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Self-regulated Learning and Digital Behavior in University Students in an Online L2 Learning Environment*

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The current study examines the digital behaviors of 124 university students enrolled in a blended learning class in Korea. The students were divided into two groups (upper and lower) based on their scores on a self-regulated learning questionnaire. Their digital behaviors were compared across four areas: (a) task completion scores; (b) strategy use; (c) the days on which tasks were completed; and (d) learning gains. The results revealed a significant difference in task completion scores between the upper and lower groups. However, no meaningful difference was observed in strategy use between the two groups. Students in the upper group were more proactive in completing videos, homework, and TOEIC tests, often finishing these tasks ahead of deadlines. In contrast, students in the lower group tended to complete their assignments on the due date. Finally, there were no significant differences in learning gains between the two groups. These findings may inform the design and management of online L2 learning programs.

Key words: learning analytics, online learning behaviors, digital behaviors, self-regulated learning, language learning, L2 online learning

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1. INTRODUCTION

Self-regulated learning (SRL) refers to learning where learners can actively regulate their cognition, motivation, and behavior in order to achieve their goals, and thus perform better (Zimmerman, 1989). Consequently, self-regulated learners stay proactive throughout their learning: setting goals, implementing strategies, monitoring progress, seeking help, and persevering to achieve their goals (Zimmerman, 2008). Thus, SRL skills can play a critical role in an online learning environment which generally offers low levels of support or guidance to learners (Kizilcec, Pérez-Sanagustín, & Maldonado, 2017).

Currently, in the field of language education, asynchronous online learning has become a common learning mode with widespread inclusion of online materials and technology-enhanced learning activities. Language learners are often asked to complete assignments logged on to specific learning platforms in their own time (Kim & Kim, 2017; Li & Hegelheimer, 2013; Ryu, 2017). When self-studying online, language learners' capacity to engage in SRL can be an influential factor in their learning outcomes (Barnard, Lan, To, Paton, & Lai, 2009; Chang, 2005).

Some studies have investigated online L2 learning based on the learners' self-reported SRL, and these have shown that SRL is positively related to students' learning outcomes (Lin, Zhang, & Zheng, 2017; Zheng, Li, & Chen, 2018b) and their learning motivation (Chang, 2005; Zheng, Liang, Yang, & Tsai, 2016; Zheng, Liang, Li, & Tsai, 2018a). With the evolution of cyber learning, learning analytics (LA) has been used to investigate SRL in learners studying a wide variety of subjects. These studies have predicted students' SRL patterns, course performance, and academic success (Cho & Yoo, 2017; Kia, Teasley, Hatala, Karabenick, & Kay, 2020; Li, Baker, & Warschauer, 2020; Montgomery, Mousavi, Carbonaro, Hayward, & Dunn, 2019). LA studies in SRL have also found that a relationship exists between SRL and strategy use (Aguilar, Karabenick, Teasley, & Baek, 2021; Kizilcec et al., 2017; Papamitsiou & Economides, 2019).

Research on SRL in the field of L2 language learning is gaining momentum. The ability of online learners to self-regulate their learning process has been shown to have beneficial effects in the fields of statistics, computer science, and economics. (Cho & Yoo, 2017; Kim, Yoon, Jo, & Brance, 2018; Kizilcec et al., 2017). However, little research has been carried out with regards to the SRL of L2 learners in online environments. To date, LA has been completely overlooked as a research tool for analyzing the SRL of L2 learners studying in asynchronous online learning environments in both Korean and foreign contexts. In an asynchronous L2 online learning context, students' task completion rates and their learning outcomes are the two most important factors for successful learning. Therefore, the present study aims to investigate areas closely related to these two aspects. The digital behaviors regarding the assignment submission of learners with different levels of SRL will be

analyzed in order to determine (a) completion of assignments, (b) strategy use in completing assignments, (c) days of the week assignments are submitted, and (d) learning gains.

To examine the effects of SRL abilities on learners' digital behaviors, the participants' were divided into two groups (upper and lower) based on their scores on an SRL questionnaire, using a clustering technique. The findings of the present study may enhance understanding of online language learners and offer useful information regarding teaching L2 learners online. The following four research questions were addressed:

1) To what extent do the upper and lower SRL groups differ regarding their online task completion?
2) To what extent do the upper and lower SRL groups differ regarding their use of SRL strategies?
3) To what extent do the upper and lower SRL groups differ regarding the days of the week on which they submit assignments?
4) To what extent do the upper and lower SRL groups differ regarding their learning gains?

