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The Mediating Effect of Grit on the Relationship between Digital Literacy and Academic Self-Efficacy in Nursing Students

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Abstract

This study investigates the mediating effect of grit on the relationship between university students' digital literacy and academic self-efficacy, and to understand the influence of these variables. The study sample consisted of 260 nursing students from a university located in W city, Gangwon Special Self-Governing Province. Data collection took place from September 10 to September 25, 2024. The collected data were analyzed using descriptive statistics, t-test, one-way ANOVA, and hierarchical regression analysis with the SPSS/WIN 25.0 Program. The study found that grit partially mediated the relationship between the subjects' digital literacy and academic self-efficacy. Significant correlations were found between digital literacy and both grit and academic self-efficacy, as well as between grit and academic self-efficacy. Therefore, it is necessary to continue in-depth research, such as analyzing the effects of developing and applying programs that can enhance grit and various variables affecting the academic self-efficacy of nursing students.

Keywords: *Nursing Students, (DL)Digital Literacy, Grit, (ASE)Academic Self-Efficacy, Mediating Effect.*

Introduction

The Digital Transformation, triggered by the Fourth Industrial Revolution, is leading to fundamental changes in the healthcare environment. As advanced technologies such as Big Data, the Internet of Things (IoT) and Artificial Intelligence (AI) are rapidly integrated into the medical field, the role of nurses is being redefined from traditional caregivers to 'knowledge workers with digital competencies' who skillfully utilize digital technology to perform evidence-based practice, manage complex medical information, and participate in technology-centered patient care [1]. Modern nursing education is faced with the significant task of cultivating the next generation of nurses with a high level of digital literacy. Here, digital literacy refers to a comprehensive competency that goes beyond the technical proficiency of using specific software to include the ability to critically evaluate and effectively integrate vast amounts of digital information, and to apply this to clinical problem-solving. Recent studies consistently show that nursing students' digital literacy is deeply intertwined with several competencies essential for academic success. For instance, students with higher digital literacy not only demonstrate better academic achievement [2] and problem-solving skills [4] but also exhibit greater learning flow [3] and self-directed learning abilities [2]. This suggests that digital competency is a foundational element for cultivating future nursing professionals. Academic self-efficacy is an individual's confidence in their ability to succeed at specific academic tasks. The nursing curriculum is known for its high academic burden due to a vast amount of learning, the significant weight of the national examination, and clinical practicums accompanied by extreme stress. In this high-pressure environment, academic self-efficacy functions as a crucial psychological resource that enables students to not avoid challenging tasks, to not give up easily when faced with difficulties, and ultimately to achieve academic success. Numerous studies have identified academic self-efficacy as a key predictor of academic achievement, linking it to positive outcomes such as high levels of adjustment to college life, learning flow, and clinical performance ability. [5].

Grit, a non-cognitive trait, is defined as 'sustained passion and perseverance for long-term goals.' Since professional nurses must complete years of intensive education, overcome numerous challenges in academic and clinical settings, and maintain a long-term commitment to the profession, grit can be

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considered a particularly important quality for nursing students. Previous studies show that grit has a significant positive relationship with adjustment to college life [5] and learning flow [6], suggesting that it is a key psychological resource for successfully completing a demanding curriculum and growing into a competent professional.

While previous research has studied the relationships between these variables in pairs (e.g., digital literacy and academic self-efficacy, or grit and academic self-efficacy), the dynamic interaction among these three variables remains largely unexplored in the existing literature, especially the mediating role of grit. Therefore, this study aims to fill this research gap by empirically verifying the mediating role of grit in the effect of nursing students' digital literacy on their academic self-efficacy. Through this, it intends to present concrete evidence for the need for nursing education in the digital age to move in a direction that cultivates not only students' technical competencies but also their inner psychological strength.

Methods

Participants

The subjects of this study were nursing students enrolled in a university located in W city, Gangwon Special Self-Governing Province. A total of 264 students who understood the purpose of the study were assured of anonymity, and were informed of their rights as research participants, agreed to participate and were selected through convenience sampling. Data collection was conducted from September 10 to September 25, 2024, with the researcher directly distributing and collecting the questionnaires. Of the returned questionnaires, 4 were excluded due to inappropriate responses or non-responses, and the final sample for analysis consisted of 260 participants. According to the G-Power 3.1.9.4 formula, with a power of .95, a significance level of .05, and an effect size of .15, the maximum required sample size for one-way ANOVA, correlation, regression analysis is 160, thus the number of subjects in this study met the minimum sample size requirement.

