A STUDY INTO STUDENTS' USE OF
DIGITAL ENGLISH LEARNING STRATEGIES
IN TERTIARY EDUCATION

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Abstract

The purpose of this study is to investigate EFL university students' learning strategies used in a digital English learning environment, and to analyze the interrelations between their use of learning strategies and individual learner factors, such as gender, English proficiency levels, learning experiences, and the duration of using the digital learning environment. The participants of the study were 400 students selected from two universities located in South Korea. A questionnaire was developed to examine the use of digital English learning strategies (DELS) based on Oxford's (1990) SILL and was distributed in an online survey form. Data collected in the present study was statistically analyzed to show that, first, the most frequently used strategy category was compensation strategies, and this was followed by memory and metacognitive strategies. Second, learner factors included in this study showed statistically significant relationships with the use of DELS, but the duration of using digital devices was not related to DELS usage. From these findings, the study concludes that understanding the learning process and strategy use patterns is very critical to make students strategic learners in a digital English learning context and eventually to develop students' digital English abilities. The suggestions and implications for further study are also discussed.

Keywords: digital English learning environment; digital learning strategy; learner factors

1. Introduction

In the age of information and globalization, English has become an important means to acquire and utilize a myriad of useful information. In addition, Information and Communication Technologies (ICT) and digital devices have been used in various fields of education and have enabled a paradigm of technology-enhanced language learning (TELL) in the field of language learning. Computer-Assisted Language Learning (CALL) has become a major field of language education. More recently, Mobile-Assisted Language Learning (MALL), which is based on

using mobile devices such as notebooks, podcasts, MP3s, and smartphones, has been constantly promoted in the field of language education research. From this, the possibilities and effectiveness of language teaching and learning using various digital devices have been widely discussed and shown through research.

Ever since Prensky (2001) introduced the term "digital natives", which refers to a new generation that has grown up with technologies, it has appeared in numerous studies (Bennett, Maton, & Kervin, 2008; Jones, Ramanau, Cross, & Healing, 2010; Yot-Domínguez & Marcelo, 2017) through the use of such terms as "digital generation", "new generation", "net generation", etc. Specifically, a "digital native" is defined as a member of a generation where digital technologies and the Internet are a part of everyday life (Thomas, 2011, p. 2). Therefore, Prensky (2001) insisted that teachers should recognize that today's learners have different and distinct characteristics from learners in the past. Teachers should try to understand learners' characteristics and adapt their teaching approach to their learning strategies because the learners nowadays may acquire information differently and perform many functions in different ways. Especially, it is crucial for teachers to understand the way that learners react like using learning strategies to digital technologies in their learning (Teo, 2013).

The use of digital devices in language learning can enhance learners' learning motivation and attitudes. This is because the digital device enables differentiation according to the learners' language proficiencies or characteristics, as well as providing immediate feedback and active interactions. Additionally, it enables learner-centered education that allows the learners to plan, manage, and evaluate the process of their learning independently. In the past, many studies in the field of CALL and MALL have reported on the effective nature of digital language learning environments for learner-centered language learning (Jung, 2012; Kim & Lee, 2017; Kim & Rha, 2014; Kukulska-Hulme & Shield, 2008; Ogata & Yano, 2005).

So far, research on CALL and MALL has focused on verifying the effects of using various digital devices on language learning and examining learners' attitudes and perceptions towards digital language learning. However, it has been rather rare to observe how learners actually use digital devices in the context of digital language learning, or how the characteristics of a digital environment lead to the use of learning strategies in a learner's learning process.

In the field of English language education, research about learners has been actively pursued in the study of learning strategies since the 1990s, and tools for measuring the lists or categories of learning strategies have become increasingly fragmented and systematized (Li, 2005; McGroarty & Oxford, 1990; Oxford, 1990; Symons, Richards, & Greene, 1995). Based

on these previous studies, the use of learning strategies has been shown to be highly affected by language learning contexts, as well as individual learner factors such as gender, age, nationality, English ability, previous learning experiences, motivation, attitude, and beliefs towards language learning.

With rapid advancement and wide use of digital technologies, the recent research trends of English education have shifted in the direction of language teaching and learning using various digital devices. By reflecting these trends, this research aims to identify the learning strategies that constitute digital English learning. This study not only explores the types of digital English learning strategies (DELS) the language learners use but also the relationship between the use of DELS and learner factors such as gender, levels of English proficiency, English language learning experiences, and the duration of using digital learning environment.

Although the CALL and MALL studies conducted in the field of English education have defined digital English proficiency in different approaches, there was little research to comprehensively classify the learning strategy factors constituting digital English learning and to visualize their effect on the learner factors. Therefore, this study aims to bridge this gap in order to understand the learning process of English learners in a digital environment. The study will attempt to investigate key elements which support development of learners' digital English ability in English teaching and learning contexts.