2. LITERATURE REVIEW

2.1. SRL in Online Learning

While a learner's SRL ability is important in any learning situation, it can be more important in an asynchronous online learning environment since learners are responsible for choosing and setting academic goals by themselves when they study. Similarly, some researchers (Barnard et al., 2009; De Barba, Kennedy, & Ainley, 2016) claim that asynchronous online learning environments require considerable SRL abilities because the successful academic outcome of learners relies heavily on how they themselves initiate and control their use of online resources in their own time.

Although online language learning environments are garnering more attention as more and more language classes either integrate some form of online learning resources into their programs or are fully delivered to L2 learners via the internet, only a dearth of research appears to have adopted the framework of SRL when investigating online L2 learning: SRL strategies and L2 motivation (Chang, 2005); L2 motivation and online self-regulation (Zheng et al., 2016; Zheng et al., 2018a); SRL strategies and learning outcomes (Lin et al., 2017); SRL system and learning outcomes (Zheng et al., 2018b).

Chang (2005) investigated the effect of SRL strategies on the learning motivation of 28 vocational university students in Taiwan. SRL strategies were incorporated into the semester-long web-based course: they read articles on various topics, had discussions online,

summarized the reading material, and kept learning journals and forms recording study time. The results showed that, after one semester, these students improved in the areas of intrinsic motivation, task value, learning beliefs, and self-efficacy.

Zheng et al. (2018a) examined the relationship between L2 learners' motivation and online self-regulation in a sample of 332 Chinese undergraduate students enrolled in a required English course. The students completed two kinds of questionnaires about their motivation for online language learning and their online self-regulation of English learning. The results of the path analysis showed that students with a positive view of L2 learning and culture had higher self-regulation in online learning. Zheng et al. (2016) investigated the relationship between Chinese L2 learners' perceptions of learning English and their self-regulation in asynchronous online learning environments. A total of 401 university students enrolled in a compulsory English course were instructed online during a biweekly, two-hour, face-to-face class. The results indicated a positive relation between the learners' views of English learning and the way they were able to use self-regulation strategies in online environments. Thus, relevant interventions were recommended to encourage more SRL behaviors in the students online.

Lin et al. (2017) and Zheng et al. (2018b) proved that a positive relationship exists between SRL strategies and student learning outcomes. Lin et al. (2017) examined whether the use of motivation and/or SRL strategies predicted students' learning outcomes. A total of 466 high school students in the Midwestern U.S. enrolled in various L2 online courses completed surveys on motivation, learning strategies, and satisfaction with online learning. The results showed that SRL strategies, such as goal-setting, self-evaluation, organizing, and help-seeking, predicted the success of learning outcomes. Zheng et al. (2018b) developed a mobile SRL system using Winne and Hadwin's model (Azevedo, Moos, Johnson, & Chauncey, 2010). A total of 60 freshmen in China were randomly divided into two groups. When reading passages, those in the experiment used a mobile SRL system to learn, whereas those in the control group learned via a conventional system. The findings showed that the experimental group significantly outperformed the control group in learning achievement. Further, those who used the mobile SRL system showed an improvement in their SRL skills relative to their counterparts.

2.2. LA Research in SRL

LA stands out as a way to gain an understanding of learning processes by probing the digital behaviors of online learners (Brown, 2011; Drachsler & Kalz, 2016; Peña-Ayala, 2018). According to Long and Siemens (2011), LA is "the measurement, collection, analysis and reporting of data about learners in their context, for purposes of understanding and optimizing learning and the environment in which it occurs" (p. 34). In the context of an

asynchronous online learning environment, applying an LA approach in research can provide valuable insight into factors such as learners' SRL patterns, learning outcomes, and strategy use. Accordingly, information from LA research may allow for proactive intervention from teachers and the design of language programs that align with students' learning behaviors (Thomas & Gelan, 2018).

