상관계수로, 그릿과 문제해결능력의 매개효과는 Baron and Kenny가 제안한 3단계 회귀분석 매개효과 검증방법을 이용하였다.

결과: 그릿, 고통감내력, 자기주도성, 문제해결능력은 서로 양의 상관관계를 보였고, 간호대학생의 그릿과 문제해결능력의 관계에 고통감내력과 자기주도성의 매개효과가 있는 것으로 나타났다.

결론: 간호대학생의 문제해결능력 향상을 위해 고통감내력과 자기주도성을 향상시킬 수 있는 프로그램 개발이 필요함을 밝히는 바이다.

주제어: 간호대학생, 고통감내력, 그릿, 문제해결능력, 자기주도성