2. Literature review

2.1. Language Learning Strategies

Learning strategies have been seen as tools that language learners can use to accelerate or assist their second language learning. Rubin (1981) defined language learning strategies as the techniques or devices that a learner could utilize to acquire language. Learning strategies were also understood as "any sets of operations, steps, plans, routines used by the learner to facilitate the obtaining, storage, retrieval, and use of information" (Wenden & Rubin, 1987, p.19). On the other hand, Richards, Platt, and Platt (1992) insisted that using learning strategies in learners' learning process could be an intentional behavior and thoughts for them to understand, learn, or remember new information better. Based on various definitions of learning strategies from the earlier studies, thus, learning strategies can be described as special and intentional ways of processing information in order to improve learners' comprehension, learning, or retention of new information.

Past studies on learning strategies tried to classify language learning strategies according to various approaches among scholars. Above all, according to O'Malley and Chamot's (1990) cognitive theory, learning strategies are distinguished cognitive strategies that facilitate learning processes, meta-cognitive strategies that organize and assess learning, and socio-affective strategies that influence social and affective learning. On the other hand, Oxford (1990) classified direct and indirect strategies according to their direct relevance between language learning strategies and target language learning. Direct learning strategies involve memory strategies, cognitive strategies, and compensation strategies, while indirect learning strategies include metacognitive strategies, affective strategies, and social strategies. Oxford's classification of learning strategies has been universally accepted as the most comprehensive measure (Brown & Lee, 2015; Ellis, 1994; Li, 2005). After that, Oxford (2002) included communicative strategies additionally into the type of compensation strategies, and she offered the updated version of Strategies Inventory for Language Learning (SILL), which can measure learners' language learning strategies, widely used in various fields so far.

Learner factors influencing the use of learning strategies and target language achievement in language learning include motivation, attitude, belief, age, cultural background, major field, gender, language level, learning style, and duration of target language learning (Hwang, Choi, Shin, & Lee, 2016; Oxford, 2002). It has been reported that the learner factors have a meaningful correlation with the effects of learning strategy trainings and a significant effect on learners' selection and use of learning strategies (Dreyer & Oxford, 1996; Griffiths, 2003; Ham, 2005; Lee, 2001; Nisbet, Tindall, & Arroyo; 2005). However, related studies of learning strategies left it unanswered which learner factors were influential in determining patterns of learning strategy use that contribute to either successful or unsuccessful learners' language learning (Salahshour, Sharifi, & Salahshour, 2003; Wharton, 2000).

Due to technological advancement various digital devices have been applied in various educational environments and have enabled development and usage of numerous useful learning programs and educational software. The development of various mobile technology devices has recently opened up more interactive and useful language teaching and learning activities to many language professors, teachers, and learners, along with the establishment of wired and wireless network systems. Thus, language learners can use language learning materials that are meaningful and comprehensible whenever and wherever they want (Kukulska-Hulme & Shield, 2008; Lyddon, 2016). Additionally, social network sites and the Internet have recently been used to train students in digital English learning strategies with positive results in the digital learning environment (Alias, Manan, Yusof, & Pandian, 2012;

Kim, 2017; Rahimi & Katal, 2012; Yoon, 2014). In this way, the use of digital environment has become a necessity for language learners, which is different from conventional language learning. Thus, English learners need to use particular learning strategies in digital English learning environment, so-called DELS (Digital English Learning Strategies).

2.2. Language Learning Strategies in Digital English Learning Environments

CALL and MALL studies have been conducted based on the existing classification of learning strategies and applied in digital learning environment. A general language learning strategy is defined as a variety of social and cognitive activities that learners use consciously in the process of understanding, storing, remembering, recalling, and using new information or skills when they learn a specific language (Wenden & Rubin, 1987). Accordingly, DELS includes the types of English language learning strategies that are used by learners to search effectively for vast amounts of information and select materials that meet their English learning goals. Ultimately, learners can learn new language information and contents on their own. Therefore, DELS supports learners' self-directed learning, and, in this process, they are asked to use various types of conscious and unconscious strategies at the same time (Liang, 2009; Zhou & Wei, 2018).

As stated earlier, research into general language learning strategies has been utilized in the research field of digital language learning environment (Bae & Kim, 2018; Jung, 2012; Khabbaz & Najjar, 2015; Kim, 2002; Kim, 2017; Lee & Kwon, 2007; Liang, 2009). Based on these studies, learners tend to apply various digital devices and wired/wireless Internet access in their language learning, and in this process, they are most likely to use cognitive strategies such as conceptualization or deductive reasoning with reference to online materials (Bae & Kim, 2018; Lee & Kwon, 2007). It has been also revealed that learners use many of the metacognitive strategies such as planning, organizing, and self-monitoring, etc., and reading strategies such as skimming, scanning, understanding topics, and inferring during web browsing (Bae & Kim, 2018; Jung, 2012; Kim, 2002; Lee & Kwon, 2007; Oh, 2014).