LA research has been carried out in various academic settings. Some studies have investigated learners' SRL patterns in an online learning context. Cho and Yoo (2017) compared the predictive power of self-reported SRL and saved log files on 60 undergraduates' online courses at a US university. The results showed that the higher SRL group had higher achievement scores and better course grades than their lower counterparts. Both measures positively predicted SRL patterns, but log files were found to be a more reliable source of evidence for students' achievements in online learning environments. Volk, Kellner, and Wohlhart (2015) examined the online English learning platform of a lower secondary school in Austria. The platform was called Cyber Homework (www.more-online.at) and was used as an additional tool to complement the course book *More!* Each day, up to 20,000 students visited this platform to complete interactive exercises in reading, writing, and speaking. They found the students' SRL patterns that their visits to the online platform were highest on Sundays and Mondays, aligning with assigned deadlines. Kim et al. (2018) investigated how learners with different SRL profiles differ in their learning patterns. A total of 284 university students enrolled in a business statistics course in Korea were divided into three SRL profiles: (a) self-regulation, (b) partial self-regulation, and (c) non-self-regulation. These groups were then analyzed according to three learning strategies using data-mining techniques: time investment in content learning, study regularity, and help-seeking. The study showed that the total time invested in learning was not a significant factor across groups. Students in the 'self-regulation' group were those who learned content in a timely fashion, exhibited effective use of time management strategies, and were more likely to seek help. These students completed their course content well before exams, whereas those in the 'non-self-regulation' group did so during the exam period.

Some LA studies have investigated learners' digital behaviors related to their learning outcomes in an online environment. Li et al. (2020) were interested to discover to what extent clickstream measures correspond to self-reported SRL, and which of these is a better predictor of course performance. A total of 238 university students in the US participated in the study. Analyses of the data showed that clickstream measures were significantly correlated with self-reported SRL data, and both were highly predictive of course performance. The clickstream measures improved the prediction of current and subsequent course performance when used along with self-reported SRL measures. Montgomery et al. (2019) examined 157 university students in a flipped bended learning Music Teacher Education course in terms of the relationship between their SRL and academic achievement.

The self-regulated behaviors were measured by the students' online interactions with the course materials, and included online access location, day-of-the-week, time-of-the-day, online frequency, online regularity, and exam review patterns. It was found that when (day-of-the-week) and how frequently the student logged on to the online material during the week strongly predicted their academic success. Aguilar et al. (2021) were interested in whether or not academic advisors' use of an early warning system in the dashboard was correlated with SRL, motivation, and academic achievement. A total of 201 university students in the US who enrolled in a summer bridge program took one of the math, English, or general study skills courses, throughout which they regularly met their academic advisers. They found that advisors' use of the information provided by the early warning system during meetings with the students had a positive influence on their performance and moderate effects on their motivation and SRL.

A few LA studies have investigated online SRL in terms of learners' use of strategies. Kizilcec et al. (2017) investigated how the use of SRL strategies manifested in the online behavior of 4,831 MOOC students studying various subjects, such as Computer Science, Engineering, and Management in Chile. Data collection included overall course grade, interactions with online content, and self-reports. The results indicated that the learners who perceived themselves to be more skilled at SRL tended to have better learning strategies, more frequently revisiting course materials, in particular, course assessment including peer review and multiple-choice quizzes. Papamitsiou and Economides (2019) investigated the effects of four SRL strategies (effort regulation, goal-setting, help-seeking and time management) on learners' abilities to make autonomous decisions. The data was collected from 113 undergraduates at a European university taking the Management Information Systems I course. The findings showed that effort-regulation had moderate effect on students' autonomous learning, and goal-setting and time-management had strong positive impacts on improving autonomous learning capacity.

3. METHODOLOGY

3.1. Research Context

College TOEIC (Test of English for International Communication) was a blended learning course which combined a traditional class with online self-study. This was a test-prep course aiming to teach test-taking strategies for TOEIC, an English proficiency test, developed by ETS in the US. TOEIC consists of seven parts: four Listening Comprehension (LC) and three Reading Comprehension (RC), as shown Table 1. Its purpose is to examine L2 learners' English abilities in everyday life and the workplace (Korea TOEIC Committee, 2024).

TABLE 1

Contents of TOEIC

Sections	Contents
LC section	
Part 1	Describing pictures
Part 2	Wh- & other types of questions
Part 3	Conversations
Part 4	Talks/speeches by one person
RC section	
Part 5	Grammar & vocabulary (filling in blanks)
Part 6	Filling in blanks in a long discourse
Part 7	One-passage/Two-passage/Three-passage readings

Students attended a traditional class once a week for two hours where they learned essential grammar and tips for solving LC and RC questions using a TOEIC prep-textbook. In addition to the regular class, students were asked to practice their skills via the online TOEIC website, an additional tool complementing the course book. These online assignments consisted of three kinds of task with specific deadlines: (a) videos (LC and RC lectures); (b) homework (problem solving); and (c) tests (a shortened version of the full TOEIC test).

