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The Difference of User Satisfaction and Net Benefit of a Mobile Learning Management System According to Self-Directed Learning: An Investigation of Cyber University Students in Hospitality

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Abstract: The purpose of the study is to investigate the features affecting user satisfaction and net benefits of a mobile learning management system (LMS) for cyber university students working in the hospitality industry using the quality factors from the updated DeLone and McLean information system success model. Also, the study focuses on finding whether there is a difference in the perception of the cyber university's mobile LMS depending on self-directed learning (SDL). A series of theory-based hypotheses were examined through structural equation modelling using empirical data collected from a sample of 328 students in cyber universities in Korea. The results indicate that information quality, system quality, and service quality have a positive effect on user satisfaction, and the subsequent user satisfaction has a positive effect on net benefits. The multi-group analysis revealed that all the paths were significant for high SDL groups, whereas for low SDL groups, a path between information quality and user satisfaction was not statistically supported. These results suggest that a differentiated strategy based on SDL level is needed to improve user satisfaction and the net benefit of the mobile LMS. The results are expected to provide implications for the stable operation of mobile LMSs for cyber universities.

Keywords: updated DeLone and McLean information system success model; cyber universities; self-directed learning; learning management system; mobile learning

1. Introduction

Unlike traditional offline education, distance education, such as e-learning, has expanded and is fulfilling the needs of many adult learners [1]. In Korea, cyber universities, where students can take a four-year bachelor's degree, have grown rapidly in recent years, providing many adult students with learning and satisfying their degree demands.

Cyber universities in Korea started in 2001 with 6220 students in nine universities, and, as of 2018, have a total of 109,406 students enrolled at 21 cyber universities. Although the majority of freshmen in offline universities are students who have just graduated from high school, 79.7% of students enrolled in cyber universities are over the age of 26 [2]. The dropout rate is rather high because most of the students take classes while working full-time jobs [3], showing they face psychological pressure due to trying to balance work and studies [1]. This fact allows cyber universities to run systems that can be implemented in mobile environments, which are much less constrained in time and place than a lecture hall, and on a PC. The current mobile campus allows attendance management, posting questions,

messaging, and monitoring academic calendars, so students are normally observed attending online courses and posting messages on bulletin boards while commuting or at any time they are available [4].

For the student who works in the hospitality industry, the working hours are different from those of ordinary workers, and there are many cases where they work shifts or on weekends and holidays. Hence, the employees working in the hospitality industry and studying in cyber universities are characterized by learning through mobile devices during a break or commuting to work via public transportation. This may lead to difficulties in participating in the lectures if students do not take the initiative in learning for themselves.

Cyber universities in Korea have e-learning courses in various content types, but the satisfaction of the students regarding this content does not differ much [5]. Learner characteristics such as cognitive ability, self-efficacy, motivation, personality, perceived utility, career/job variables, and locus of control are known to affect the transfer of learning [6]. In online education, however, self-directed learning (SDL) is an important factor [7–11]. SDL can be a predictor of academic achievement [8] and is positively related to average achievement grades [7,9,10]. Thus, it is vital to look for a way to increase the SDL level of learners in the online learning environment [11].

Since employees in the hospitality industry who study at cyber university are likely to use a mobile learning management system (LMS) as they take classes in their spare time rather than sitting at a desk and taking lessons on the PC, a high level of SDL is needed to keep up the lessons. Thus, for working students to recognize benefits through the mobile LMS, the need to understand the features of the mobile LMS arises. Although SDL is related to positive outcome variables, all cyber university students have different SDL levels; hence, it is necessary to examine the differences in the use of mobile LMSs based on the difference in SDL levels.

The purpose of the study, therefore, is to investigate the features affecting user satisfaction and net benefits of the mobile LMS for cyber university students working in the hospitality industry using the quality factors from the updated information systems success model (Updated IS Success Model) by DeLone and McLean [12], which is known to be suitable for technical quality measurements. The study aims to verify the differences in mobile LMSs according to the SDL level of the learners. The results are expected to provide implications in terms of complementing the existing solutions to such problems and the stable operation of the mobile LMS for all the institutes that offer distance learning. In addition, in a situation where studies on cyber universities that offer a four-year degree through online classes are rarely conducted, this study will serve as a foundation for future distance education research.

