

Factors Influencing the Online Learning Behaviors of Middle School Students in South Korea

한국 중학생의 온라인 학습 행동에 영향을 미치는 요인

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ABSTRACT : This study presented the factor analysis on constructing the new factors affecting the middle school students' online learning behaviors from the questionnaires employed among middle school students. A total of 204 students participated and the data were collected in South Korea. The sample of middle school ninth-grade students was selected and used through purposive sampling. Findings from the factor analysis provided evidence for the eight-factor solution for the 35-items accounting for 66.15% of the shared variance. A wide range of factors has been considered to identify students' online learning behaviors. The appropriate experience and use of e-learning in the middle school period is also important as it will be a critical stepstone for future education. This research provides information that has been taken into account for advancing online learning to enhance the quality of e-learning systems for middle school students. The study results provided eight new factors affecting the middle school students' online learning behaviors: that is 1) communication using social media as a learning tool, 2) intention to share information using ICT, 3) addiction of technology, 4) adoption of technology, 5) seeking information using ICT, 6) use of social media learning, 7) information search using ICT, and 8) immersion of technology. This study confirmed that middle school students prefer communication using social media as a learning tool, and value intention to share information using ICT for the most part. The data obtained based on factor analysis can highlight the online learning behaviors towards a mixture of social media learning and ICT to ensure a new educational platform for the future of e-learning. This research expects to be useful for both middle schools of online learning to better understand students' online learning behaviors and design online learning environments and information professionals to better assist students who particularly need digital literacy.

KEYWORDS : Online Learning Behaviors, ICT, Technology Affinity, Social Media Learning, Factor Analysis, Middle School Students

요약 : 본 연구에서는 중학생을 대상으로 중학생의 온라인 학습 행동에 영향을 미치는 새로운 요인을 구성하기 위한 요인분석을 제시하였다. 총 204명의 한국 중학생이 참여했으며, 중학교 3년 학생의 표본을 목적표본으로 선정하여 사용하였다. 요인 분석 결과는 공유 분산의 66.15%를 차지하는 35개 항목에 대한 8개 요인 솔루션을 제시했다. 중학생들의 온라인 학습 행동을 식별하기 위해 다양한 요인이 고려된다. 이때, 중학교 시기 온라인 러닝의 적절한 경험과 활용도는 그들의 미래 교육의 중요한 발판이 되기 때문에 중요하다. 본 연구의 결과는 중학생을 위한 온라인 러닝 시스템의 질을 향상시키고 온라인 학습을 발전시키기 위한 정보를 제공할 것으로 기대한다. 연구 결과는 중학생의 온라인 학습 행동에 영향을 미치는 8가지 중요한 요인을 제시했고, 그것들은 1) 소셜 미디어를 학습 도구로 활용한 커뮤니케이션, 2) ICT를 활용한 정보 공유 의지, 3) 테크놀로지 중독, 4) 테크놀로지 도입, 5) ICT를 활용한 정보 탐색, 6) 소셜 미디어 학습 활용, 7) ICT를 이용한 정보 검색, 그리고 8) 테크놀로지 몰입이다. 본 연구의 결과는 중학생들이 학습도구로 소셜미디어를 활용한 커뮤니케이션을 선호하며, ICT를 활용한 정보 공유 의도를 대부분 중시하고 있음을 확인하였다. 요인 분석을 기반으로 얻은 데이터는 온라인 러닝의 새로운 교육 플랫폼을 적용하기 위해, 소셜 미디어 학습과 ICT의 혼합에 대한 온라인 학습 행동에 중요하게 적용할 수 있을 것이다. 이 연구는 중학생들의 온라인 학습 행동을 더 잘 이해하고 온라인 학습 환경을 설계하는 정보 전문가가 특히 디지털 리터러시가 필요한 중학생에게 더 잘 지원할 수 있도록 유용하게 사용할 것으로 기대한다.

주제어 : 온라인 학습행동, ICT, 기술친화성, 소셜미디어 학습, 요인분석, 중학생

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I. Introduction

Covid-19, which hit the world in 2020, has transformed the world's traditional educational paradigm. The spread of the virus naturally transformed students from traditional face-to-face education into online education systems. Even after the pandemic is over, education in the classroom should no longer be the top goal. The experience of online education that we have built up during the pandemic is our educational legacy that needs to be continuously enhanced in the future. However, for all students, online learning may not bring out the maximized the learning effect. This is because many factors, such as students' individual learning characteristics and learning preferences, Information technologies skills, or information behavior differ from one student to another, to name a few (Maes et al., 2017).

As the development and advancement of Information and Communication Technology (ICT) have become ubiquitous, online and mobile technologies have increasingly influenced students and teachers to learn and teach information on a daily basis. Students who well use information and communication technologies are possibly considered to be important motivational factors for their peers, supporting to construct positive student attitudes in regard to online learning. Thus, it is very considerably important to understand the middle school students' online learning behaviors by virtue of the advance of ICT. Given the information implications for the widespread of ICT and the adoption of online and internet associated with online learning tools, this research seeks to better understand online learning behavior in information technology pervasive in online learning environments. In this research, we used a survey method to examine the factors that drive middle school students to engage in online learning and how these factors relate to online learning behaviors.