The videos consisted of two approximately 15-minute lectures (one on LC and one on RC) which explained test-taking strategies relating to each chapter in the TOEIC prep-textbook. Students were asked to watch these videos every week and were given eight days to finish (from the beginning of Monday one week to 11:59 pm the following Monday). The homework task was composed of 150 questions, generated based on each student's test performance. Students had to complete these homework assignments within three weeks. With respect to tests, students had to complete three sets of tests by specific deadlines. On average, they took these tests once a month and were given eight days to do so, the same as for the videos. These were a shortened form of the full TOEIC test, although they also consisted of seven parts, as shown in Table 1. Students could not take the test again even if they were not content with their test scores. By completing these three types of task, students could earn 20% of the total points of the course.

3.2. Participants

A total of 124 undergraduates enrolled in the College TOEIC course in Korea participated in the present study. Originally, 130 students took part, but six students did not do any online tasks throughout the course. These six students were subsequently taken out. As a result, the actual participants of the present study numbered 124. These students were divided into two groups according to their SRL abilities, using the K-medoids clustering technique in R. The

K-medoids clustering technique is a type of data partitioning method. As a result of this, 56 students were placed in the lower group and 68 students were placed in the upper group.

The College TOEIC course was a general elective course, so students were mixed in terms of grades, majors, and gender. The course consisted of year one to year four students, and their age ranged from 18 to 26. They were all Korean but from various academic major backgrounds, and the gender mix was 41% female, 59 % male. According to university entrance examination scores, their English listening and reading abilities ranged from low intermediate to intermediate levels.

3.3. Instrument

SRL refers to the ability to plan one's learning, implement, adjust, evaluate, and determine when and how to learn the content (Milligan & Littlejohn, 2014; Zimmerman, 2000). The SRL survey developed by Kim and Park (2001) was used to measure students' SRL abilities in the online environment (e.g., "I usually make a plan before I start studying, and I study according to the plan."). Kim and Park (2001) developed an academic self-efficacy scale and tested its validity in their study. The scale consisted of three factors: self-confidence, SRL ability, and task difficulty. The SRL survey consisted of 10 items (see Appendix). The reliability of the SRL survey in the present study was 0.86.

3.4. Data Collection and Analysis

At the beginning of the semester, students were informed in detail about the online assignments as part of the course syllabus. They therefore knew that they could earn between 0 to 20 points depending on how well they completed the three kinds of task by the deadline throughout the semester. Ethical clearance was obtained through the university institutional review board. Students who wanted to participate in the study had to complete an informed consent form and the SRL questionnaire.

Students started their online assignments from the second week of the semester, and this continued until the Monday of the 15th week. As soon as the course was over, the researchers received relevant data regarding the four research questions from the two specialists in charge of the TOEIC website. When comparing task completion or learning gains between the two SRL groups, One-Way ANOVAs were conducted to check whether there were any statistical differences between them. For the comparison in strategy use between the two groups, a Chi-Square test was carried out. Finally, when examining task completion in relation to days of the week between the two groups, frequency tables were presented, and then the results of Chi-Square tests were given to visualize the differences between them.

4. RESULTS

4.1. Task Completion Scores

The first research question was whether there was a statistical difference regarding task completion scores between the upper and lower SRL groups. The maximum score that students could earn by completing the online tasks was 20 points, that is, 20% of the total score. Table 2 presents the descriptive statistics of the two groups in relation to their task completion scores.

TABLE 2

Descriptive Statistics of the Two Groups Regarding Task Completion Scores (N = 124)

Group	*N*	Minimum	Maximum	Mean	*SD*
Lower	56	1.33	20	15.31	5.71
Upper	68	2.67	20	17.31	4.28

The homogeneity of variance test between the two groups indicated that the *p*-value was significant, so robust tests of equality of means were carried out, and the Welch test indicated that these two groups were homogenous ($p < .03$). Thus, a One-Way ANOVA was carried out comparing the task completion scores between the upper and lower groups in SRL ability. A significant difference was found between these two groups (F (1, 122) = 4.96, $p < .05$). Students who belonged to the upper SRL group displayed significantly high mean scores (M = 17.31, SD = 4.28) compared to those who had lower SRL abilities (M = 15.31, SD = 5.71).