Meanwhile, Kim (2017) indicated that the use of compensation strategies and metacognitive strategies has increased through mobile-assisted listening practices and strategy training. According to her study, English learning in the digital environment is helpful for self-directed learning as it allows learners to use particular strategies, such as finding out other means of helping learners' deficiencies or planning, monitoring, and evaluating their learning process in order to become strategic learners. Similarly, Bae and Kim (2018) investigated the use of DELS by Korean high school students in digital English learning environment and

analyzed the interrelations between the use of DELS and learner factors. The result of the study suggested that learners tended to use direct strategies more frequently in the process of digital English learning, and most learner factors are highly related to the use of DELS.

The previous research into the digital learning strategies has been limited to describe the learning process and strategies in the digital environment in terms of cognitive and affective domains. There is also a limit in revealing the interrelation between various learning strategies and the learners' variables that may affect the use of learning strategies. However, in view of the wide spread of the recent digital environment and the possibility and realistic trend of the digital language learning, it seems important that DELS should be considered as the integral concept including cognitive, metacognitive, and socio-affective strategies, etc. Moreover, it is critical to identify how DELS interacts with the learner's individual factors in the actual learning process in the digital English learning context.

Therefore, the current study investigated the overall language strategy use of Korean university students enrolled in the digital English learning context. In addition, it also examined the relationship between DELS usage and individual learner factors and investigated the differences of digital learning strategy use depending on such learner variables as gender, level of English proficiency, duration of English learning, and experience of using digital devices (or digital learning environment). Two research questions are presented to be answered as follows:

1. What kind of learning strategies do Korean university students use when learning in a digital English language environment?
2. Are there any differences in the use of digital language learning strategies depending on learner characteristics?

3. Methodology

3.1. Participants

The participants of this study were 448 students from two universities located in the middle province of Korea. Out of these, 48 students who did not complete the survey and the whole research procedures were excluded; so the final participants of the present study were 400 cases of the data. Out of the total of 400 university students, 141 (35.3%) students were male and 259 (64.8%) students were female, and their age ranged from 20 to 29. They were from various majors: the largest percentage was in English education (20.4%), and the rest of them were from nursing (8.8%), clinical pathology (9.0%), social education (6.6%), aerial service, hotel management, and so on.

As regards the total duration of English study, the participants have studied English at least for one year (22.0%) to more than ten years (38.5%). Regarding the duration of use of digital devices, most students (76.8%) had more than five years of experience; however, only 18.5% had less than five years of studying English with digital devices, and the majority of students (53.8%) had less than one year of digital English learning experience. As regards self-evaluation of English proficiency, 48.3% marked themselves as beginning level, followed by intermediate level (45.8%) and only 6.0% as advanced level. Table 1 displays demographic information of 400 participants and individual variables used for the present study.

Table 1. Participants' background information and characteristics

Variables	Categories	N	%
Gender	Female	141	35.3
	Male	259	64.8
Duration of English learning	below 1 years	88	22.0
	1 ~ 3 years	46	11.5
	3 ~ 7 years	41	10.3
	7 ~ 10 years	71	17.8
	over 10 years	154	38.5
Duration of using digital devices	below 1 year	40	10.0
	1-2 years	15	3.8
	2-3 years	13	3.3
	3-4 years	25	6.3
	over 5 years	307	76.8
Duration of digital English learning	below 6 months	169	42.3
	6 months - 1 year	46	11.5
	1-3 years	68	17.0
	3-5 years	43	10.8
	over 5 years	74	18.5
Self-evaluation of English proficiency	beginning	193	48.3
	intermediate	183	45.8
	advanced	24	6.0

3.2. Instruments

To answer the two research questions presented above, the study developed a questionnaire for the DELS survey based on several previous studies (Bae & Kim, 2018; Oxford, 1990, 2002; Lee & Kwon, 2007). The original idea of the DELS survey was based on Oxford's (1990) Strategy Inventory for Language Learning (SILL), which has been employed as a key instrument in numerous studies (Hong-Nam & Leavell, 2006; Kim, 2002; Lee, 2001; Lee & Kwon, 2007; Liang, 2009; Wharton, 2000). The original SILL was a self-reported questionnaire containing 50 question items designed to assess language learning strategies. It was adapted for this study by adding and modifying some items to fit the research aims. In other words, since the current study focused on the learning strategy use in digital English learning environments, the statements of several items were modified and some items were

added according to the previous studies that examined learning strategies in computer-assisted and/or digital language learning contexts (Bae & Kim, 2018; Lee & Kwon, 2007; Liang, 2009).