One of the main issues of library education is consistency. Consistent delivery of digital literacy education, especially for middle school students, requires prior knowledge of the important factors influencing their online learning behaviors. Therefore, libraries and information professionals need to know what to do, what is important, and how and where to intervene to help with the online learning of current middle school students. Because it affects the efficiency of library education, collections, services and programs, wasting existing information resources and driving digital illiteracy up for students. Libraries can also help middle school student's development of critical thinking by strengthening their information literacy as well as digital literacy. Thus, this research aspires to explore factors influencing the online learning behaviors of middle school students in South Korea.

II. Literature review

To identify middle school students' online learning behaviors, we need to consider the environments in which the learning in online takes place. This chapter includes a literature review of students' online learning behaviors, social media as a learning tool, and technologies for advanced learning.

1. Best practices of online learning behaviors

A typical question about online learning is whether the educational outcomes of online learners are superior to or the same as those of learners in a brick and mortar face-to-face setting. The following literature confirms which factors influence the online behaviors of students and we will identify what factors influencing the online learning behaviors of middle school students overlap in this study.

Thai et al. (2020) compared four learning circumstances with students' learning performance, which are a traditional face-to-face type, entirely online learning type, blended learning, flipped learning, and flipped classroom. They stated that a significant positive differential effect on learning performance appeared when learning in a flipped classroom and blended learning type and students perceived more freedom about time and place when learning in flipped classroom, blended classroom, and entirely online type and they experience considerably significant positive self-efficacy in a flipped classroom type. Wang et al. (2020) studied learning outcomes and collaborative online learning in behavioral patterns towards the effect of cognitive load and the use of various multimedia. They showed that behavioral patterns differ in the formats of learning media and cognitive load intervenes between behavioral patterns and information presentation. Yang and Hsieh (2013) investigated online learning behavioral patterns in regional differences, showing that online learning behaviors is driven by individual characteristics in regional differences. They found that online learning behavioral patterns allowed regional differences, as regional parts were caused by individual parts of different use pattern.

Chen et al. (2020) explored the association between students' learning performance and online learning behaviors. They found that although most students failed the most difficult module of study, students who have typical learning behavior were more likely to receive a higher total score, but students who relied on guesswork for assessment tended to receive a lower total score. Zhang (2016) also investigated the association between students' learning outcomes and online

students' behaviors, as measured by final grade in an e-learning management system. The study results showed that as the number of discussion boards increased, the number of days students delayed access to class materials each week showed a significant negative correlation with final grades. Song et al. (2018) showed that the online learning platform has an impact on the students' course scores. Nguyen (2015) stated that online classes can be just as effective as traditional classes if they are well structured and properly applied. However, Liang et al. (2017) confirmed that online learning requires specific objectives, internal motivation, simultaneous communication, and freedom of the learners. The important factors identified in the above literature study are online learning platforms, cognitive load, and information presentation. These have been found to influence students' outcomes and performance in online learning.

Studies have been examined on the effectiveness of students' online learning. Hong et al. (2021) studied inefficiencies of online learning by students in an experimental class during the Covid-19 pandemic. They found that participants' online learning inefficiency was gender-specific, and in the online learning environment, female students were more likely than male students to have online learning inefficiency. Chen et al. (2021) studied the effect of middle school students' self-efficacy on their intention to use an online learning platform. They found that the perceived quality of online learning resources and the close relationship between teachers and students had a significant effect on middle school students' online resource purchase intentions. Luaran et al. (2014) studied the students' views on the effectiveness in using online learning. They emphasized that most participants have been experienced to online learning in terms of providing greater flexibility to choose teacher-led or self-directed learning courses anywhere and anytime.

Ali and Maksum (2020) studied ICT learning when implemented the Google classroom application in online learning. They stated that the google classroom application promotes the students' ICT learning activities during the Covid-19 pandemic. Gopal et al. (2021) studied the effect of online learning on the students' satisfaction and performance during the Covid-19 pandemic. They found that four independent factors, "instructor quality", "course design", "quick feedback", and "student expectations", had a positive effect on the participants' satisfaction, and furthermore, that the participants' satisfaction had a positive effect on the participants' performance. Wei and Chou (2020) discussed the students' performance and satisfaction to see if their perceptions and readiness in online learning have an effect on the students' online learning performance and satisfaction. They found that self-efficacy in using computer and internet is

an important factor that affects not only one's learning perception but also course satisfaction. Paul and Jefferson (2019) compared the students' performance in online learning versus face-to-face learning in an environmental science course from 2009 to 2016. Interestingly, overall, there were no significant differences in student performance by gender or class rank between online learners and face-to-face learners. It can be seen from the literature that self-efficacy is related to readiness to use online learning platform, flexibility is closely related to online learning selection, and students' age and intention, and perceptions of online learning are importantly related to the students' online learning satisfaction and performance.