4.2. SRL Strategy Use

The second research question was whether there were significant differences in SRL strategy use between the two groups. Students checked one of the options when asked what kind of strategy they had used in order to remember to complete their online task every week: (a) I didn't use any strategy; (b) I always completed the online task on the same day of the week; (c) I set an alarm on my smartphone to be notified before the deadline; (d) I wrote a memo on my smartphone calendar; (e) I made my own schedule to finish the online task; (f) I completed the task between my classes on campus; (g) I put a note on a paper calendar; (h) I put up a post-it or memo where it could easily be seen; (i) Other strategy. These nine options were developed based on a simple survey of students who had taken the same course in the previous semester, in which the students outlined the different strategies they had used to remember their online assignment due dates.

Table 3 presents the results of the Chi-Square test of two groups and their strategy use.

The upper SRL group used more strategies (77.9%) than the lower SRL group (66.1%). A Chi-Square test of independence was used to compare the upper and lower groups. No significant relationship was found ($\chi 2(1) = 2.17$, $p > .05$). Strategy use appeared to be an independent factor.

TABLE 3

SRL Strategies * Group Cross Tabulation

	Lower Group		Upper Group		Total	
	Count	% within group	Count	% within group	Count	% within group
Strategies						
Not used (a)	19	33.9	15	22.1	34	27.4
Used (b~i)	37	66.1	53	77.9	90	72.6
Total	56	100.0	68	100.0	124	100.0

4.3. Days of Submission of Assignments

The third research question was to investigate to what extent the upper and lower SRL groups differed in the days on which they submitted their assignments. Results were presented in the order of (a) videos, (b) homework, and (c) tests since these were the three types of assignments given.

4.3.1. Days of video submission

First, the study investigated whether there was a significant difference between the upper and lower SRL groups regarding the days on which videos were watched. Table 4 presents the frequency of the two groups in relation to this.

TABLE 4

Frequency of Video Submission Throughout the Week ($N = 124$)

Group	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Next Mon.	Total
Lower ($N = 56$)	77	35	39	15	43	42	99	167	517
Upper ($N = 68$)	136	44	54	55	64	64	136	171	724

A Chi-Square test was carried out in order to investigate whether there was a statistical difference between the two groups regarding the days on which videos were submitted. Table 5 shows differences in the Chi-Square values and the proportions between the two groups throughout the week.

TABLE 5

Differences of Proportions Between the Two groups (*N* = 124)

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Next Mon.
Chi-Square value	3.21	0.24	0.00	12.49	0.11	0.20	0.03	11.47
Lower vs. Upper	0.15/ 0.19	0.07/ 0.06	0.08/ 0.08	0.03/ 0.08	0.08/ 0.09	0.08/ 0.09	0.19/ 0.19	0.32/ 0.24

The results of the Chi-Square test indicated a statistical significance on Thursdays ($\chi 2(1) = 12.49, p < .05$) and on the following Mondays ($\chi 2(1) = 11.47, p < .05$). In other words, on these days, the lower SRL and upper SRL groups completed a statistically significant different amount of their video assignments. On Thursdays, only 3% of the lower group watched videos, whereas 8% of the upper group watched the assigned videos. However, on the following Mondays (the deadline), as much as 32% of the lower group completed their video assignments, whereas 24% of the upper group did so.

4.3.2. Days of homework submission

Second, the days on which homework was submitted were investigated to check whether there was a statistical difference between the upper and lower SRL groups. Table 6 presents the frequency of the two groups in relation to this.

TABLE 6

Frequency of Homework Submission Throughout the Week (*N* = 124)

Group	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Next Mon.	Total
Lower (*N* = 56)	39	20	16	8	25	22	70	242	442
Upper (*N* = 68)	57	23	26	31	39	41	96	258	571

Table 7 presents the Chi-Square values and the proportions between the upper and lower SRL groups throughout the week. The results of the Chi-Square test indicated a significant relationship on Thursdays and the following Mondays, with values of ($\chi 2(1) = 12.49, p < .05$) and ($\chi 2(1) = 11.47, p < .05$), respectively. These findings meant that the two groups completed statistically significant different amounts of their homework on these days. On Thursdays, only 2% of the lower group, compared to 5% of the upper group, completed their homework. In other words, more students in the upper group did their homework earlier compared to their lower counterparts. However, on the following Mondays (the deadline), more students in the lower group (55%) rushed to finish their homework than those in the upper group (45%).

