



Influence of Smart Device Utilization on Career Maturity of Korean Adolescents: Mediating Effect of Information Capabilities and Moderated Mediation Effect of School Level

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ABSTRACT

The problem and the aim of the study. This study examined the mediating effect of information capabilities and the moderated mediating effect of school level on the relationship between smart device utilization and career maturity among South Korean middle and high school students. *The primary aim* was to explore whether and how students' information capabilities mediate the link between their use of smart devices and career maturity, and whether this mediating effect differs by school level.

Research methods. Questionnaires were administered to 400 South Korean middle and high school students, measuring their smart device utilization, career maturity, information capabilities, and school level. Data analysis was conducted using SPSS Win 27.0, which included reliability analysis, descriptive statistics, frequency analysis, and correlation analysis. To analyze the mediation and moderated mediation effects, the SPSS PROCESS Macro 4.2ver was utilized, specifically using Model 4 (for mediation) and Model 7 (for moderated mediation).

Results. The findings of the study are as follows.: South Korean middle and high school students reported low levels of smart device utilization ($M=2.03/5$) and of information capabilities ($M=53.41/160$) but high level of career maturity ($M=109.17/150$). Second, Smart device utilization influenced career maturity indirectly through the mediating variable of information capabilities (indirect effect = .161, 95% CI [.095, .241]). Students who used smart devices more frequently tended to have greater information capabilities, which in turn enhanced their career maturity. Third, the effect of smart device utilization on career maturity, mediated by information capabilities, varied by school level. The study underscores that improving career maturity among South Korean middle and high school students requires not only the utilization of smart devices but also the enhancement of information capabilities. These findings carry important implications for career education and development strategies in secondary schools.

Conclusion. The results of this study are significant in that they highlight the importance of enhancing information capabilities to enhance career maturity among students. Furthermore, the findings indicate that high school students exhibit greater smart device utilization compared to middle school students, which moderates the effect on their information capabilities.

KEYWORDS

smart device utilization, career maturity, information capabilities, school level, mediating effect of information capabilities and moderated mediation effect

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INTRODUCTION

The advancements in and proliferation of information and communication technology have laid the foundation for the growth of e-commerce, non-face-to-face financial activities, and the development of social networks through the use of artificial intelligence, big data, and the metaverse using smart devices [1]. In particular, the years following the COVID-19 pandemic have seen rapid advancements in technologies supporting education, work, and social network formation in non-face-to-face environments, increasing the demand for digital literacy [2]. As of 2023, smartphone ownership among Korean youth stood at 96.5%, and the use of smart devices among students is on the rise as smart devices are being introduced to students as non-face-to-face teaching aids in educational settings as a result of COVID-19 [3]. Adolescents exhibit a preference for smartphones over computer devices, with a higher rate of smart device utilization for social networking services (hereinafter referred to as SNS) and instant messaging compared to other age groups [4]. Adolescents may benefit emotionally from engaging in social interactions through smartphone use, which can contribute positively to their emotional well-being [5]. However, not only excessive use but also the persistence of such excessive use [6] has been linked to negative mental health outcomes, including depression, anxiety, loneliness, and stress [7].

According to the data from middle and high schools in Korea, increased smartphone usage among third-year high school students correlates with increased anxiety levels compared to their middle school counterparts [8]. This suggests that Korean high school seniors limit smartphone usage due to the pressures of preparing for college entrance exams. Additionally, high school students use media such as online video platforms, portal sites, and social media more frequently than middle school students for educational purposes and information searches [9]. However, as student progress through elementary, middle, and high school, their awareness of having received media literacy education decreases. Therefore, it becomes imperative to develop information capabilities through systematic education to enable effective media utilization and recreation.