The questionnaire for the DELS survey was divided into two parts. The first part included some initial questions that collected the participants' demographic information. The second part consisted of 60 question items that referred to various learning strategies used for digital English learning. Then, as Oxford (1990, 2002) pointed out, all of the 60 learning strategies were grouped into six categories; memory (Mem) strategies, cognitive (Cog) strategies, compensation (Comp) strategies, metacognitive (Meta) strategies, affective (Aff) strategies, and social (Soc) strategies. In addition, the questionnaire used 5-point Likert scale, ranging from 1 (never) to 5 (always), and asked the participants to respond to each item honestly about their learning strategy use.

Once the DELS survey was drafted, it was validated by a group of 20 students randomly selected from one university, and checked for the level of reliability. Two question items that influenced lower internal consistency were found and revised. After all questions of the questionnaire were finalized, the online survey form was designed in order to be distributed to the participants. Survey Monkey, which is an online platform that allows public users to create, publish, and implement free online survey, was chosen for the present study, paying a certain fee. In order to measure the reliability of the DELS survey, Cronbach's alpha coefficient was calculated. The total internal consistency was 0.964, which was acceptable for the social scientific research (Bae & Kim, 2018; Kim, 2015). Table 2 displays the six categories of the DELS survey and the levels of reliability for each category.

Table 2. Instruments of DELS survey and analysis of the reliability scores

Strategy Category	Description	Number of items	Reliability
Mem	storing and retrieving information	8	.820
Cog	understanding and producing the language	14	.880
Comp	overcoming limitations in learning	8	.744
Meta	planning and monitoring learning process	13	.914
Aff	controlling emotions and motivation	8	.793
Soc	cooperating with others in learning	9	.889
Total		60	.964

3.3. Data collection and analysis

Once the online DELS survey form was completely designed, it was administered by two researchers during a regular class hour. The researchers, as instructors of classes, explained the

purpose of the study and provided full descriptive instructions about the procedures of the survey. The students were told that there were no right and wrong answers to questions, and their responses were confidentially secured and used only for research purposes. After that, the address of online survey (URL) was sent to each student's mobile phone and the learners were asked the survey. The instructors walked around the classroom while implementing the DELS survey and answered to the student's questions if any.

After the data were collected through the online survey form, an Excel spreadsheet with all 448 cases and answers for each variable was generated. These data were automatically imported to a SPSS sheet to work with, and in this process, any errors contained in the data, such as wrong response, duplicated answers, and missing cases, were eliminated and edited before importing the information to SPSS. The quantitative data collected from 400 participants were analyzed using SPSS 23.0 version.

Data analyses included descriptive statistics to present demographic information of the participants and to calculate overall strategy use. The first research question focused on how university students use digital English learning strategies, and which types of learning strategies were preferred by the students. Therefore, the average frequency of each category of DELS was calculated and compared. The second research question was to examine the relations between the use of DELS and different individual variables. In order to determine any variation in strategy use relative to individual learner factors (gender, level of English proficiency, duration of English learning, experience of digital devices), the independent *t*-test and the analysis of variance (ANOVA) were conducted using these factors as independent variables and the six categories of strategies as dependent variables. The Bonferroni post-hoc test was used to find where any significant differences in strategy use lay. For all statistical analyses, the significance level was set at .05.

4. Results and findings

4.1. Digital English learning and overall learning strategy use

To answer the first research question, the descriptive statistical analysis was conducted to find out the students' preferences of overall learning strategy use. Based on the results, the most preferred learning strategy category were Comp strategies (*M*=3.26, *SD*=.57), which meant that the students of this study frequently used digital learning strategies when they encountered any difficulties in learning and needed to overcome their limitation of English abilities. Additionally, the students also preferred Mem and Cog strategies in similar levels of

frequencies (*M*=3.17, *M*=3.11, respectively). In contrast, the least used strategy category were Soc strategies (*M*=2.95), which indicated that the students rarely cooperated with others in the learning process. Table 3 shows the ranks of each category of DELS with mean scores.

Table 3. Overall results of digital English learning strategies (N= 400)

Strategy Category	*M*	*SD*	Rank
Mem	3.17	.67	2
Cog	3.11	.65	3
Comp	3.26	.57	1
Meta	3.08	.69	4
Aff	3.03	.66	5
Soc	2.95	.79	6
Total	3.10	.57	

On the other hand, Table 4 shows the ranks of individual strategy items with mean scores, and the results are presented in the descending order from the most to the least preferred learning strategies. As shown in Table 4, the most preferred strategy by the university students was a cognitive strategy "*Using digital devices to search words/meanings*" (*M*=3.94). The least preferred strategy item was an affective strategy "*Practicing English with foreigners*" (*M*=2.42). Out of all the 60 DELS items, the highest ranked strategies (*M*=3.50 or above) were three Cog strategies, two Comp strategies, and one Mem strategy. Other strategies were reported medium usage of frequencies (they ranged from 2.50 to 3.49), and only one Aff strategy fell within the low usage of range (*M*=2.49 or below).