2. Social media as a learning tool from previous studies and cases

The collaborative and open platforms (e.g., YouTube, Facebook, WordPress, Blogs, Wikispaces, Google Docs, etc.) facilitated by social media allow for knowledge sharing, which means that students can increase the amount of critical thinking, creative questioning, communication process in specific ways. Kolokytha et al. (2015) stated that social media can be considered as a learning tool by employing the suitable infrastructure and appropriate platforms. Moghavvemi et al. (2018) referred to social media as a complementary learning tool for both learning and teaching in use of YouTube. They found that students use YouTube for entertaining, information searching, knowledge sharing and learning. Social media can support self-directed learning that helps students to find relevant information and prepare to make their own decisions. Blaschke (2014) studied the impact of social media use to participate and build up the online self-directed learning. The author suggested that students engage with specific social media (i.e., Google Docs) along with distinctive learning experiences to develop specific metacognitive abilities. Social media can also give students more flexibility to work with their peers beyond the brick and mortar classroom.

Ansari and Khan (2020) found that social media in collaborative learning has a significant effect on interactions with peers, teachers, and online information sharing behaviors. Liu (2010) found that the Facebook, Wikipedia, and YouTube are the most used social media tools online. The author indicated that the reasons to frequently use a social media tool are "social engagement", "directional communication", "feedback speed", and "relationship building." It can be seen that through social media, students were able to do collaborative learning, and it gave them more freedom and flexibilities to self-directed online learning. A recent study revealed that there are multiple terms related to digital literacy (Audrin & Audrin, 2022). They determined six key factors

that closely identified digital literacy, which are information literacy, developing digital literacy, digital learning, ICT, social media, and 21st digital skills. Sukmanasa (2022) studied the effect of digital literacy and concluded that there is a positive influence of digital literacy on the learning independence of students in the Covid-19 situation in 2019. Yu, Lin, and Liao (2017) explored factors influencing information communication technology adoption behavior. They found that task characteristics and social interaction advance “media richness”, “media experience”, and “media techno stress”, which in turn improves ICT adoption behavior.

The use of the mobile technologies with the Internet have become extremely important in online learning environments. Sung, Chang, and Liu (2016) found that various intervention for mobile device literacy were needed to many different factors such as user ages, system settings, and domain expertise in terms of mobile device use effectiveness. Briz et al. (2016) studied that different factors could influence students’ behaviors in the use of mobile technologies for mobile learning. They found that social influence was an important factor in attitudes and behavioral intentions to use mobile learning. Razzaq et al. (2018) examined smartphone behaviors about self-efficacy and found that there is a significant overlapping between the heavy use of smartphones and academic activities in mobile learning. Zawaideh (2017) studied the effects of mobile learning on student learning behavior and performance development. The authors found that mobile learning had a positive effect on students’ learning motivation and there was a positive correlation between mobile learning and improved academic achievement.

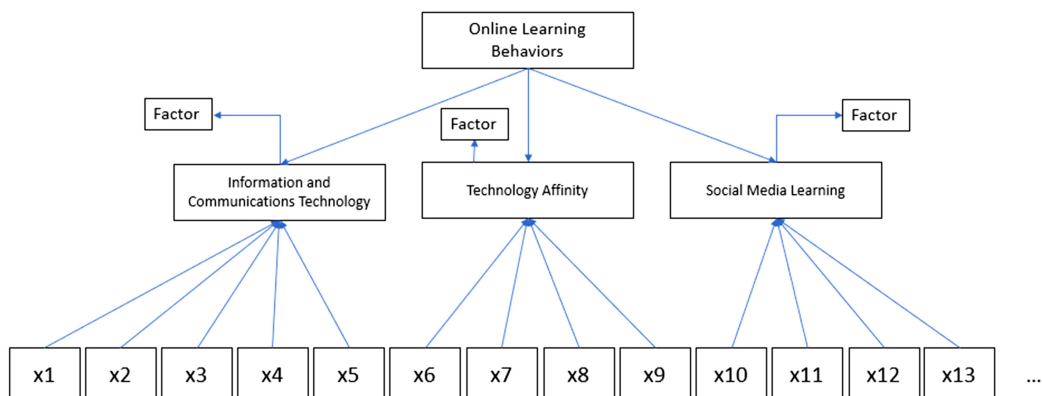
Conversely, Abbas et al. (2019) examined the effect of social media on learning behaviors for continual education and found that social media use in Pakistan had a negative influence on student learning. Lepp et al. (2015) investigated the relationship between cell phone use and students’ academic achievement in a sample of US college students. They found that an increase in cell phone use was associated with a decrease in academic achievement after controlling for other established predictors. Burford and Park (2014) studied the effect of mobile tablet devices on young adults information behaviors. They found that access to mobile tablets would significantly change the behavior of young adults immersed in digital information and the widespread use of mobile device applications and establish an open and limited view of information in the Web.