Although various smart devices are under development, limited access for adolescents can impede their ability to use them and engage with information effectively [10]. In order to enhance information capabilities through education, it is essential to ensure lifelong access to a variety of smart devices, reinforcing the need for continuous education [11]. The increasing demand for information capabilities is also calling for revisions to the national curriculum, which forms the basis of Korean school education. The 2022 revised curriculum [12] focuses on supporting learning tailored to students' characteristics and career pathways by empowering them to navigate the age of artificial intelligence and digital transformation. Practical subjects such as Technology and Home Economics now integrate digital and AI literacy in their goals, content frameworks, and achievement standards [13]. In addition, there are plans to enhance tailored education through AI-powered digital textbooks, with an emphasis on cultivating career capabilities essential for navigating future uncertainties [14]. Strengthening information capabilities through targeted education based on individual learner needs can lead to positive outcomes. In this process, information capabilities that include digital information utilization, information management, and the ability to leverage digital information and technology are becoming increasingly important [15]. Research suggests that these information capabilities can significantly improve the quality of life by enabling the acquisition of useful information through computers and mobile devices, aided by information and communication technologies [16].

While information capabilities are often interchangeably referred to as ICT capabilities, digital capabilities, digital literacy, or digital information capabilities, this study defines them as information capabilities. In Korea, research on information capabilities mainly discusses the information gap among the elderly, people with disabilities, and low-income groups, focusing on the ways to bridge this gap [17]. When it comes to middle-aged and elderly people, research has primarily demonstrated that information capabilities play a mediating role in the relationship between attitudes toward new technologies and information activities [18]. However, there remains a need for further research to examine the relationship between information capabilities and career maturity.

In the case of youth, the focus should be on enhancing information capabilities that go beyond simply consuming information and can be actively utilized and applied to their career paths [19]. Adolescents' information capabilities include several key aspects such as their sense of efficacy in using digital devices, attitudes toward digital technology, information use (PC), social relationships and information sharing services (PC and smartphone), and the extent of information production

and sharing [3]. It was the pandemic that catalyzed the development of robust infrastructure for learning through smart devices, underscoring the need to strengthen information capabilities that can be effectively applied to real-life situations [20]. This process facilitates the establishment of a learning environment that allows students to receive tailored education and guides them to shape their desired career paths [21].

In the school setting, smart devices can be integrated into the curriculum to develop students' affective attitudes and cognitive abilities necessary for career exploration, planning, and career maturity – the ability to decide and execute a career path [22]. Career maturity refers to not only the cognitive and affective abilities required to choose a career path but also the ability to act on it [23]. In today's technology-driven society, this concept of career maturity is not only linked to students' information capabilities using smart devices [24] but is also reported to enhance learning effectiveness [25]. Additionally, the use of smart devices positively affects self-directed learning by enhancing knowledge and information processing capabilities [26]. Students with high career maturity tend to use smart devices to plan their future and exhibit lower levels of smartphone addiction or excessive gaming [27]. In addition, studies show that adolescents who perceive themselves as competent in using smartphones report higher career maturity and school satisfaction, suggesting that effective smart device use can improve students' information capabilities and career maturity [28].

A comprehensive analysis of existing studies suggests a correlation between smart device utilization and information capabilities, as well as between information capabilities and career maturity. However, research specifically examining the relationships among smart device utilization, information capabilities, and career maturity at the middle and high school levels is lacking.

This study aims to fill this gap by analyzing the effects of smart device utilization, information capabilities, and career maturity, with a particular focus on differences between middle and high school students. Specifically, it investigates the mediating effect of information capabilities on the relationship between smart device utilization and career maturity, as well as the moderated mediation effect of school level. The study seeks to propose strategies for enhancing career maturity among middle and high school students.

To this end, the study answers the following research questions: First, it examines the general trends and correlations among smart device utilization, career maturity, and information capabilities. Second, it analyzes the mediating effect of information capabilities on the relationship between smart device utilization and career maturity while also investigating the moderated mediation effect of school level among middle and high school students.

METHODS

Research Model

This study examines the effect of smart device utilization on career maturity among middle and high school students, focusing on the mediating role of information capabilities and the moderated mediation effect of the school level. Figure 1 depicts the research model.

