Learners' Smart Media Literacy on the Gender and School Levels[*]

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The present study aims to examine whether the gender and school of students affect smart media literacy in South Korea. For the purpose of this study, data in Korea Youth Competency Measurement and International Comparative research II was analyzed. The data was nationwide data collected from 11,284 students in elementary, middle, high, and undergraduate school in South Korea. The participants were asked to answer 18 items of smart media literacy questionnaire (SMLQ) that consisted of four factors; *ability to learn using smart media, ability to operate smart devices, ability to use smart applications, and positive perception of using smart media.* As a result, statically significant differences were observed in the participants' gender and school levels. In relation to the gender level, female students scored higher than male students on the smart literacy survey. With regard to the school level, middle school students scored the highest while elementary school students scored the lowest. In addition, a statistically significant difference was found in the gender level of smart media literacy on two dependent measures in terms of the interaction effect of gender and school levels. Based on the findings of the present study, strategies to improve smart media literacy according to students' gender and school levels have been made and suggestions for further research have been proposed in detail.

Keywords: Smart Media Literacy, smart media, gender differences, school level

Introduction

Literacy of learners in the 21st century

Society, economy, culture, and life as a whole are rapidly changing all over the world, dramatically accelerated by information and communication technology. In this era of rapid change, doing well in school does not guarantee a lifelong job or career any longer, but the knowledge and skills one has to negotiate constant change and reinvent oneself can help adapt to new situations (Bellanca & Brandt, 2010). To secure the competitiveness of the 21st century, people should have abilities to adapt to and survive in new changing environments (Sung & Jin, 2015).

Thus, smart media literacy is one of the critical factors for success in the 21st century. Smart media refer to advanced mobile devices such as "smart" phones or pads where multiple functions, including telephone, WiFi, 3G, Bluetooth, and global positioning system (GPS), are embedded (El-Hussein, Cronje, 2010; Sheng, Nah, & Siau, 2005; Sung, 2014). According to the Korea Communications Commission (KCC) and the Korea Internet & Security Agency (KISA) (2010; 2012), more users of smart media are reported to spend time on the Internet for communication (51.0%), more information and knowledge (73.4%) and more effective learning and business (51.0%). This, in turn, means that smart media has changed the ways we work, carry on with daily life and learn while offering potentials to improve learning performance and facilitate learning process. In short, such potentials stem from smart media's ability to connect people to a vast sea of information and to offer mobility to get information, anytime and anywhere (Vinu, Sherimon, & Krishnan, 2011).

What is smart media literacy?

Thanks to high connectivity and mobility, smart media offer learners to access

knowledge and information both in and out of the classroom and expand the breadth and depth of formal and informal education, in accordance with the learners' backgrounds and situations (Yen & Lee, 2011). Then, what kind of literacy is needed to use smart media effectively? In an attempt to understand the smart media literacy, one needs to take a closer look at the characteristics of smart media. First of all, smart media has two characteristics; smart devices, and smart contents or software. A smart device is a device which integrates multiple functions and media, such as telephone, WiFi, computing technology, GPS, MP3 player, presentation software, word processing software, image editing software, dictionary, navigation software, fax, 3D, augmented reality, G-censor, Big data, etc.). Smart devices integrating multiple functions and media software are more easy to use and effectively removing boundaries between different forms of media (Sung, 2014; 2015). On the other hand, smart contents or applications can maximize the functions of smart devices by providing user needs in terms of usefulness, convenience and usability (Choi, Woo, & Jung, 2013; Woo, Choi, Jung & Kim, 2012). Smart media literacy is taken as an umbrella concept of ICT literacy, media literacy and information literacy. The general definition of literacy is "the condition of being literate"(Chambers English Dictionary, 2003). However, the ICT literacy refers to a set of skills that enable users to actively participate in a society where social and cultural services are computer-supported and available online (UNESCO, 2011) while the media literacy indicates an ability to access, understand and critically evaluate different aspects of the media and its contents and to create communication in a variety of contexts (European Commission, 2007). Moreover, the information literacy is one of the key ability in a Knowledge Society which is the optimal ability to locate, identify, retrieve, process and use digital information (UNESCO, 2011). In addition, according to Sung (2014; 2015), the smart media literacy is an ability to collect, edit and create information and knowledge while using the hardware and software of smart devices with a positive perception of the smart media. In his view, there are four abilities that constitute the smart media