Table 4. Frequency and ranks of Digital English Learning Strategies

Strategy Category	Strategy No.	Statement of items	Rank	Mean
High Preference (*M*=3.50 or above)				
Cog	18	Using digital devices to search words/meanings	1	3.94
Cog	10	Practicing repeatedly by digital tools and programs (for speaking/writing)	2	3.65
Comp	28	Using alternatives to unavailable words	3	3.59
Comp	23	Guessing unknown words from contextual clues	4	3.58
Mem	3	Memorizing new words as to sounds/rhymes	5	3.56
Cog	19	Skimming whole texts quickly to understand overall meaning first	6	3.52
Medium Preference (*M*=2.50~3.49)				
Soc	52	Asking for clarification or repetition	7	3.48

Mem	2	Associating new concepts to things already known	8	3.42
Cog	13	Watching English video materials	9	3.36
Comp	25	Using unrelated clues to guess the meaning of words	10	3.35
Meta	34	Looking for new methods to practice English in digital contexts	11	3.35
Cog	11	Using words in varied ways through digital programs/applications	12	3.34
Meta	37	Seeking better digital programs/applications to fit the learning objectives	13	3.34
Meta	36	Having clear goals and targets for studying English	14	3.33
Comp	29	Making conversation with familiar topics	15	3.33
Comp	26	Anticipating while watching or reading digital materials	16	3.30
Mem	5	Searching for sentences with new words	17	3.30
Aff	46	Coping with emotional difficulties in the learning process	18	3.29
Mem	4	Memorizing new words by visualizing situation	19	3.26
Meta	40	Noticing mistakes so as to improve	20	3.26
Aff	44	Trying to relax when being afraid of using English	21	3.26
Soc	60	Trying to learn about target cultures	22	3.25
Aff	45	Self-minding positively to continue English learning	23	3.22
Mem	7	Reviewing regularly	24	3.21
Cog	9	Practicing repeatedly using digital contents (for reading/listening)	25	3.20
Aff	48	Noticing tension in learning or using English	26	3.19
Meta	33	Paying attention while learning in digital contexts	27	3.14
Cog	17	Avoiding word-by-word translation	28	3.13
Cog	12	Seeking patterns of English through digital resources	29	3.12
Comp	27	Looking up similar words in mother tongue	30	3.11
Meta	38	Planning proper digital activities to achieve the goals	31	3.11
Meta	35	Planning to ensure enough time for English	32	3.10
Aff	53	Seeking help from natives	33	3.08
Meta	32	Avoid distraction by not activating unnecessary programs or browsers	34	3.05
Aff	55	Looking up others' experience or texts to correct errors	35	3.04
Aff	47	Rewarding oneself when doing well	36	3.04
Mem	6	Searching for related words to remember new words	37	3.04
Meta	43	Self-evaluating on the efficiency	38	3.01
Meta	31	Building associations to entire contents	39	3.01
Meta	39	Seeking chances to use English with digital tools	40	2.99
Comp	24	Guessing unknown words from linguistic clues	41	2.98
Mem	8	Memorizing new words by using digital programs/applications	42	2.88
Cog	20	Using digital translators to read in depth	43	2.88
Aff	56	Sharing information with fellow learners	44	2.87
Comp	30	Making up new words when needed	45	2.83

Aff	49	Using self-reflection check-list	46	2.83
Soc	58	Participating in collaborative work to improve English	47	2.83
Cog	21	Marking (or Recording) a favorite list to look up things when needed	48	2.80
Cog	22	Summarizing the information on electronic notes or word programs	49	2.78
Meta	42	Self-evaluating on the improvement	50	2.75
Aff	54	Asking teachers or professors through online access	51	2.73
Aff	50	Writing diaries to record feelings about learning English	52	2.71
Cog	16	Using digital messengers to talk in English	53	2.71
Aff	51	Talking to others about how you feel in learning English	54	2.71
Mem	1	Classifying new words by using digital tools	55	2.69
Aff	57	Practicing English with fellow learners	56	2.68
Meta	41	Self-reflecting on the progress in learning	57	2.65
Cog	15	Reading digital texts for fun	58	2.62
Cog	14	Using social network system (SNS) to practice with natives	59	2.59
Low Preference (*M*=2.49 or below)				
Aff	59	Practicing English with foreigners	60	2.42

4.2. Digital English Learning Strategy use by individual learner characteristics

The differences of digital learning strategy use depending on learner variables such as gender, levels of English proficiency, duration of English learning, and experience of using digital devices (or digital learning environment) were investigated to answer the second research question. First of all, to analyze the data grouped by gender, the independent *t*-test was conducted to reveal statistically significant differences in the use of DELS. Table 5 shows the results of the use of DELS with the participants grouped by gender. With regard to overall strategy use, female students (*M*=3.13) engaged in strategy use more frequently than male students (*M*=3.05), but this mean difference was not statistically significant (*t*=-1.33, *p*=.09). However, there was a statistically significant difference in the use of Mem strategies between males and females (*t*=-2.40, *p*=.02), and females (*M*=3.23) reported higher use of memory strategies than males (*M*=3.06). With regard to mean scores of each strategy category, male and students favored the use of Comp strategies (*M*=3.22) the most while Soc strategies (*M*=2.93) the least. Female students reported using Comp (*M*=3.28) and Mem strategies (*M*=3.23) the most while Soc strategies (*M*=2.96) the least.