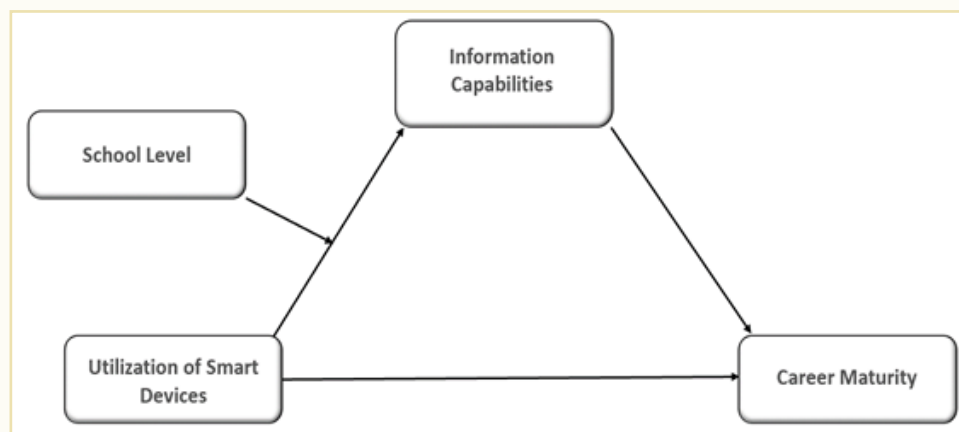


Figure 1 Research Model

Research subjects and data collection procedures

This study surveyed middle and high school students in South Korea, analyzing a total of 400 complete responses. Data were collected using a questionnaire approved by the Kyungpook National University Ethics Committee (IRB, 2024-0023), and the study was conducted after obtaining consent from legal representatives and research subjects. The survey was conducted using Google Forms from February 1 to April 6, 2024. The study subjects resided in Seoul and Gyeonggi regions, as well as Kyungpook and Busan regions.

Instruments and Procedures

The smart device utilization scale comprises 12 items, rated using a five-point Likert-type scale (1 = very unlikely, 5 = very likely). The measurement tool is based on the questionnaire from the 2023 digital information gap survey conducted by the Ministry of Science and ICT & National Information Society Agency [17]. The scale measures the frequency of use of various technologies over the past week. These include desktop computers, laptops, tablet PCs, e-book readers, external storage devices, cloud storage services, augmented reality (AR) and virtual reality (VR), Internet of Things (IoT), AI robots, personal broadcasting/video content production/equipment, SNS, and video conferencing services. The higher the score, the higher the smart device utilization. The Cronbach's alpha for the scale is .720.

The information capabilities measure comprises 32 items, rated using a five-point Likert-type scale (1 = very unlikely, 5 = very likely). It includes 14 questions on information activities (PC and smart devices) and 18 on information utilization (PC and smart devices). A higher score means stronger information capabilities, with a Cronbach's alpha of .920.

The career maturity scale, developed by Lee [29] for high school students, comprises 30 items, rated using a 5-point Likert-type scale (1 = very unlikely, 5 = very likely). The Cronbach's alpha for this scale is .966.

Characteristics of research subjects

The subjects of this study were female students (45.8%) and male students (54.3%). Grade-level distribution was: 21.0% middle school second-year students, 26.0% middle school third-year students, 38.5% high school first-year students, and 14.5% high school second-year students, with a slightly higher proportion of high school students than middle school students. Regarding the level of academic achievement, 52.8% of students reported above-average achievement, while 47.3% reported below-average achievement.

Statistical Analysis

Data analysis included reliability analysis, frequency analysis, descriptive statistics, and correlation analysis using SPSS (ver. 27.0 for Windows). The mediating effect and moderated mediation effect were examined using the PROCESS macro version 4.3 (Models 4 and 7) developed by Hayes [30]. Cronbach's alpha values were calculated to assess the reliability of the variables and the internal consistency of the measurement scales.