TABLE 7

Differences of Proportions Between the Two Groups (N = 124)

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Next Mon.
Chi-Square value	0.39	0.15	0.55	8.82	0.58	2.07	0.17	9.12
Lower vs. Upper	0.09/ 0.10	0.05/ 0.04	0.04/ 0.05	0.02/ 0.05	0.06/ 0.07	0.05/ 0.07	0.16/ 0.17	0.55/ 0.45

4.3.3. Days of test submission

Third, the days on which tests were submitted were analyzed to check whether there was a significant difference between the upper and lower SRL groups. Table 8 presents the frequency of the two groups in relation to this factor.

TABLE 8

Frequency of Test Submission Throughout the Week (N = 124)

Group	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Next Mon.	Total
Lower (N = 56)	4	7	10	5	4	8	52	66	156
Upper (N = 68)	8	7	11	15	22	15	67	48	193

A Chi-Square test was carried out to investigate whether there was a statistical difference between the two groups regarding test submission days. Table 9 presents the differences in the Chi-Square values and the proportions between the two groups throughout the week.

TABLE 9

Differences of Proportions Between the Two Groups (N = 124)

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Next Mon.
Chi-Square value	0.65	0.17	0.27	3.33	9.76	0.98	11.93	11.93
Lower vs. Upper	0.03/ 0.04	0.04/ 0.04	0.06/ 0.06	0.03/ 0.08	0.03/ 0.11	0.05/ 0.08	0.33/ 0.35	0.42/ 0.25

A significant relationship was found on Fridays, and the following Mondays. The results of the Chi-Square test revealed significant differences on Fridays ($\chi 2(1) = 9.77$, $p < .05$) and the following Mondays ($\chi 2(1) = 11.93$, $p < .05$). This means that the lower and upper SRL groups completed a statistically significant different number of assigned tests on these days. On Fridays, only 3% of the lower group completed the tests each day, whereas the upper group finished 11%. However, on the following Mondays (the deadline), as much as 42% of the lower group completed their tests, whereas only 25% of the upper group did theirs.

More students in the upper group appear to have done their tests before the deadline, whereas students in the lower group tended to wait until the last minute to finish them.

4.4. Learning Gains

The fourth research question aimed to determine whether there was a meaningful difference between the upper and lower SRL groups with respect to learning gains. Students took the test three times throughout the semester: Test 1 on the 2nd week; Test 2 on the 6th week; Test 3 on the 11th week. Students' learning gains were calculated by subtracting Test 1 from Test 3, so those who did not take either Test 1 or Test 3 were removed from the data. This meant that six students from the lower group and two students from the upper group were taken out. As a result, the learning gains of 116 students were calculated between the two groups, as seen in Table 10.

TABLE 10

Descriptive Statistics of the Two Groups Regarding Learning Gains (N = 116)

Group	*N*	Minimum	Maximum	Mean	*SD*
Lower	50	-165	265	60.60	116.18
Upper	66	-205	480	68.33	117.62

The homogeneity of variance test, Levene's test, indicated that the p-value between the two groups was not significant, meaning that the two groups were homogenous ($p < .70$). Thus, a One-Way ANOVA was carried out to determine if there was a statistical difference between the two groups. No significant difference was found ($F(1, 114) = .12, p > .05$). The students in the two groups did not differ significantly in terms of learning gains on these tests.

5. DISCUSSION

5.1. SRL, Task Completion, and Strategy Use

In the present study, students with higher SRL abilities earned significantly higher task completion scores than their counterparts in the lower group. If we take a close look at the characteristics of the SRL ability, this result is unsurprising. As Zimmerman (2000) pointed out, students who have a higher SRL ability may be able to adjust their cognition, motivation, and behavior at will to achieve their goals. Thus, students' SRL abilities may be an important factor in achieving their learning goals, especially when they have to self-regulate their learning in an asynchronous online learning context. As mentioned in Cho and Yoo (2017),

self-reported SRL appeared to be a reliable measure in positively predicting the SRL patterns of students engaged in online learning. Although we need more research on SRL and task completion rate in the future for stronger conclusions, the positive relationship between SRL ability and task completion scores in the present study appears to support Cho and Yoo (2017)'s findings.

In relation to this finding, since students with higher SRL abilities completed significantly more tasks than those in the lower group, it appeared to be worth investigating whether the former used more strategies than the latter. It turned out that students in the upper SRL group did in fact used more strategies to avoid forgetting to complete their assignments than those in the lower SRL group; however, the difference was not significant. This finding was surprising because Kim et al. (2018) found that students in the 'self-regulation' group exhibited timely content learning and an effective use of time management strategies, and Papamitsiou and Economides (2019) found that time management had a strong positive impact on improving autonomous learning capacity. These studies have shown that SRL ability relates to the use of time management strategies, and time management is related to students' autonomous learning. Considering that making an effort to remember to complete online tasks is a type of time management skill (an SRL strategy), this finding in the present study was somewhat unexpected.