Table 5. Results of Digital English Learning Strategy use by gender

Strategies	Male		Female		t	p
	M	SD	M	SD		
Mem	3.06	.72	3.23	.64	-2.40	.02*
Cog	3.07	.72	3.15	.61	-1.15	.25
Comp	3.22	.65	3.28	.53	-1.10	.27
Meta	3.05	.75	3.10	.66	-.71	.48
Aff	3.03	.72	3.04	.62	-.19	.85
Soc	2.93	.79	2.96	.79	-.36	.72
Total	3.05	.63	3.13	.53	-1.33	.09

*p<.05

Secondly, the data were collected and grouped by the self-evaluated levels of English proficiency (beginning, intermediate, advanced) and the ANOVA test was conducted to reveal statistically significant differences in the use of DELS. Table 6 summarizes the ANOVA results for the six categories of DELS use grouped by three levels of English proficiency.

Table 6. Results of Digital English Learning Strategy use by English proficiency

Variables	Beginning		Intermediate		Advanced		F	Sig.	Difference*
	M	SD	M	SD	M	SD			
Mem	2.99	.68	3.29	.60	3.73	.70	19.46	.00*	Beg.<Int.
Cog	2.89	.62	3.28	.56	3.74	.78	31.59	.00*	Int.<Adv. Beg.<Adv.
Comp	3.10	.62	3.38	.49	3.66	.47	18.16	.00*	Beg.<Int. Beg.<Adv.
Meta	2.89	.69	3.18	.63	3.80	.60	24.68	.00*	Beg.<Int.
Aff	2.82	.64	3.17	.61	3.72	.45	30.56	.00*	Int.<Adv.
Soc	2.68	.72	3.12	.74	3.81	.71	33.98	.00*	Beg.<Adv.
Total	2.90	.56	3.23	.49	3.81	.43	38.82	.00*	

Beg.=Beginning, Int.=Intermediate, Adv.=Advanced

*p<.05

With regard to DELS use by level of English proficiency, overall digital learning strategies were used more by the Advanced level (*M*=3.81) than the Beginning level (*M*=3.23) and the Intermediate level (*M*=2.90), and the differences between groups were statistically significant (*F*=38.82, *p*=.00). In addition, statistically significant differences were also found in each category of strategies; the Advanced level of students used digital learning strategies the most, the Beginning level of students used them the least, while the Intermediate students used more strategies than Beginners. For comprehension strategy category, there was no significant difference found between Intermediate and Advanced levels.

As described above, the majority of the participants had more than 10 years of English learning experience. Table 7 displays the results of the DELS use when the participants were grouped by the duration of English language learning. In terms of the overall use of digital learning strategies divided according to five groups of English learning duration, the longer the English learning experience of students, the more strategies they used. In addition, statistically significant differences were found in all categories of DELS. However, although the difference in strategy use was statistically significant among the groups, the results of the Post-hoc test showed that there was no statistically significant difference found in the use of most strategy categories. Only Cog and Comp strategies showed significant differences between groups. In case of Cog strategies, there was a significant difference between ~1 year group (*M*=2.99) and 10~years group (M=3.23) at the .05 level (*p*=.048). Additionally, in the case of Comp strategies, ~1 year group (*M*=3.11) used fewer strategies than 7~10 years group (*M*=3.43) and 10~years group (*M*=3.34), and these differences were statistically significant (*p*=.01, *p*=.03, each), and the difference between 1~3 years group (*M*=3.11) and 7~10 years group (*M*=3.43) was also significant (*p*=.03).