RESULTS

Correlation between variables

Before proceeding with the analysis of the research model, descriptive statistics were computed for the main variables, including the mean, standard deviation, skewness, and kurtosis (see Table 1). Results show smart device utilization among middle and high school students is low, with a mean score of 2.034 out of a possible 5. In contrast, the mean scores for information capabilities and career maturity were significantly higher, at 3.815 and 3.639, respectively.

These findings suggest that, relative to the median score of 3, the level of smart device utilization among Korean middle and high school students is low. Conversely, both information capabilities and career maturity are rated high.

To ensure the validity of subsequent analyses, variable distribution was assessed using Kline's [31] standards. According to these criteria, skewness should not exceed an absolute value of 3, and kurtosis should not exceed an absolute value of 10. The analysis revealed skewness ranged from .028 to .900 while kurtosis ranged from .134 to .824, confirming normal distribution and satisfying assumptions for further statistical analyses.

Table 1 General trends of key variables <n=400>

	M(S.D.)		Skewness		Kurtosis	
	M	S. D.	Statistics	S. E	Statistics	S. E
Smart Device Utilization	2.034	.563	.900	.122	.824	.243
Information capabilities	3.815	.776	-.643	.122	.616	.243
Career maturity	3.639	.695	.028	.122	.134	.243

Contrary to initial expectations, the analysis revealed unexpectedly low overall smart device utilization among participants. To gain further insights, the mean and standard deviation of the 12 specific questions related to smart device usage were examined (Table 2). The results indicated that traditional smart devices, such as desktop computers, laptops, and tablet PCs, had notably low overall utilization. However, a significant exception was observed in the usage of social networking services (SNS), scoring a mean of 4.023 out of 5. Therefore, it is difficult to conclude that the level of smart device utilization among Korean youth is low based on the low overall mean.

Table 2 Frequency smart device utilization<N=400>

Items	M	S.D.
desktop computer	2.290	1.433
laptop	2.190	1.284
tablet PC	2.775	1.483
e-book reader	1.293	0.740
external storage device.	1.690	1.035
Cloud Storage service	1.970	1.258
AR & VR	1.413	0.757
IoT	1.787	1.16
AI robot	1.587	0.888
Internet private broadcasting/ Image Contents Production/ Equipment	1.450	0.877
SNS	4.023	1.346
video conferencing service	1.945	1.077

Correlation between variables

Before analyzing the moderated mediation effect of school level on the relationship between smart device utilization, information capabilities, and career maturity among middle and high school students, the correlations among these variables were examined [Table 3].

Table 3 Correlation between variables <n=400>

	Smart Device Utilization	Information capabilities	Career maturity
Smart Device Utilization	1		
Information capabilities	.323**	1	
Career maturity	.238**	.438**	1

The analysis revealed significant positive correlations between all variables. Specifically, higher smart device utilization was associated with increased information capabilities ($r = .323$, $p < .01$) and greater career maturity ($r = .238$, $p < .01$). Additionally, information capabilities and career maturity showed a strong positive correlation ($r = .438$, $p < .01$). The correlation coefficients ranged from .238 to .438, thus excluding potential multicollinearity.

Mediating effect of information capabilities in the relationship between smart device utilization and career maturity of middle and high school students

To investigate the mediating effect of information capabilities, the SPSS PROCESS Macro Model 4 proposed by Hayes [30] was employed [Table 4, Figure 2]. The analysis revealed statistically significant mediating effects along all pathways.

Table 4 Mediating effect of information capabilities <n=400>

Variables	Coeffect	SE	t-value	p	LLCI	ULCI
Dependent variable: career maturity						
Constant	3.043	.127	23.997	.000	2.793	3.292
Smart Device Utilization	.293	.060	4.881	.000	.175	.411
$R^2 = .104$, $F=46.334$, $p=.000$						
Mediating variable: information capabilities						
Constant	2.911	.0138	21.120	.000	2.640	3.182
Smart Device Utilization	.445	.065	6.807	.000	.316	.573
$R^2 = .104$, $F=46.334$, $p=.000$						
Dependent variable: career maturity						
Constant	1.989	.170	11.704	.000	1.655	2.324
Smart Device Utilization	.132	.058	2.265	.024	.018	.247
information capabilities	.362	.402	8.524	.000	.278	.445
$R^2 = .202$ $F=50.381$, $p=.000$						
Total effect, direct effect						
	Coeffect	SE	t-value	p	LLCI	ULCI
Total effect	.293	.060	4.881	.000	.175	.411
Direct effect	.132	.058	2.265	.024	.018	.247
Verification of indirect Effect						
	Effect	BootSE	BootLLCI	BootULCI		
Smart Device Utilization->information capabilities->career maturity	.161	.037	.095	.241		