literacy – namely, ability to learn using smart media, ability to operate smart devices, ability to use smart applications, and positive perception of using smart media. The ability to learn using smart media is an ability to acquire new knowledge by collecting, editing, and creating information while using smart media. The ability to operate smart devices is an ability to operate the hardware of smart media while the ability to use smart applications is an ability to appropriately use various software embedded in smart media for the right purpose. Lastly, the positive perception of using smart media is a positive image a user has of the usefulness and convenience of smart media. In the course of this paper, the term, Smart Media Literacy (SML) will be used as it pertains to other literacies.

How does learners' ability to use smart media change over the school years?

Smart media literacy (SML) is shown to be significantly different according to learner characteristics. While in elementary and middle school, learners have a positive relationship with smart media and perceive positively of using smart media with regard to their learning ability (Sung, 2014; 2015). Elementary school students with a high level of smart media literacy show better subjective attitude and academic performance than elementary students with the low level of smart media literacy (Sung, 2015). As for middle school students, there is a significant gender difference where female students have a higher level of smart media literacy than their male counterparts (Sung, 2014).

A few studies report that a gender issue in technology use is an important factor in teaching and learning because the issue stems from culture as technology is not neutral (Gurumurthy, 2004). Gurumurthy (2004) reported that woman and men of the same social background may not enjoy equal access to information and communication technology. Also, British Educational Communications and Technology Agency (2008) reported that there are a few significant differences in

girls' access to and use of technology within school and home. Moreover, at the school levels, mobile phones as smart media are one technology where girls are significantly ahead of boys in terms of both their use and ownership (Ofcom, 2008). According to Ofcom (2008), amongst learners aged 12-15, girls show a significantly higher level of mobile phone use than boys. This means that there exist differences as learners move up the school levels.

However, the aforementioned studies did not report on gender differences (male vs. female) among the learners with regard to their school levels (elementary, middle, high and undergraduate schools). If the studies were to find out the differences in smart media literacy in relation to learners' gender and school levels, it would be able to be provide the learners' aptitude for creating strategies to use smart media by gender and school levels. Thus, more research is needed to identify the differences in smart media literacy with regard to learners' school levels such as primary school, secondary school and undergraduate school.

Therefore, this study is to examine the differences in learners' smart media literacy with regard to their gender and school levels. To this end, the following research questions have been made:

1. Is there a gender difference in learners' smart media literacy?
2. Is there a school level difference in learners' smart media literacy?
3. Is there an interaction effect of gender and school levels in learners' smart media literacy?

Method

Data collection

The present study used a data set from the Korean Youth Competency Measurement and International Comparative Study II: International Civic and

Citizenship Survey (ICCS) 2016 was collected from elementary school students (4~6th grades), middle school students (1~3th grades), high school students (1~3th grades), and undergraduate students (1~4th years) nationwide in South Korea. In this research, a stratified clustered sample design was used on the sample group of randomly selected 2,914 elementary school students (1,512 males, 1,402 females), 3,404 middle school students (1,685 males, 1,719 females), 3,966 high school students (2,541 males, 1,425 females), and 1,000 undergraduate students (499 males, 501 females) from 7 cities and 9 provinces in South Korea. In other words, a total number of 11,284 students (6,237 males (52.2%) and 5,047 females (47.8%)) participated in the study. The mean age of participants was 15.90 years (SD=3.17); 11.99 years (SD =.82) for elementary school students, 15.02 years (SD =.83) for middle school students, and 17.99 years (SD =.81) for undergraduate students.