In this era of Covid-19, Internet-based mobile learning has attracted attention and is importantly used for student learning (Muthuprasad et al., 2021). Mobile devices such as smartphones are heavily used by students for recreational purposes: online shopping, email communication, news and blogs access, and social media connection, to name a few (Liu, 2010). Technology affinity

may play a key role in understanding student motivation to continue sustainable learning in online learning environments. Jin and Divitni (2020) studied technology affinity and intentions of teenagers' learning. They found that technology affinity was positively associated with sustainable learning motivations, and this correlation was arbitrated by perceived usefulness. Yan (2021) studied the individual experiences with changes in technology use during the Covid-19 pandemic. The author pointed out that virtual classroom settings required technical, cognitive, and strategic adjustments. Further, she stated that small tweaks can lead to powerful results, the ability to continuously discover new features in a single technology, and that technology can bridge social distances between friends. It can be seen from the above literature that the appropriate skills in the use of ICT have a significant impact on students' outcomes and quality of performance in online learning.

When examining the literature above, the following question emerged. Do ICT, technology affinity, and social media learning affect students' online learning behaviors? Further, this paper examines three categories of ICT, technology affinity, and social media learning items and how they correlate with each other and construct higher-order factors. Therefore, the purpose of this study was to investigate the factor analysis from the questionnaires to identify the main factors that examine students' online learning behaviors. Thus, our research questions for the analysis are:

- Q1: How many factors are measured by our 35 questions?
- Q2: Which questions measure similar factors?
- Q3: Which online learning behaviors are represented by which factors?



<Figure 1> Conceptual Framework in Online Learning Behaviors in Middle School Students

III. Method

The authors used a survey questionnaire to investigate students' online learning behaviors. This study focused on middle school students located in Southeastern G city in South Korea.

1. Survey design

The survey consisted of three parts: information and communication technology learning survey (ICTLS), technology affinity survey (TAS), and social media learning survey (SMLS). The 35 self-report items from the version of ICTLS, TAS, and SMLS were adopted and modified so that participants rated their perceptions of each question (Franke et al., 2019; Mills & Knezek, 2012; Mills et al., 2013). The response was a Likert-type scale, where 1 was “strongly disagree”, 2 was “disagree”, 3 was “neutral”, 4 was “agree”, and 5 was “strongly agree”.

Questionnaires on ICT, technology affinity, and social media learning (See Table 1) that significantly affect online behaviors learned from the literature were adopted in this study. The items of important factors from the questionnaires related to the students' online learning behaviors were selected in an attempt to identify any underlying relationships from a number of different variables, and then reduced to a relatively smaller number of components. The questions in the first part were focused to ask the participants' attitudes on how they would interact with ICT tools in online learning environments. The questions in the second part asked the technology affinity questions. In the third part, the participants were asked about social media learning (see Table 1).

<Table 1> Operationalization

	Questions	Items	Factor
Q1.1	I use Internet technology to search topics of interest.	ICTL1	Information and Communications Technology Learning (ICTL)
Q1.2	I like to enroll in classes using Internet technology for learning.	ICTL2	
Q1.3	I like to take classes from great teachers using Internet technology.	ICTL3	
Q1.4	I use Internet communication technology tools when I want to learn something new.	ICTL4	
Q1.5	I think Internet technology can help me take classes successfully.	ICTL5	
Q1.6	I learn more when I find information about what I want to know.	ICTL6	
Q1.7	I use Internet technology to get the latest learning information.	ICTL7	
Q1.8	I like to participate in being a member of the online community.	ICTL8	
Q1.9	I like to share my interests and thoughts online.	ICTL9	
Q1.10	I use Internet technology to express myself.	ICTL10	
Q1.11	I learn more by interacting with other internet users.	ICTL11	
Q1.12	I post information that may be of interest to others online.	ICTL12	

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	Questions	Items	Factor
Q2.1	I usually talk to my friends via text message (messenger).	TAS1	Technology Affinity scale (TAS)
Q2.2	I think some people are too immersed in online conversations rather than real conversations.	TAS2	
Q2.3	I use mobile and text messages while talking to others.	TAS3	
Q2.4	I often use mobile when I'm walking down the street.	TAS4	
Q2.5	I sometimes check mobile messages during class and study.	TAS5	
Q2.6	I feel anxious when I'm away from the internet or mobile for more than a day.	TAS6	
Q2.7	I'm anxious if I don't have a cell phone when I go out.	TAS7	
Q2.8	I prefer meeting online and mobile rather than meeting with friends in person.	TAS8	
Q2.9	It is easier for me to maintain a friendship with social media.	TAS9	
Q2.10	My computer or smartphone is the most important thing.	TAS10	
Q2.11	I think many people use their smartphones too much.	TAS11	
Q2.12	I think many people meet a lot of good friends through social media.	TAS12	
Q2.13	Sometimes I think a computer or a smartphone is more helpful than a family.	TAS13	
Q3.1	I think that the development of social media as a learning tool has empowered personal learning rather than classroom setting at school.	SML1	Social Media as a Learning tool (SML)
Q3.2	I think that I can easily use social media as a learning tool for online learning.	SML2	
Q3.3	I think that the social media learning tool helps my learning by providing many opportunities for online learning.	SML3	
Q3.4	I think many students use social media as a learning tool in middle school.	SML4	
Q3.5	I feel like I am communicating with other students when learning using social media as a learning tool.	SML5	
Q3.6	I think asking questions to other students on social media as a learning tool helps me better understand my learning.	SML6	
Q3.7	I think I can get a faster response from other students when using social media tools.	SML7	
Q3.8	I think I can receive a faster response from the instructor when using the social media as a learning tool.	SML8	
Q3.9	I think that using social media as a learning tool allows one to communicate more effectively with other students and instructors.	SML9	
Q3.10	I think that using social media learning tool can increase class participation than physical classes.	SML10	