Figure 2 Statistical Models Mediating Effect

First, the results showed that smart device utilization had a positive effect on career maturity (coefficient = .293, $p < .001$), suggesting that greater smart device utilization is associated with increased career maturity. Moreover, when the mediating variable was included, the analysis showed

that smart device utilization positively influenced information capabilities (coefficient = .445, $p < .01$), which, in turn, positively affected career maturity (coefficient = .132, $p < .001$). These findings confirm that information capabilities mediate the relationship between smart device utilization and career maturity [Figure 2]. In other words, increased smart device utilization boosts information capabilities, which subsequently enhances career maturity.

Furthermore, while the total effect of smart device utilization on career maturity was .293, the direct effect decreased to .132 when information capabilities were included in the model. This suggests that information capabilities partially mediate the relationship between smart device utilization and career maturity [Table 4]. Bootstrapping with 5,000 resamples and a confidence interval set at 95.0% further validated the significance of the mediating effect [Table 4]. The mediating effect value was .161 for smart device utilization → information capabilities → career maturity was .161. Since the bootstrap lower limit of .095 and upper limit of .241 did not include zero, the effect was deemed statistically significant. Therefore, the analysis confirmed that information capabilities mediate the relationship between smart device utilization and career maturity.

Moderated mediation effect of school level

We employed Hayes's SPSS PROCESS Macro Model 7 to analyze the moderated mediation effect of the school level on the relationship between smart device utilization and career maturity through information capabilities. The analysis involved 5,000 bootstrap resamples with a 95% confidence interval [Table 5]. The results indicated that the interaction term between smart device utilization and school level had a positive effect on information capabilities (coefficient = .269, $p < .001$). The increase in R^2 due to this interaction was also significant ($\Delta R^2 = .009$, $p < .05$), demonstrating that school level moderates the relationship between smart device utilization and information capabilities.

A simple slope analysis further investigated the moderating effect, with the results presented in Figure 3. The graph shows that higher smart device utilization is associated with greater information capabilities among high school students compared to their middle school counterparts. This finding confirms that the school level significantly influences the relationship between smart device utilization and information capabilities.