Materials

The paper-based material consisted of participant characteristics and a Smart Media Literacy Questionnaire (SMLQ). The participant questionnaire solicited demographic information concerning a respondent's age, gender, and school levels while the SMLQ consisted of 18 rating items with regard to four factors (ability to learn using smart media, ability to operate smart devices, ability to use smart applications and positive perception of using smart media) developed by Sung (2014; 2015). The questionnaire of this study was validated by three middle school teachers, three educational technology researchers and three smart media experts. The respondents were asked to rate on a 4-point scale (from 4 = strongly agree to 1 = strongly disagree) of frequency with which they used their smart media for items such as "I can get a variety information with using internet of smart device.", "I can learn a variety learning materials (e.g. lecture movie clip, YouTube, TED, web document, etc.)", "I can easily operate the various functions of smart device.". The reliability coefficient obtained by *Cronbach's alpha* was .926 with each subscale in the range of 0.690 and 0.851, indicating suitable reliability.

Table 1. Reliability of the four factors of smart media literacies

Factors	Number of items	Cronbach's alphas
Ability to learn using smart media	3	.690
Ability to operate smart devices	4	.838
Ability to use smart applications	5	.851
Positive perception of using smart media	6	.850
Total	18	.926

Data analysis

Two-way Multivariate Analysis of Variance (MANOVA) was used in order to examine whether the respondents showed any gender and school-level difference in smart media literacy and an interaction effect of these dependent variables (gender and school levels).

During the first phase of the analysis, a standard normal distribution of SMLQ's ratings was identified by verifying that the value of skewness (<2) and kurtosis (<7) were within an acceptable range (Chou & Bentler, 1995; Curran, West, & Finch, 1996), and Cronbach's alpha value of analyzing the reliability was over the threshold of being acceptable (.600) (Brace, Kemp, & Snelgar, 2009). Therefore, it was found that the distribution of SMLQ was normal with the skewness in the range of -1.31 and -.00 and the kurtosis in the range of .40 and 6.04. Moreover, the reliability coefficient showed a suitable value of .926. In the second phase, correlation analysis was employed to examine the relationship among the four factors of smart media literacy while in the third phase, a two-way multivariate analysis of variance (MANOVA) was conducted to examine whether the respondents exhibited any gender and school-level differences, and to determine the interaction effect of gender and school levels on smart media literacy. The survey results may point to the key effects of gender and school levels on smart media literacy. SPSS 19.0 software was used to analyze the data.

Results

Correlations among the four factors of smart media literacy

Table 2 depicts Pearson correlations among the four factors of smart media literacy. The ability to learn using smart media is found to be significantly correlated with the ability to operate smart devices ($r = .62$, $p<.001$), ability to use smart applications ($r = .64$, $p <.001$) and positive perception of using smart media ($r = .53$, $p <.001$). In addition, the ability to operate smart devices also was shown to be significantly correlated with the ability to use smart applications ($r = .75$, $p <.001$) and positive perception of using smart media ($r = .58$, $p <.001$). The ability to use smart applications also had significant correlations with the positive perception of using smart media ($r = .62$, $p <.001$).

Table 2. Pearson Correlations among the four factors of smart media literacy

Factors	Ability to learn using smart media	Ability to operate smart devices	Ability to use smart applications	Positive Perception of using smart media
Ability to learn using smart media	1	.62***	.64***	.53***
Ability to operate smart devices		1	.75***	.58***
Ability to use smart applications			1	.62***
Positive perception of using smart media				1

*$p<.05$, **$p <.01$, ***$p <.001$

Associations between gender and school Levels in smart media literacy

A two-way multivariate analysis of variance (MANOVA) was conducted to

determine the differences among the four factors of smart media literacy in relation to the two dependent variables (gender and school levels). As reported in Table 3, in terms of gender, there were statistically significant differences in smart media literacy on the dependent measures; *Wilk's Lambda* =.99, F $_{(4, 11,273)}$ =35.24, *p*<.000. Moreover, in terms of school levels, another dependent variable, there found to be statistically significant differences; *Wilk's Lambda* =.94, F $_{(12, 29,826)}$ =58.59, *p*<.000. In addition, the MANOVA showed a statistically significant interaction between the gender and school levels for smart media literacy; *Wilk's Lambda* =1.00, F $_{(12, 29,826)}$ =4.36, *p*<.000.