Note. Many of questionnaire considerations are adopted and modified in reference to the elements in the Franke *et al.*, Mills & Knezek, and Mills *et al.* instruments (Franke *et al.*, 2019; Mills & Knezek, 2012; Mills *et al.*, 2013); we provide these only as motivating examples.

2. Participants

Ninth-grade middle school students enrolled in G city South Korea participated in this study. Data were collected from a total of 204 participants. In year of 2021, groups of participants were identified and selected that were especially knowledgeable about or experienced with online learning, social media, and ICT. Their identity, rights and willingness to participate were secured, and incentive was given after the completion of the survey. Of the participants, 104 were female (51%) and 100 were male (49%), which is well balanced. Field (2013) stated that in general over 300 cases is probably an adequate sample size for factor analysis, but communalities after

extraction should be greater than 0.5 (see Table 5). Purposive sampling was used because it helps make the most out of a small and representative population of interest and arrive at valuable research outcomes (Robinson, 2014). Because middle school students frequently use online and mobile technologies in conjunction with ICT, it is important to better understand their online learning behaviors to design online learning technology interventions (Na et al., 2021). Moreover, ninth grade in middle school is a critical time to experience diverse online activities to learn and gain appropriate online learning behaviors for future education.

IV. Results and discussion

We investigated how important ICT learning, technology affinity, and social media as a learning tool were in terms of students' online learning behaviors. These three categories were also examined to see if they are correlated with each other in students' perception for students' online learning behavior. This study employed factor analysis, which is used to reduce a large number of variables into a few numbers of factors. Factor analysis can be used to determine the number of components that underlie a set of items and the extent to which these components represent the observed variables (Henson & Roberts, 2006; Shrestha, 2021). Thirty-five questions relating to online learning behaviors were factor analyzed using principal components analysis with Varimax and Promax rotation.

1 Reliability and validity

Reliability analysis was employed to evaluate the internal consistency of the questionnaires based on Cronbach's Alpha index ranging between 0 and 1, with higher values indicating that the survey is more reliable. The survey consisted of 35 items and the value of Cronbach's Alpha for the survey was $\alpha = .910$, which is considered very highly reliable indicating a high level of internal consistency. All the values that Cronbach's alpha would be if a specific item was dropped from the scale are greater than .905. Therefore, we would not want to remove any of these questions. Then, principal component analysis (PCA) with varimax rotation was performed to identify orthogonally aligned factors. PCA produced eight factors with Eigen values greater than one. The Scree plot analysis also reveals eight possible factors that remain sharply decreasing the components of the graph before the first flattening point.

<Table 2> Reliability Analysis

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.910	.911	35

2. Factor analysis

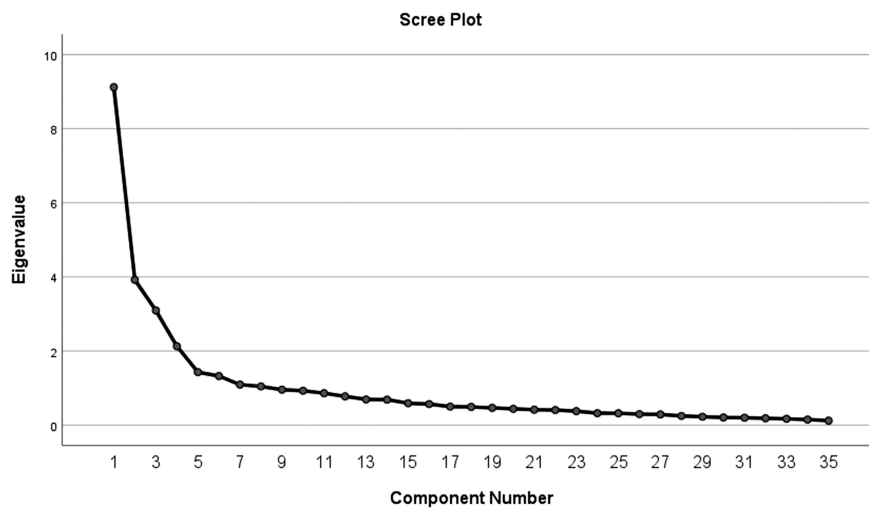
Firstly, the factorability of the 35 items was investigated. A correlation matrix for the factorability was employed. 31 of the 35 items correlated at least 0.3 with at least one other item, suggesting that they could construct a reasonable factorability. The communalities were all above 0.3 (see Table 5), further confirming that each item shared some common variance with the others. Considering these comprehensive indicators, the factor analysis was judged to be suitable for all 35 items. Secondly, the Kaiser-Meyer-Olkin test for sample adequacy assesses whether the sample size is sufficient for factor analysis. Values less than 0.5 indicate that the sample is too small, but ideally aim for 0.7 or greater. The KMO value in this study is .852, which is higher than the generally recommended value of 0.6, thus our sample size is sufficient. To ensure that factor analysis was appropriate, Bartlett's test of sphericity was also significant ($\chi^2 (595) = 3842.338, p < .000$).