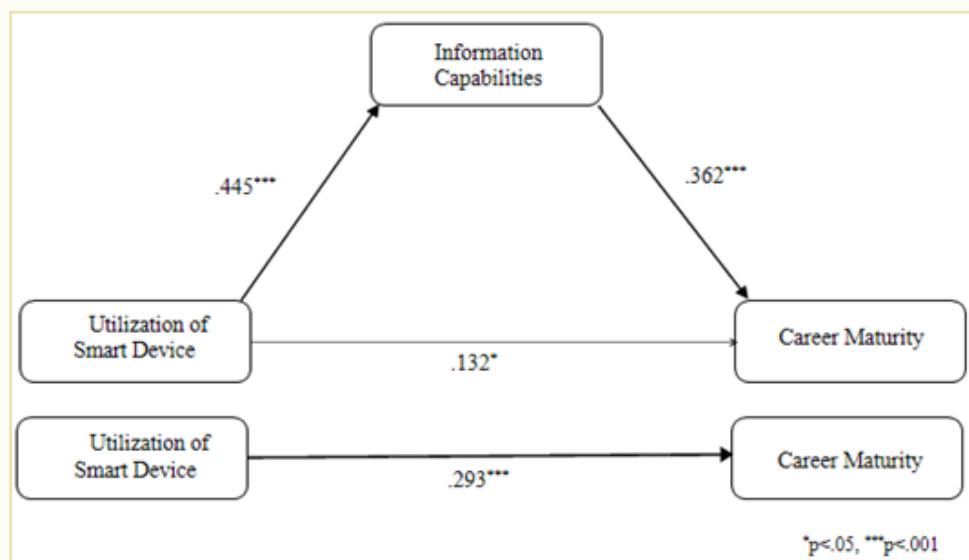


Figure 3 Moderating mediation effect of school level

Given that school level was found to have a moderating effect, the analysis proceeded to examine the conditional indirect effect of school level in the pathway from smart device utilization to information capabilities to career maturity. The analysis revealed a conditional indirect effect of .118 for middle school students and .215 for high school students, both statistically significant. These findings suggest that as the school level increases, the effect of smart device utilization on career maturity becomes more pronounced through information capabilities.

Moreover, the moderated mediation effect index was significant at .097 (95% CI: .005 to .1995), further confirming that school level mediates the influence of smart device utilization on career maturity through information capabilities [Table 5, Figure 4].

Table 5 Moderated mediating effect of School Level <N=400>

Classification		Model of mediating variable (DV: information capabilities)			Model of defendant variable (DV: career maturity)		
		Coeffect	SE	t-value	Coeffect	SE	t-value
Constant		3.587	.429	8.371***	1.989	.170	11.704***
Dependent variable	Smart Device Utilization	.057	.201	.283	.132	.058	2.265*
Dependent variable	information capabilities	-	-	-	.362	.042	8.524***
Moderated Mediation variable	School level	-.471	.276	-1.706			
Interaction	Smart Device Utilization*school level	.269	.131	2.055*			
Highest order unconditional interaction	R ²	.009					
	F	4.223*					
Model Summary	R ²	.116			.202		
	F	17.334***			50.381***		

Conditional indirect effect of school level (Smart Device Utilization->information capabilities->career maturity)				
School level	Effects	SE	LLCI	ULCI
Middle school stu-dents	.118	.046	.033	.214
High school students	.215	.043	.139	.307

Verification of conditional indirect effect				
	Effects	BootSE	BootLLCI	BootULCI
School level	.240	.128	.010	.519

LLCI=Boot lower bound 0within the 95% confidence interval of the indirect effect
 ULCI=Boot upper bound within the 95% confidence interval of the indirect effect