About 78% of the students in the upper SRL group used some kind of time management strategy, compared to about 66% of the students in the lower group. In other words, about 22% of the students in the upper SRL group did not use any kind of time management strategy. This could mean that high SRL ability in online L2 learning does not automatically guarantee the use of time management strategies. This area needs more research to better clarify the relationship between SRL ability and strategy use.

5.2. SRL and Days of the Week of Task Completion

Montgomery et al. (2019) found that the day-of-the-week a student logged on to the online material was strongly related to that students' academic success. The present study revealed that in the case of videos and homework, students in the upper SRL group significantly completed more tasks than the lower SRL group on Thursdays. However, on the deadline, those in the lower SRL group significantly completed more tasks than their upper counterparts. In other words, those students with higher SRL abilities were likely to finish their assigned task earlier than the deadline, whereas those with lower SRL abilities procrastinated until the very last day.

Regarding taking tests, the students also exhibited clearly different behaviors. A great number of students in the upper SRL group tended to complete their tests in advance. Compared to the lower SRL group, a significant number of the upper SRL students finished

their assigned tests on Fridays. On the other hand, when compared with the upper SRL students, a significant number of students in the lower SRL group put these off until the following Mondays (the deadline).

Respect to tests, students started doing them much earlier than the deadline. Seventy-five percent of them began on Thursdays and finished on Sundays, before the deadline. This again implies that those with a higher SRL appear to have better time management skills when doing assigned tasks than their lower counterparts. In other words, students with higher SRL abilities are able to manage their time better, allowing them to complete their assigned work earlier, instead of waiting until the last minute.

These findings are consistent with previous research. Volk et al. (2015) found that students' visits to the online platform of an intermediate school in Austria were highest on Sundays and Mondays, aligning with assigned deadlines. In general, learners seem to postpone completing assignments until the due date. When compared across three different SRL groups, (a) self-regulation, (b) partial self-regulation, and (c) non-self-regulation, Kim et al. (2018) reported that the 'self-regulation' group performed content learning in a timely fashion and used effective time management strategies. In addition, these students completed their course content before exams, earlier than those in the 'non-self-regulation' group, who tended to complete course content during the exam period. Similarly, Papamitsiou and Economides (2019) indicated that SRL strategies, such as effort regulation, goal-setting, help-seeking and time management skill had a strong positive impact on students' autonomous learning. Thus, the better time management skill students have, the more successfully they can learn.

Considering this, two types of approaches can be used to encourage students to complete tasks in a timely manner. As recommended by Zheng et al. (2016), relevant intervention techniques can be used to encourage students to adopt SRL behaviors online. As shown in Table 3, 15 out of 68 students in the upper SRL group did not use any strategies at all to avoid forgetting to complete their online assignments. Given that the SRL skill of effective time management is highly correlated with successful online learning, it seems that these students would have benefited from being explicitly taught this SRL strategy, i.e., how to remember to do their assigned online tasks.

In addition to receiving explicit teaching, another option for teachers may be to insert built-in features in the online environment. For example, a built-in early warning system which sends a message to students' mobile phones telling them that they have an assignment to complete. Those students with lower SRL abilities especially would benefit from a feature like this, encouraging them to do their work in a timely manner without procrastinating until the last minute.

5.3. SRL and Learning Gains

Some previous studies have shown that SRL strategies or systems function as effective predictors of the success of learning outcomes and learning achievements. Lin et al. (2017) pointed out that SRL strategies (goal-setting, self-evaluation, organizing, and help-seeking) were able to predict the success of high school students' learning outcomes. When Zheng et al. (2018b) compared an experimental group with a mobile SRL system and a control group with a conventional system, they learned that the experimental group significantly outperformed the control group in their learning achievements. In the present study, the upper SRL group did perform better than the lower SRL group, but the difference was not statistically meaningful.

The fact that there was no meaningful difference in learning gains between these two groups can be attributed to two factors. The first is the students' lack of motivation. The task completion score (20% out of 100%) depended solely on the extent to which they finished the three kinds of task throughout the semester, not on how well they performed on these assignments. The score system was designed like this because the English proficiency levels of the students within the TOEIC class varied widely. As a result, the students may not have tried their best to gain high scores on these tests. Since they were not motivated to perform well on these tests, they may have done them in noisy environments with many distractions.