Table 3. Results of multivariate analysis of variance

Independent variable	Wilk's *Lambda*	F	Hypothetical *df*	Error *df*
Intercept	.03	105,300.89***	4	11,273
Gender	.99	35.24***	4	11,273
School levels	.94	58.59***	12	29,826
Gender * School levels	1.00	4.36***	12	29,826

* *p*<.05, ** *p* <.01, *** *p* <.001

In all the four factors of smart media literacy, there were significant differences among gender, school levels, and gender*school levels. However, in the item of *Positive perception of using smart media*, no significant difference was found between male and female students (*F* = .59, *p*=.442).

Gender differences of smart media literacy

As shown in Table 4, there were statistically significant differences between genders in the smart media literacy at the levels *ps*<.000. On the whole, female students (*M*=3.38, *SD*=.48) have a higher level of smart media literacy than male students (*M*=3.31, *SD*=.50). Moreover, with regard to the ability to learn using

Table 4. MANOVA results of gender and school levels for smart media literacy

Dependent Variables	Independent Variables	Type III Sum of Squares	df	MEAN Square	F
Ability to learn using smart media	Corrected Model	82.79	7	11.83	34.89***
	Gender	26.15	1	26.15	77.14***
	School levels	20.37	3	6.79	20.02***
	Gender*School levels	8.68	3	2.89	8.54***
Ability to operate smart devices	Corrected Model	64.58	7	9.23	32.64***
	Gender	5.02	1	5.02	17.76***
	School levels	48.31	3	16.11	56.98***
	Gender*School levels	7.25	3	2.42	8.55***
Ability to use Smart applications	Corrected Model	148.17	7	21.17	63.70***
	Gender	21.93	1	21.93	65.99***
	School levels	101.12	3	33.71	101.43***
	Gender*School levels	10.26	3	3.42	10.29***
Positive perception of using smart media	Corrected Model	109.29	7	15.61	45.77***
	Gender	.20	1	.20	.59
	School levels	99.84	3	33.28	97.56***
	Gender*School levels	8.71	3	2.90	8.51***
Total	Corrected Model	84.71	7	12.10	51.72***
	Gender	7.84	1	7.84	33.52***
	School levels	60.94	3	20.31	86.82***
	Gender*School levels	8.18	3	2.73	11.66***

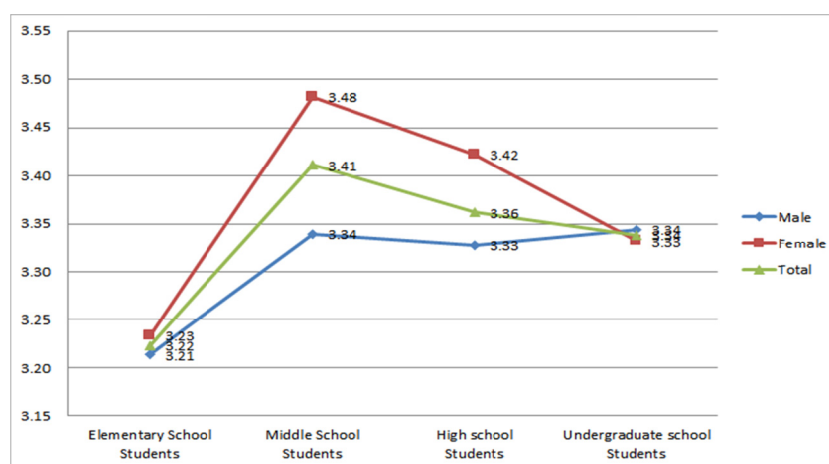$^{*}\,p<.05,\,^{**}\,p<.01,\,^{***}\,p<.001$