Research Tools

Digital literacy was assessed using the instrument developed by Shin and Lee [7] and used by Kim and Na [4]. This tool consists of a total of 18 items across four domains: ICT basic competency (5 items), SNS utilization and collaboration ability (5 items), basic work utilization ability (4 items), and SW-centered society adaptation ability (4 items). Each item is rated on a 5-point Likert scale, with higher scores indicating a higher level of digital literacy. The Cronbach’s α for the instrument was .96 in this study, which is comparable to the .84 found in the study by Kim and Na [4].

Academic self-efficacy was assessed with a tool developed by Ayres [8], used by Jeong and Oh [9]. This tool consists of 10 items on a 5-point Likert scale, ranging from 1 ('not at all true') to 5 ('exactly true'), with higher scores indicating a higher level of academic self-efficacy. In the study by Jeong and Oh [9], Cronbach's α was .90, and in this study, it was .80.

Grit was assessed using the tool developed by Duckworth et al. [10] and used by Kim et al. [11]. This tool consists of a total of 12 items across two domains: The scale comprises two domains: perseverance of effort (8 items) and consistency of interest (4 items). All items are rated on a 5-point scale, anchored by 1 ('not like me at all') and 5 ('very much like me'), where higher scores indicate a greater level of grit. In the study by Kim et al. [11], Cronbach's α was .77, and in this study, it was .82.

Analysis Methods

The data were analyzed using the SPSS 25.0 statistical program, with the statistical significance level set at .05. The collected data were analyzed by calculating descriptive statistics to summarize the subjects' general characteristics and variable levels , using t-test and ANOVA with the Scheffé test to analyze group differences , examining correlations with Pearson's coefficients , conducting hierarchical regression to determine the influence on academic self-efficacy , and finally, verifying the mediating effect of grit using the procedure proposed by Baron and Kenny [12] and the Sobel test.

Results

General Characteristics of Subjects and Levels of Digital Literacy, Grit, and Academic Self-Efficacy

Regarding the general characteristics of the subjects, 78.1% were female students, the average age was 21.58 years, 77.3% had experience with digital education, 55.4% did not have a computer-

related certificate, and the 'moderate' group was the largest for academic achievement at 47.3% (Table 1).

The subjects' level of digital literacy was an average of 3.49 on a 5-point scale, grit was an average of 3.67 on a 5-point scale, and academic self-efficacy was an average of 3.69 on a 5-point scale (Table 2).

Differences in Academic Self-Efficacy According to General Characteristics

There was a significant difference in academic self-efficacy based on academic achievement. Students with higher academic performance showed higher academic self-efficacy (p<.001) (Table 1).

Table 1. Difference of Academic Self-Efficacy by General Characteristics(N=260)

Characteristic	Categories	n (%)	Academic Self-Efficacy		
			M±SD	t/F(p)	Scheffe
Gender	Male	57(21.9)	3.73±.84	.41 (.682)	
	Female	203(78.1)	3.67±.87		
Age			21.58±1.04		
Digital education experience	Yes	201(77.3)	3.64±.75	-1.60	
	No	59(22.7)	3.84±1.16	(.112)	
Computer related certificates	Yes	116(44.6)	3.68±.79	-.10	
	No	144(55.4)	3.69±.92	(.919)	
Academic achievement	High[a]	58(22.3)	4.47±.83	55.16 (<.001)	a>b>c
	Medium[b]	123(47.3)	3.65±.72		
	Low[c]	79(30.4)	3.16±.63		

Table 2. Degree of Digital Literacy, Grit and Academic Self-Efficacy (N=260)

Variables	M±SD	Range	Reference range
Digital Literacy	3.49±.04	2.33 ~ 4.89	1~5
Grit	3.67±.05	2.25 ~ 7.75	1~5
Academic Self-Efficacy	3.69±.05	2.20 ~ 9.00	1~5

Correlations Digital Literacy, Grit, and Academic Self-Efficacy of Subjects

The subjects' digital literacy showed a significant positive correlation with grit (r=.58, p<.001) and academic self-efficacy (r=.57, p<.001). Grit also showed a significant positive correlation with academic self-efficacy (r=.50, p<.001) (Table 3).