Table 7. Results of participants' usage of DELS by the duration of English learning

Strategies	Duration	*N*	*M*	*SD*	*F*	*p*	Post-hoc
Mem	A	88	3.02	.77			
	B	45	3.14	.59			
	C	41	3.00	.58	3.02	.02*	
	D	71	3.27	.56			
	E	153	3.27	.67			
Cog	A	86	2.99	.77			
	B	46	2.99	.48			
	C	39	3.00	.53	3.02	.02*	A<E
	D	70	3.18	.63			
	E	152	3.23	.64			
Comp	A	87	3.11	.68			
	B	46	3.11	.50			A<D, E
	C	41	3.15	.64	5.08	.00*	
	D	71	3.43	.47			B<D
	E	153	3.34	.54			
Meta	A	86	2.97	.72			
	B	45	2.95	.59			
	C	41	2.95	.59	2.54	.04*	
	D	70	3.13	.67			
	E	153	3.20	.73			
Aff	A	88	2.93	.70			
	B	46	2.95	.54	2.48	.04*	
	C	41	2.86	.63			

	D	70	3.12	.71		
	E	154	3.13	.64		
	A	85	2.86	.72		
	B	46	2.73	.63		
Soc	C	41	2.78	.67	2.82	.03*
	D	69	3.06	.80		
	E	152	3.07	.87		
	A	84	2.98	.64		
	B	44	2.99	.37		
Total	C	39	2.95	.51	3.69	.01*
	D	67	3.20	.55		
	E	147	3.20	.58		

A=less than 1 year, B=1~3 years, C=3~7 years, D=7~10 years, E=more than 10 years

*p<.05

The participants' use of DELS was then compared with students' experiences of digital devices as well as the duration of English learning through digital devices. In terms of the experiences of digital devices, there was no statistically significant difference in the use of DELS, which meant that it had no effect on the students' use of learning strategies, no matter how long and/or how much they have used any kinds of digital devices such as computers, notebooks, and smartphones, etc.

On the other hand, the participants' use of DELS was also compared among the groups of their digital English learning experience. As Table 8 shows, the majority of the participants had less than 6 months of digital English learning experience. Moreover, all categories of DELS as well as the overall use of DELS showed a significant difference at the .05 level. The detailed analysis of ANOVA results by each category of strategies shows that the students who had longer experience of digital English learning tended to use more DELS than those who had shorter experience of digital English learning. For instance, 5~years group used more strategies than other four groups. They reported the most use of Cog, Comp, Meta, Aff, and Soc strategies (*M*=3.56, *M*=3.58, *M*=3.56, *M*=3.35, and *M*=3.43, respectively) whereas ~6 months group reported the least use of these strategies (*M*=2.91, *M*=3.12, *M*=2.83, *M*=2.88, and *M*=2.74, respectively). Additionally, overall use of DELS showed a significant difference between groups of students' digital English learning experience (*F*=16.46, *p*=.00). According to the results of the post-hoc test, the differences were found in 5~years group (*M*=3.50) and ~6 months group (*M*=2.91), 6 months~1 year group (*M*=3.01), 1~3 years group (*M*=3.12) as well as ~6 months group (*M*=2.91) and 3~5 years group (*M*=3.26).

Table 8. Results of Digital English Learning Strategy by the digital English learning experience

Strategies	Duration	*N*	*M*	*SD*	*F*	*p*	Post-hoc
Mem	H	168	2.96	.73	13.73	.00**	H, I < J, K, L J < L
	I	46	3.02	.60			
	J	66	3.27	.51			
	K	43	3.31	.56			
	L	73	3.58	.56			
Cog	H	165	2.91	.68	14.96	.00**	H, I, J, K < L H < K, L
	I	45	3.08	.56			
	J	67	3.11	.49			
	K	43	3.23	.50			
	L	73	3.56	.61			
Comp	H	168	3.12	.62	10.01	.00**	H, I, J < L H < K
	I	46	3.15	.54			
	J	67	3.24	.49			
	K	43	3.41	.46			
	L	74	3.58	.51			
Meta	H	169	2.83	.71	17.66	.00**	H, I, J, K < L H < J, K
	I	45	2.97	.65			
	J	66	3.17	.44			
	K	43	3.20	.57			
	L	74	3.56	.66			
Aff	H	169	2.88	.69	8.82	.00**	H, I, J < L H < K
	I	46	2.95	.64			
	J	68	3.00	.47			
	K	42	3.26	.62			
	L	74	3.35	.63			
Soc	H	165	2.74	.78	11.23	.00**	H, I, J < L
	I	46	2.86	.67			
	J	67	2.91	.65			
	K	42	3.10	.72			
	L	73	3.43	.83			
Total	H	161	2.91	.60	16.46	.00**	H, I, J < L H < K
	I	45	3.01	.51			
	J	63	3.12	.35			
	K	41	3.26	.45			
	L	71	3.50	.54			

H= ~6 months, I= 6 months~1 year, J= 1~3 years, K= 3~5 years, L= 5~years
**$p<.01$

5. Discussion

With the rapid development of various digital devices and wide spread of Internet networks and Wi-Fi access, the adoption of digital technology is no longer a choice but a necessity. In most educational settings, including schools and institutes, the infrastructure for a digital environment has already been established, and therefore, both language teachers and students are now exposed to, and are able to utilize, a wide range of digital materials. At the same time,

students have the opportunity to learn and practice language through interactions in a more natural setting. For this reason, it is critical to have deep understanding about language learners' use of learning strategies in a digital learning environment.