Figure 1. Smart media literacy on gender and school levels

smart media, female students (*M*=3.36, *SD*=.56) scored higher than their male counterparts (*M*=3.22, *SD*=.60) while female students (*M*=3.57, *SD*=.52) were also higher than male students (*M*=3.51, *SD*=.55) in operating smart devices. In addition, female students (*M*=3.44, *SD*=.56) used smart applications better than male students (*M*=3.32, *SD*=.60). What is more, female students (*M*=3.22, *SD*=.59) had a more positive perception of smart media use than male students (*M*=3.19, *SD*=.59). The female students showed the highest score in the ability to operate smart devices (*M*=3.57, *SD*=.52) but the lowest score in the positive perception of using smart media (*M*=3.22, *SD*=.59). Such tendencies were also observed among the male students who showed the highest score in the ability to operate smart devices (*M*=3.51, *SD*=.55) but the lowest score in the positive perception of using smart media (*M*=3.19, *SD*=.59).

Table 5. Descriptive statistics of gender in smart media literacy

Factor	Gender	N	Mean	Std. Deviation
Ability to learn using smart media	Male	6,237	3.22	.60
	Female	5,047	3.36	.56
Ability to operate smart devices	Male	6,237	3.51	.55
	Female	5,047	3.57	.52
Ability to use smart applications	Male	6,237	3.32	.60
	Female	5,047	3.44	.56
Positive perception of using smart media	Male	6,237	3.19	.59
	Female	5,047	3.22	.59
Total	Male	6,237	3.31	.50
	Female	5,047	3.38	.48

* p<.05, ** p <.01, *** p <.001

Differences of Smart Media literacy by School Levels

Post Hoc tests were conducted in order to examine the differences in the perception of smart media literacy among the elementary, middle, high, and

undergraduate school students. The *Post Hoc* tests showed significant differences among school levels ($F_{(3, 11,280)}$ = 83.33, *p*<.000). According to the results, middle school students (*M*=3.41, *SD*=.46) perceived their smart media literacy to be higher than those of high (*M*=3.36, *SD*=.46) and undergraduate school students (*M*=3.34, *SD*=.43). However, elementary school students recognized their smart media literacy to be the lowest (*M*=3.22, *SD*=.57) except for their ability to operate smart device (*M*=3.47, *SD*=.60).

Table 6. Post Hoc test results on school levels for smart media literacy

	School levels	N	Mean	Std. Deviation	*F*	*Post Hoc Tests*
Ability to learn using smart media	Elementary	2,914	3.22	.67	20.02***	Middle=Undergraduate>High= Undergraduate >Elementary
	Middle	3,404	3.33	.56		
	High	3,966	3.28	.56		
	Undergraduate	1,000	3.32	.51		
Ability to operate smart device	Elementary	2,914	3.47	.60	56.98***	Middle=High> Elementary>Un dergraduate
	Middle	3,404	3.59	.50		
	High	3,966	3.57	.51		
	Undergraduate	1,000	3.41	.52		
Ability to use smart applications	Elementary	2,914	3.22	.69	101.43***	Middle=High> Undergraduate >Elementary
	Middle	3,404	3.44	.55		
	High	3,966	3.44	.54		
	Undergraduate	1,000	3.38	.49		
Positive perception of using smart media	Elementary	2,914	3.06	.68	97.56***	Middle=Undergraduate>High> Elementary
	Middle	3,404	3.31	.56		
	High	3,966	3.20	.55		
	Undergraduate	1,000	3.26	.49		
Total	Elementary	2,914	3.22	.57	86.89***	Middle>High= Undergraduate >Elementary
	Middle	3,404	3.41	.46		
	High	3,966	3.36	.46		
	Undergraduate	1,000	3.34	.43		