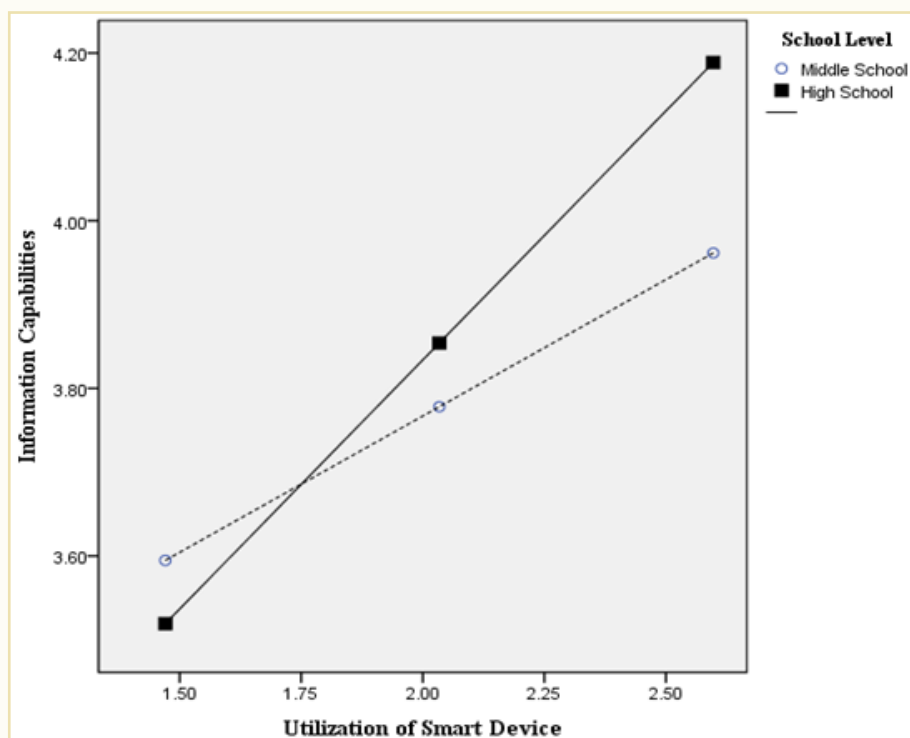


Figure 4 Statistical figure on moderated mediation effects of school level

DISCUSSION & CONCLUSIONS

This study examined the mediating effect of information capabilities and the moderated mediation effect of the school level on the relationship between smart device utilization and career maturity among middle and high school students. To this end, the study analyzed data from 400 middle and high school students nationwide using SPSS Win 27.0 Ver. for reliability analysis, descriptive statistics, frequency analysis, and correlation analysis. The mediation and moderated mediation effects were analyzed using SPSS PROCESS macro 4.2 ver. (Model 4, 7). The study yielded several key findings. First, middle and high school students exhibited low levels of smart device utilization but high levels of information capabilities and career maturity. Students primarily use smart devices for SNS, with tablet PCs, desktop computers, and laptops being the most frequently used devices after smartphones. The low overall frequency of smart device utilization among adolescents aligns with the prior research indicating that limited access to various smart devices, apart from smartphones, leads to lower information utilization [10]. The finding is also consistent with research showing that adolescents have a higher rate of using smart devices for SNS compared to other age groups [17]. Therefore, in order to enhance the information capabilities of youth, it becomes imperative to increase their access to and utilization of various smart devices.

Second, information capabilities were found to partially mediate the relationship between smart device utilization and career maturity among middle and high school students. In other words, the higher the smart device utilization, the higher the information capabilities, which, in turn, led to enhanced career maturity. This is consistent with existing research that links career maturity to smart device utilization and information capabilities, with career maturity increasing smartphone usage proficiency [24, 28]. These results underscore the need to improve both smart device utilization and the development of information capabilities to enhance career maturity. In other words, rather than simply focusing on searching for information or using SNS, the goal should be to utilize smart devices to enhance information capabilities that not only facilitate the lifelong acquisition of useful information but also contribute to improving quality of life [16]. Third, adolescents' smart device utilization was found to vary by school level in influencing career maturity through information capabilities. It can be observed that the higher the utilization of smart devices among high school students relative to their middle school counterparts, the more rapidly the effect on information capabilities manifests, suggesting that high school students are more influenced by smart device utilization in developing information capabilities. This indicates that high school students may have less experience with smart device utilization or media literacy education compared to middle school students, affording them a potential edge in enhancing their information capabilities when utilizing smart devices [9]. Therefore, it is recommended to emphasize education that improves the information capabilities of high school students before middle school students. Educational efforts must focus on enhancing students' analytical skills to determine the reliability of media information and their ability to produce data using smart devices through school education [9].

The results of this study are significant in that they highlight the importance of enhancing information capabilities to enhance career maturity among students. Furthermore, the findings indicate that high school students exhibit greater smart device utilization compared to middle school students, which moderates the effect on their information capabilities.

However, the study has certain limitations that warrant attention. Notably, it analyzed various forms of smart device utilization, except for smartphones, which happen to be the most widely used and accessible devices among adolescents. Additionally, the study's scope was limited by scarce research addressing the relationship between smart device utilization and information capabilities across different grade levels.

Future research should conduct a more detailed examination of the relationship between smart device utilization, information capabilities, and career maturity by grade. It should also investigate the relationship between students' information capabilities and career maturity for each specific smart device, including smartphones, which adolescents heavily use.

This comprehensive approach will offer valuable insights into how different devices influence students' information skills and career readiness, thereby contributing to more effective educational strategies.

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