Table 3. Correlation among Digital Literacy, Grit, Academic Self-Efficacy(N=260)

	Digital Literacy	Grit	Academic Self-Efficacy
Digital Literacy	1		
Grit	.58(<.001)	1	
Academic Self-Efficacy	.57(<.001)	.50(<.001)	1

The influence of Subjects' Digital Literacy and Grit on Academic Self-Efficacy

The results of the hierarchical regression analysis to analyze the factors affecting the subjects' academic self-efficacy are shown in Table 4. In step 1, control variables (general characteristics) were entered. In step 2, digital literacy was added, and in step 3, grit was added. General characteristics such as gender, digital education experience, computer-related certificates, and academic performance were dummy-coded.

In step 1, with only control variables, academic performance was found to have a significant effect (β=-.54, p<.001). In step 2, after controlling for the control variables, the addition of digital literacy showed a significant effect on academic self-efficacy (B=.40, p<.001), and the explained variance (R^2)

increased by 10% from step 1 to 40%. In step 3, with control variables controlled, both digital literacy (β=.19, p=.008) and grit (β=.31, p<.001) showed a significant influence on academic self-efficacy. The explained variance in step 3 increased by 6% compared to step 2, indicating that digital literacy and grit explain about 46% of the variance in academic self-efficacy.

The multicollinearity of the variables was checked, and the tolerance was above 0.1, while the Variance Inflation Factor (VIF) values were between 1.0 and 2.3, which is less than 10, confirming no multicollinearity issues. The Durbin-Watson value for this study was 1.976, indicating no problems with autocorrelation of errors.

Table 4. The Effects of Digital Literacy, Grit on Academic Self-Efficacy (N=260)

Variables	Model1			Model2			Model2		
	B	*β*	p	B	*β*	p	B	*β*	p
Gender	-.07	-.03	.547	-.15	-.07	.169	-.11	-.05	.296
DEE	.13	.06	.231	.09	.04	.397	.12	.06	.224
CRC	-.02	-.01	.830	.-.04	-.02	.666	-.04	-.02	.636
AA	-.64	-.54	<.001	-.37	-.31	<.001	-.43	-.36	<.001
DL				.49	.40	<.001	.23	.19	.008
Grit							.37	.31	<.001
R^2		.30			.40			.46	
Adj R^2		.29			.39			.45	
F		26.97 (<.001)			33.95 (<.001)			36.33 (<.001)	
Durbin-Watson							1.98		
DL: Digital Literacy, DEE: Digital Education Experience, CRC: Computer Related Certificates, AA: Academic Achievement									

The Mediating effect of Grit in the Relationship between two Variables

A mediation analysis was conducted to examine the mediating effect of grit on the relationship between the subjects' digital literacy and academic self-efficacy. The significance of the mediating effect was verified using the Sobel's Z-test, and the result was significant (Sobel's Z = 4.04, p<.001), exceeding the threshold of ±1.96.

The results of the regression analysis to determine the effect of digital literacy on academic self-efficacy showed that the VIF was between 1.0 and 2.3, below the threshold of 10.0, and the tolerance was above the threshold of 0.1, indicating no collinearity. The Durbin-Watson statistics were 1.98, close to the standard of 2.0, making the regression model suitable.

The mediating effect of grit on the relationship between digital literacy(DL) and academic self-efficacy(ASE) is presented in Table 4.

- **Step 1:** The effect of subjects' digital literacy(DL) on grit was statistically significant (β=.58, p<.001).
- **Step 2:** The effect of subjects' digital literacy(DL) on academic self-efficacy(ASE) was also statistically significant (β=.57, p<.001).
- **Step 3:** When subjects' digital literacy(DL) and the mediating variable, grit, were entered simultaneously, both digital literacy (β=.42, p<.001) and grit (β=.26, p<.001) had a significant effect on academic self-efficacy(ASE).

A comparison of the regression coefficients shows that the β value in step 2 (β=.57) was greater than the β value in step 3 (β=.42), confirming a partial mediating effect. The explained variance (R^2) was 33.9% in step 1, 32.7% in step 2, and 37.1% in step 3.