<Table 3> KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity	
.852	Approx. Chi-Square	3842.338
	df	595
	Sig.	.000

PCA was used to examine the compound scores for the components underlying the short form of the survey. The initial eigenvalues indicated that the first four factors accounted for 26.06%, 11.20%, 8.84%, and 6.08% of the variance, respectively. The fifth, sixth, seventh, and eighth factors had eigenvalues slightly higher than 1, and each explained 4.08%, 3.78%, 3.12%, and 2.98% of the variance, respectively. An analysis using both the Scree plot and eigenvalues greater than 1 to determine the underlying components yielded 8 factors that accounted for a total of 66.15% of the variance in the data (See Table 4 & Figure 2). The Scree graph plots all 35 eigenvalues for the factors. This can help visualize which factors to keep and eight factors are

selected for rotation (see Figure 2). Other factors accounted for a very small proportion of variability and were considered insignificant. Thus, since the items within each factor were determined to have high content validity, the eight-factor solution was selected. These factors were named conforming to their characteristics in this study.



〈Figure 2〉 Scree Plot for Factor Analysis

Higher-order factor analysis was employed to examine possible constructs at a higher level of communality among the eight scales indicated by PCA. This analysis showed that six of the eight components accounted for the cumulative 60.05% of the variance in online learning behaviors (see Table 4).

〈Table 4〉 Eigenvalues, Percentages of Variance and Cumulative Percentages for Factors for 35 Questionnaire Items

Factor	Eigenvalue	% of variance	Cumulative %
1	9.122	26.064	26.064
2	3.920	11.200	37.264
3	3.095	8.842	46.106
4	2.129	6.083	52.189
5	1.428	4.080	56.268
6	1.324	3.783	60.051
7	1.092	3.121	63.171
8	1.043	2.980	66.152

Note. Extraction Method: Principle Component Analysis

<Table 5> Factor Loadings and Communalities for Promax Rotated Eight-Factor Solution for 35 Online Learning Behaviors Items

	Factor loading								Communality
	1	2	3	4	5	6	7	8	
Q3-7	.802	.063	.072	.240	.159	.015	.049	.129	.754
Q3-9	.760	.175	.160	.175	.080	.218	-.025	.019	.719
Q3-8	.746	.040	.129	.219	.257	.018	-.134	.163	.734
Q3-5	.725	.107	.061	.023	-.033	.287	.051	-.034	.629
Q3-6	.693	.108	.094	.233	-.007	.268	.214	-.023	.673
Q3-10	.621	.144	.184	-.078	.107	.278	.000	.104	.546
Q1-10	.063	.855	.081	.117	.106	.109	.023	.087	.786
Q1-11	.103	.846	.039	.057	.128	.002	.111	.132	.777
Q1-8	.088	.821	.037	.147	.199	.058	.138	.015	.768
Q1-9	.073	.813	.100	.149	.179	.008	.081	.112	.750
Q1-12	.223	.707	.094	.172	.058	-.007	.021	.086	.599
Q2-7	.018	-.024	.781	.219	.077	.043	.050	.120	.683
Q2-6	.042	.007	.769	.339	.098	.078	-.102	-.033	.735
Q2-5	.273	.111	.614	.148	-.107	.038	.062	-.035	.503
Q2-4	.257	.186	.602	.106	.094	-.058	-.030	.312	.584
Q2-3	.243	.231	.496	.065	.046	-.092	-.082	.364	.513
Q2-8	.224	.168	.309	.719	.016	.184	-.041	-.034	.727
Q2-9	.298	.293	.126	.687	-.019	-.036	-.068	.115	.681
Q2-12	.187	.272	.130	.673	-.059	.145	.138	.184	.656
Q2-10	-.077	-.018	.439	.619	.096	-.056	-.055	.158	.623
Q2-13	.215	.153	.382	.561	-.069	.141	-.007	.012	.555
Q1-2	.107	.167	.011	-.008	.820	.058	.125	-.023	.731
Q1-3	.042	.220	.026	.038	.769	.234	.169	-.082	.733
Q1-5	.167	.165	.078	-.007	.693	.196	.255	.047	.647
Q1-7	.190	.211	.105	-.190	.517	.198	.470	.018	.655
Q3-2	.261	.124	-.074	.147	.153	.770	.030	.123	.744
Q3-3	.279	.045	.043	.112	.306	.750	.079	-.004	.756
Q3-1	.321	-.073	.030	.080	.173	.706	.195	.179	.714
Q3-4	.396	.035	.300	-.097	.009	.439	.110	-.288	.545
Q1-1	-.023	-.030	-.117	.084	.124	-.036	.784	.090	.662
Q1-6	.002	.186	.041	-.100	.167	.120	.780	.054	.699
Q1-4	.085	.196	.003	.006	.362	.270	.628	-.033	.645
Q2-2	-.008	.198	.093	.194	.048	.156	.031	.686	.583
Q2-1	.158	.187	.168	-.002	-.186	.072	.120	.675	.598
Q2-11	.089	-.321	.099	.185	.262	-.090	.292	.357	.444