The pedagogical implications of this study are as follows. First of all, in order to effectively utilize the digital English learning environment in contemporary education, systematic guidance is needed so that learners can clearly understand the characteristics of digital English learning and the advantages of the digital learning environment to adapt it into their learning process appropriately. The digital environment provides English learners with various opportunities to take the desired quantity and quality of learning activities anytime and anywhere, and this environment facilitates immediate interaction and cooperative learning for English learners (Kim & Rha, 2014; Kukulska-Hulme & Shield, 2008; Ogata & Yano, 2005). Thus, English teachers should provide students with clear guidelines on how to use DELS, so as to act as facilitators to help them select, train, use, and check proper DELS.

Secondly, as the present study revealed, the individual learner factors showed significant influence on usage of DELS. This is highly related to the fact that the digital English learning environment provides an appropriate educational environment for differentiated learning or self-directed learning, which is tailored to the learner's individual features (Kim & Lee, 2017; Kukulska-Hulme & Shield, 2008). In order to effectively perform individualized self-directed learning, the learner needs to practice using requisite learning strategies, and it is necessary for students to select, develop, and use appropriate learning strategies to regulate their own learning (Yot-Domínguez & Marcelo, 2017). In particular, university students, nowadays, are in a digital generation which is naturally exposed to the digital environment. To enable them to use vast amounts of information and learning materials enabled by digital technologies, such as search functions, interactive SNS tools, and collaborative activities, it is important for the students to cultivate appropriate learning strategies for actively planning, selecting, managing, controlling, and evaluating their individual learning. In this process, the teachers should not only understand individual learner's differences but also carry out teaching activities taking various individual learner factors into account. In addition, teachers need to continuously develop and present individualized digital learning strategies to improve their students' digital English achievement (Meltzer & Hamann, 2005).

6. Conclusion

The current study investigated the use of DELS based on the survey data that was collected from Korean university students and examined the interrelations between the use of DELS and

different learner factors. Above all, considering the overall use of DELS, the university students who participated in the current study reported using comprehension, memory, and cognitive strategies more frequently than metacognitive, affective, and social strategies during their digital English learning. This was partially consistent with the results of several previous studies that investigated learning strategy use in CALL or digital learning contexts (Bae & Kim, 2018; Kim, 2002; Kim, 2017; Lee & Kwon, 2007; Oh, 2014). Based on these studies, ESL students, particularly Korean students, were shown to be more familiar with certain strategies to overcome their limitations in learning, and frequently relied on rote memorization to store and retrieve information. This might be explained by the students' upbringing and previous language learning experience which has impacted their behavior in the digital learning context. The participants of this study also used these strategies more frequently and tried to practice and produce English language with the help of digital technology tools (Alias, et al., 2012; Kim, 2002). However, the least favored strategies by the participants were social and affective strategies, which indicated that the participants of this study showed less preference for cooperative learning and discouraged discussion of their feelings with others (Reid, 1987; Wharton, 2000).

With regard to interrelations between DELS use and learner factors, gender, level of English proficiency, duration of English learning and digital learning experience were significantly related to the use of DELS. On the other hand, duration of using digital devices had no effect on DELS usage. As shown in many previous studies, the results of this study also revealed that females tended to use more DELS than males (Green & Oxford, 1995; Hong-Nam & Leavell, 2006; Oxford, 1990; Oxford & Ehrman, 1995), and there was a statistically significant difference in memory strategy use between two genders. Thus, female students utilize particular strategies when storing and retrieving information more frequently than male students.

Next, it has been demonstrated that the advanced learners showed more strategy use than beginner learners. In addition, more experienced learners used more strategies. These findings were partially consistent with previous research, demonstrating a positive linear relationship between strategy use and English proficiency level (Dreyer & Oxford, 1996; Green & Oxford, 1995; Wharton, 2000). Lastly, this study also found that the duration of digital learning experience was related to DELS use, and the longer students experienced digital English learning, the more they utilized all categories of DELS. However, the periods of using digital devices did not affect digital English learning or strategy use (Bae & Kim, 2018; Lee & Kwon, 2007; Oh, 2014; Yot-Domínguez & Marcelo, 2017).

Despite the above research findings, this research has some limitations. First, the study did not consider participants' English learning proficiency based on the scores of certified exams, so it was insufficient in measuring the effect of DELS use by different language proficiency levels and to suggest the effective methods of the strategy training. Another limitation is that learners' affective domains, such as motivation and attitude toward English learning, are not included among the individual variables in the study. Finally, the questionnaire of DELS survey presented in this study does not allow qualitative analysis of individual learning strategy because it measures only the type and frequency of approximate strategy use. By complementing these limitations, future research should be able to investigate the actual effects of DELS as well as the analysis of DELS use patterns. In-depth research is needed into the use of learning strategies that characterize differentiated students with diverse learner factors.

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