The second potential factor is the nature of TOEIC itself. The TOEIC tests were used as a measure of students' learning gains because they were thought to reliably assess what students had learned from the TOEIC videos and problem-solving activities. However, the use of the TOEIC tests appears to be a limitation of the present study. TOEIC is a norm-referenced test which measures students' English proficiency levels by ranking the tested individual in relation to other individuals who took the same test. It is therefore unlikely that students will be able to improve their ranking within a short period of time, such as the 14-week period in this study.

6. CONCLUSION

Using LA, the present study divided 124 Korean university students into two groups based on their SRL abilities and compared their digital behaviors in order to better understand them and lead to more effective management in asynchronous online learning environments. Students in the upper SRL group demonstrated a number of different online behaviors, in comparison with the lower group. Those in the upper group significantly completed more tasks than their lower counterparts. They also used more strategies, but the difference was not statistically meaningful. Regarding task submission days, the upper group appeared to

start doing their tasks before the deadline, but the lower group was more likely to procrastinate until the last minute. In the case of learning gains, the upper group performed better than the lower group, but the difference was not statistically significant. More research in these areas is needed to draw stronger conclusions. These findings are useful for teachers who manage a blended or an online language learning program. The following implications can be drawn from the study.

First, this is the case which empirically shows that the upper SRL students complete significantly more task than the lower SRL students. De Barba et al. (2016) pointed out that students in the online learning environment need a quite high level of SRL ability. The present study has proved that relatively high level of SRL students were significantly able to get their task done on time than those in the lower level. For the clearer conclusion, there needs more studies on this area in the future.

Second, even students with high SRL abilities appeared to need strategy training. The present study uncovered that those who belonged to the upper SRL group did not significantly use time management strategies to complete their online tasks on time when compared to their lower SRL equivalents. Of the 68 students in the upper group, 15 reported that they never used any strategies to remember to do their online assignments. This implies that time management strategies should be explicitly taught to all students regardless of their SRL levels.

Third, the success of students' online learning depends on the timely completion of tasks. Thus, time management skills are once again indispensable in an online context. The findings of the present study revealed that the upper SRL students appeared to finish their tasks earlier, whereas the lower SRL students were more likely to wait until the last minute. This implies that online learning sites need to offer assistance to students with lower SRL abilities. A built-in alarm system, which automatically sends a message from the site to the students' mobile phone, may be one way to provide such assistance.

Fourth, along with encouraging students to complete their tasks, a system which motivates students to make regular learning gains should be included in an online learning context. The relative lack of learning gains seen in the present study could have been the result of the absence of such a system. Thus, when managing an online language learning program, it is important to design a curriculum which encourages both timely task completion and learning gains at the same time. An example of this would be a feature in which each student can check his/her current state of learning and compare it with other students.

In addition to these practical implications, it is hoped that the present study will stimulate future LA studies in online L2 learning contexts. First, it would be worth investigating the relationship between SRL ability and strategy use, particularly time management strategy, in an asynchronous online L2 learning context. In a non-L2 learning context, Kim et al. (2018) showed that an SRL group used time management strategies effectively, and

Papamitsiou and Economides (2019) found that time management strategies had a positive effect on autonomous learning. Unexpectedly, the results of the present study showed no significant correlation between these two variables. Therefore, more LA studies in this area are needed to clarify the effects in the context of L2 learning. Second, future researchers also need to examine the learning gains in relation to SRL skills for students not taking TOEIC courses. One possible reason that the current study did not show a significant difference between the upper and lower SRL groups may be due to the nature of TOEIC, a norm-referenced test in which students may find it difficult to show short-term improvement. Therefore, it may be worth investigating SRL in relation to courses that are not focused on TOEIC. Once more LA studies are completed, their findings should lead to the better management of more successful online language learning programs.

Applicable levels: tertiary

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APPENDIX

SRL Survey Items

1. I can clearly identify the important points from what I have learned in class.
2. I can effectively take notes of the main points in class.
3. I know effective study methods.
4. I can accurately identify what I know and don't know from what I have learned in class.
5. I can remember well what I have learned in class.
6. I can easily relate new concepts learned in class to what I already know.
7. I can simplify complex and difficult concepts to make them easy to remember.
8. I can complete a given assignment within the given time.
9. I can pay attention well in class.
10. I usually make a plan before I start studying, and I study according to the plan.