Note. Factor loadings over 0.30 appear in bold

The results of an orthogonal rotation of the solution are shown above in Table 5. The communalities show the common variance in the data after factor extraction. Communalities in Table 5 were reasonably strong, ranging from .444 to .777. The factor loading values provide the association between the underlying components and each item. The variables with factor loadings greater than 0.40 represent that they are indicative of the factor. When excluding loadings less than

0.30, the analysis resulted in an eight-factor solution with a simple structure.

<Table 6> Correlations among Extracted Factors after Promax Rotation

Factor	1	2	3	4	5	6	7	8
Factor1	1.000							
Factor2	.337	1.000						
Factor3	.422	.244	1.000					
Factor4	.299	.206	.375	1.000				
Factor5	.227	.251	.169	.106	1.000			
Factor6	.462	.257	.219	.050	.260	1.000		
Factor7	.178	.209	.060	-.065	.415	.374	1.000	
Factor8	.192	.155	.205	.325	.191	-.145	.065	1.000

From the table above, it shows that most items have correlation to some extent with each other. Further, significant positive correlations were found between variables, such as factor 1, factor 2, and factor 6. The results show that these eight factors analyzed in the data could fully predict a change of 66.15%.

A number of factors must be considered to identify student online learning behaviors such as attitude, motivation, technology, self-efficacy, satisfaction, social influence, or online service quality, and many others. This research can provide information for the development of online education and the quality improvement of online learning systems for middle school students. The appropriate experience of online learning in the middle school period is also important as it will be a critical stepstone for future education.

<Table 7> Factors Derived from 35 Items for Online Learning Behaviors

Factor	Label	Variance
Factor 1	Communication using social media as a learning tool	26.06%
Factor 2	Intention to share information using ICT	11.20%
Factor 3	Addiction of technology	8.84%
Factor 4	Adoption of technology	6.08%
Factor 5	Seeking information using ICT	4.08%
Factor 6	Use of social media as a learning tool	3.78%
Factor 7	Information search using ICT	3.12%
Factor 8	Immersion of technology	2.98%

The items grouped by the same factor indicate that factor 1 represents communication using

social media as a learning tool (26.06% of the variance), factor 2 intention to share information using ICT (11.20% of the variance), factor 3 addiction of technology (8.84% of the variance), factor 4 adoption of technology (6.08% of the variance), factor 5 seeking information using ICT (4.08% of the variance), factor 6 use of social media as a learning tool (3.78% of the variance), factor 7 information search using ICT (3.12% of the variance), and factor 8 immersion of technology (2.98% of the variance). These factors are named by the predominant theme in the content of the items that load on each factor.

The first factor explained 26.06% of the variance after rotation. For factor 1, it was labeled “communication using social media as a learning tool” due to the high loadings by the following items: I think I can get a faster response from other students when using social media tools; I think that using social media learning tool allows communicating more effectively with other students and instructor; I think I can receive a faster response from the instructor when using social media learning tool; I feel like I am communicating with other students when learning using social media learning tool; I think asking questions to other students on social media learning tool helps me better understand my learning; I think that using social media learning tool can increase class participation than physical classes.

The second factor explained 11.20% of shared variance after rotation. Five items (q53, q54, q51, q52, q58) were loaded onto factor 2. This factor loads onto using internet technology to express me, learning more by interacting with other internet users, participating in being a member of the online community, sharing my interests and thoughts online, and posing information that may be of interest to others online. This factor was labeled, “intention to share information using ICT”.

In the third factor lie the behaviors “I’m anxious if I don’t have a cell phone when I go out”, “I feel anxious when I’m away from the internet or mobile for more than a day”, “I sometimes check mobile messages during class and study”, “I use mobile and text message while talking to others”. These behaviors ultimately account for 8.84% of the behaviors in online learning of participants. This factor was labeled, “addiction of technology” according to the contents of the items put together.

The five items that load onto factor 4 identify the adoption of technology, relating to use, acceptance, and integration in the technology affinity scale. This factor was named, “adoption of technology”. This factor explained 6.08% of shared variance after rotation. In the fourth factor lie the behaviors “I prefer meeting online and on mobile rather than meeting with friends in person”, “It is easier for me to maintain a friendship with social media”, “I think many people meet

a lot of good friends through social media”, “My computer or smartphone is the most important thing”, and “Sometimes I think a computer or a smartphone is more helpful than a family”.

The fifth factor derived was labeled seeking information using ICT. This factor was named as such due to the high loadings by the following behaviors: I like to enroll in classes using Internet technology for learning; I like to take classes from great teachers using Internet technology; I think Internet technology can help me take classes successfully; I use Internet technology to get the latest learning information. The variance explained by this factor was 4.08%.