* *p*<.05, ** *p* <.01, *** *p* <.001

In general, the perception of smart media literacy among middle school students was found to be the highest while the perception of smart media among elementary school students was the lowest, when comparing with the students of other school levels. Although undergraduate school students highly perceived of their smart media literacy level in terms of the ability to learn using smart media (M=3.32, SD=.51) and the positive perception of using smart media (M=3.26, SD=.49), they scored the lowest in the ability to operate smart device among those of the students by other school levels (M=3.41, SD=.52). High school students highly perceived of their smart literacy in terms of the ability to operate smart device (M=3.57, SD=.12) and ability to use smart applications (M=3.44, SD=.54).

Discussion and Conclusion

The purpose of the present study is to examine the differences in four factors of smart media literacy in relation to learners' gender and school levels. The four factors of smart media literacy were the ability to learn using smart media, ability operate smart device, ability to use smart applications, and positive perception of using smart media.

According to the findings of the study, significant differences were found between male and female students. In general, female students' smart media literacy was higher than that of male students. Such result supports a fact that the smart media literacy of students is related to their use of smart media. For example, female students tend to use smart media and social media applications for various needs with family members and friends than male students (Sung, 2013). Therefore, their smart media literacy could improve because female students more frequently use smart media than male students.

However, both male and female students recognized that their perception of using smart media to be the lowest. This shows that most students perceive the use

of smart media to be a negative behavior. Furthermore, there were similar findings in the previous studies (Sung, 2015) and the negative perception of using smart media affects learners' academic performance in the subjects of Korean and Math.

In addition, there were significant differences among school levels in smart media literacy. Middle school students, in particular, showed the highest smart media literacy among all students. Moreover, there were differences in the usefulness of smart media among students of different school levels (Choi, Yun, & Lee, 2013). For example, with regard to the item, 'I can create and edit documents, graphics, and video clips by using various smart applications such as HWP, Excel, and PowerPoint', undergraduate school students showed the highest among all students since elementary, middle, and high school students did not have a need for word processing software. That is to say, the smart media literacy of middle school students was the highest because they were using most of smart devices and applications among all students (Ministry of Science, ICT and Future Planning, MSIP, 2014).

Many studies have shown differences in the use of smart media between female and male students (Valentine, & Bernhisel, 2008). Moreover, male students are known to play online game and enjoy online entertainments more frequently than female students (Peter, & Valkenburg, 2006) whereas female students are known to use more variety of smart media in a more positive way (Ji, Wang, Zhang, & Zhu, 2014; Lee, 2015). Therefore, the findings of the present study are in line with the previous studies as they reveal the positive use of smart media by female students who have adequate smart media literacy.

Adolescent learners are strongly influenced by smart media (Liu, Horton, Olmanson, & Toprac, 2011). According to the previous studies, middle school students, in particular, participate in and are motivated by learning environments equipped with rich smart media technology. In the present study, as middle school students showed a higher smart media literacy than those of other students, it can be inferred that middle school students have smart media literacy because they are

strongly influenced by smart media.

In this research, there are limitations that should be addressed in future research. First, the present study was dependent on the self-reporting of learners in examining their smart media literacy. Therefore, the future research should focus on investigating whether dependent variables such as a learner performance variable can be correlated with smart media literacy as independent variable. Second, in the present research, the raw scores of smart media literacy was used. A raw score itself does not provide any information that helps understand a learner's smart media literacy. Therefore, for the future research, there needs to be standardization of raw scores of learners' smart media literacy. Third, since the present research was focused on the difference analysis of gender and school levels, the future research should focus on whether the factors of smart media literacy affect learning competency according to learners' development and growth stages. Finally, the participants of the present research were of different school levels from elementary to undergraduate school. In order to obtain more meaningful results, more studies are needed to examine the smart media literacy of the same participants as a longitudinal study in the future.

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