Table 5. Mediating Effect of Grit between Digital Literacy(DL) and Academic Self-Efficacy(ASE) (N=260)

Variables	B	SE	*β*	t(*p*)	Adj R^2	F(p)	Sobel Test

							z(*p*)
Step 1. DL → Grit	.61	.05	.58	11.51(<.001)	.34	132.35(<.001)	
Step 2. DL → ASE	.71	.06	.57	11.20(<.001)	.33	125.53(<.001)	
Step 3. DL → ASE	.52	.08	.42	6.94(<.001)	.37	75.80(<.001)	
Grit → ASE	.30	.07	.26	4.23(<.001)			
							4.04(<.001)
ASE: Academic Self-Efficacy							

Discussion

This study was to verify the mediating effect of grit on the relationship between nursing students' digital literacy and academic self-efficacy. For this, a survey was conducted on a total of 260 nursing students in the natural sciences and medical fields, and quantitative data analysis was performed using t-tests, regression analysis to assess the influence of digital literacy on academic self-efficacy, and [12] Baron and Kenny's (1986) verification procedure and the Sobel test for the mediating effect of grit. The main findings based on the analysis are discussed below in relation to previous research.

First, The strong positive correlation found in this study between digital literacy and academic self-efficacy (r = .57) supports the previous findings of Jeong et al. [3], who reported a similar significant relationship (r = .451). This reaffirms that students who are proficient in handling digital information and technology tend to have higher confidence in their academic abilities. The process of efficiently finding learning materials, solving assignments, and collaborating with peers using digital tools provides students with successful learning experiences, which in turn leads to an increase in academic confidence.

Second, the significant positive correlation between grit and academic self-efficacy (r=.50) is also supported by similar results (r=.47) reported in the study by [5] Lee (2023), demonstrating its robustness. This shows that the internal characteristic of passion and perseverance toward a goal is closely linked to the academic belief that 'I can do it.' Students with high grit do not easily get frustrated when facing difficult tasks and persevere, and in this process, they positively evaluate their abilities, which strengthens their self-efficacy, forming a virtuous cycle.

Third, one of the unique and important findings of this study is the very strong positive correlation between digital literacy and grit (r=.58). Although no research directly verifying this relationship was found in the provided references, this result offers important implications for learners in the digital age. It suggests that digital competency is not just a technical dimension but can also positively influence a learner's attitude and perseverance. That is, the ability to efficiently use digital tools can make complex and long-term academic tasks more systematic and interesting, helping to maintain students' interest in learning and contributing to their persistence in finding solutions when facing difficulties.

The most crucial finding of this study is that grit plays a significant partial mediating role in the relationship between digital literacy and academic self-efficacy. This empirically demonstrates that beyond its direct effect on academic self-efficacy, there is an important indirect path through the powerful psychological mechanism of 'grit.' Furthermore, the confirmation of a partial mediating effect of grit in this study suggests the possible existence of other mediating and moderating variables. As discussed earlier, it is necessary to verify an expanded research model that includes additional mediating variables such as self-regulated learning ability and optimism, and moderating variables such as professor support, peer support, and learning styles. This will contribute to a more comprehensive and multidimensional understanding of the successful mechanisms of nursing students and aligns with the suggestion from this study's conclusion to 'identify other variables that may affect academic self-efficacy.' It is expected that such multifaceted follow-up research will help prepare more effective and sophisticated educational strategies for cultivating competent and resilient nursing talent that meets the demands of the digital age.

Conclusion and Suggestions

This descriptive survey study examined the mediating role of grit in the relationship between nursing students' digital literacy and academic self-efficacy. The results showed that nursing students' digital literacy had a significant correlation with grit and academic self-efficacy, and grit had a significant correlation with academic self-efficacy. Grit was found to have a partial mediating effect on the relationship between digital literacy and academic self-efficacy, explaining 37.1% of the variance in academic self-efficacy. Therefore, efforts are needed to satisfy nursing students' academic self-efficacy by developing and applying educational programs that can increase their digital literacy levels and enhance their grit. Based on the results of this study, the following suggestions are made:

First, we suggest repetitive studies to identify variables that affect the academic self-efficacy of nursing students. Second, we suggest continuous research by expanding the study to nursing students in various regions. Third, we suggest follow-up research to verify the effects of developing and applying educational programs that can improve the digital literacy and grit of nursing students. Fourth, as grit was found to have a partial mediating effect on the relationship between digital literacy and academic self-efficacy, we suggest research to identify other variables that may affect academic self-efficacy besides the variables presented in this study.

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