Items loaded for factor 6 related to the use of social media as a learning tool in shaping students’ online learning behaviors. This factor was labeled, “use of social media as a learning tool”. In the sixth factor lie the behaviors “I think that I can easily use social media learning tool for online learning”, “I think that social media learning tool helps my learning by providing many opportunities for online learning”, “I think that the development of social media learning tool has empowered personal learning rather than classroom setting at school”, and “I think there are many students who use social media learning tool in middle school”. This factor explained 3.78% of the variance.

Items for factor 7 identified information search using ICT in shaping students’ online learning behaviors. Factor 7 was labeled information search using ICT, explaining 3.12% of the variance for the full set of items due to the high loadings by the following items: I use Internet technology to explore topics of interest; I learn more when I find information about what I want to know; I use Internet communication technology tools when I want to learn something new.

Items for factor 8 represented immersion of technology students had related to online learning behaviors. Factor 8 has three items; that should rightfully be named immersion of technology, explaining 2.98% of the variance by the following items: I think some people are too immersed in online conversations rather than real conversations; I usually talk to my friends via text message; I think many people use their smartphone too much.

Students’ perspective regarding ICT, social media, and the impact in their daily learning is important to consider about the online learning behaviors in the Covid-19 pandemic. More educational institutions are employing ICT learning platforms for e-learning using social media as a learning tool to better communicate between students and a teacher in the platforms. This study confirmed that middle school students prefer communication using social media as a learning tool, and value intention to share information using ICT for the most part. The data obtained based on factor analysis can highlight the online learning behaviors towards a mixture of social

media learning and ICT to ensure a new educational platform for the future of e-learning. Al Kurdi et al. (2020) examined the factors affecting university students' online learning behaviors. They found that the most important constructs describing the causal learning process used in the class were "e-learning computer self-efficacy", "social Influence", "enjoyment", "system interactivity", "computer anxiety", "technical support", "perceived usefulness", "perceived ease of use", "attitude", "followed by behavioral intention to use e-learning".

The results of the study show that the middle school students' online learning behaviors are significantly influenced by their social learning influence and quality use of ICT. The students' perspective for online learning in this study confirms that there is a strong association between students' social learning and ICT and technology affinity that influence the students' attitude in online learning behaviors. The results also identify the students' needs for online learning, and this analysis suggests that it is possible for the students to put more effort to participate in online courses through properly implemented online digital tools such as social learning. This study is consistent with the past research results, showing the importance of the quality use of ICT (Pavel et al., 2015; Qazi et al., 2021) and how to appropriately use social media (Ansari & Khan, 2020; Dafoulas & Shokri, 2014) for enhanced online learning. Thus, information professionals and librarians in the field of Library and Information Science (LIS) should consider the protocols for intervening for the library education, particularly on quality use of ICT and social media, when, where, and how to promote students' digital literacy. Libraries can offer consistent ICT training education and technical support to facilitate online learning. Libraries can also help offer online learning platforms and use social media as a learning tool that allow students build up their digital skills and competencies.

Social media can be used by libraries to embrace customer service, teaching and learning, outreach program.

V. Conclusion

Since the Covid-19 pandemic has transformed education worldwide from a physical nature to online learning platforms, the online learning behaviors of students have become extremely important. The objective of this study is to investigate middle school students' online learning behaviors towards online learning in South Korea. This research reports findings from a study on online

learning behaviors to better understand students' educational behaviors and attitudes with social media learning, technology affinity, and information technology pervasive in online learning environments. The factor analysis was employed to reduce the number of study variables to a smaller number of variables. As a result of the factor analysis performed by using the PCM, it was confirmed that the initial 35 variables could be reduced to eight factors without significant loss of data. The high statistical relationship between six items formed the first factor explaining 26.06% of the variance. This study shows that factor analysis represents signs of a future method for extracting important factors to explain the underlying variables of the items for the future research.

Communication using social media as a learning tool, intention to share information using ICT, addiction of technology, adoption of technology, seeking information using ICT, use of social media learning, information search using ICT, and immersion of technology are the major factors related to students' online learning behaviors extracted using PCA and varimax orthogonal factor rotation method. The application of factor analysis provides useful insights for academia and information professionals, allowing them to focus on only a few critical components rather than many. This research expects to be helpful for both academics of online learning to better understand students' online learning behaviors and design online learning environments and information professionals to better help students who particularly need digital literacy.

VI. Limitations

There were certain limitations to the current study. First, this study includes a limited group of middle school students who were enrolled in ninth grade from G city, South Korea. Participants who choose to participate in the study may not be an adequate representation of the middle school student population and therefore limited generalizability. Since this study cannot be generalized to a large number of samples, future research can be conducted with a large number of populations and statistical sampling methods. A larger and more diverse sample would lead to stronger and more generalizable results. Another limitation of the study was the potential for culture bias. Even though it is difficult to generalize the online learning behavior with a small sample size from a different culture, this study anticipates offering some insights to understand differences and similarities, if any, between different cultures.

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