2. Literature Review

2.1. Antecedents of Learner Satisfaction in Mobile Learning

Information system researchers have proposed various theoretical models to identify factors that affect user behavior. Delone and McLean [13] suggested system and information quality as antecedents that affect individual and organizational impact through use and user satisfaction in their initial model. System quality refers to the desirable characteristics of the information system itself and is considered a necessary condition through which the system can affect individual learning performance. Providing stable system quality directly affects user satisfaction, as mobile education is more likely to encounter technical problems. Hence, system quality is a key antecedent for user satisfaction [14–16]. Information quality refers to the quality of content that the system provides [17], which includes attributes such as accuracy, relevance, and being up-to-date [18]. It is known as an important feature that has a great impact on user satisfaction [14–16,19,20] and the key component that plays a vital role in the success of m-learning [21]. Thus, Delone and McLean [13] argued that system quality and information quality influence individual impact through use and user satisfaction, and individual impact is consequently known to affect organizational impact. However, as the e-commerce environment evolves, the service function needs to be further evaluated because people who use and manage the computer systems are divided into information providers and service providers that support

end-users [22]. Hence, Delone and McLean [12,23] added service quality along with system quality and information quality in their extended model. The service quality refers to the degree of service of the organization that operates the information system, and in terms of m-learning, it can vary depending on what the learner demands from the system and how it meets that demand [14]. Especially in mobile environments, learning is done through the application provided by the schools, and since all the students have different smartphones, they might possess different requirements. Therefore, service quality plays a decisive part in the success of m-learning applications [21]. Service quality is an independent factor, not a sub-factor that affects learner satisfaction [24], and has been suggested as a significant variable that has a positive influence on learner satisfaction [14–16].

User satisfaction is an antecedent of benefits obtained by using the system and is closely interrelated with each other [12]. After using the system, user satisfaction should be prioritized so that users will recognize positive or negative benefits through system use [24]. In other words, user satisfaction may have a direct impact on the benefits of using the system [14], thereby affecting the learning goal achievement of learners. In this regard, the following hypotheses are proposed:

H1. *Information quality has a positive effect on user satisfaction.*

H2. *System quality has a positive effect on user satisfaction.*

H3. *Service quality has a positive effect on user satisfaction.*

H4. *User satisfaction has a positive effect on the net benefits of system use.*

2.2. Self-directed Learning and m-learning

Self-directed learning (SDL) is a form of learning in which the learner selects and decides the whole process of education from voluntary participation to setting goals, the selection of education programs, and the assessment of programs to voluntary intentions. According to Knowles [25] (p. 18), the following is the most cited reference in the definition of SDL: Self-directed learning describes a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes.

It is known that the SDL positively affects academic achievement [7,8,26,27]. The higher the SDL level, the higher the self-efficacy [28].

Recent education methods are expanding from traditional methods to online education using the World Wide Web. Garrison [29] argued that SDL is both theoretically and practically related to online education because SDL shares the need for responsibility and a degree of autonomy. In previous studies, SDL has been found to have a positive effect on learners in online learning environments [27,30,31]. Kim, Olfman, Ryan, and Eryilmaz [11] tried to measure the efficiency of the SDL system by enhancing SDL activities in an online education environment. Their study consisted of control and experimental groups using pre- and post-test designs. Comparing the two groups in accomplishing self-directed learning activities, the means of the experimental group using the SDL system was superior to that of the control group. The result can be interpreted as the outcomes related to learning may appear different depending on the SDL level that each individual holds. Accordingly, the following hypotheses are tested:

H5. *User satisfaction and the benefits of system use vary depending on the level of SDL.*

H5-1. *The impact of information quality on user satisfaction varies depending on the level of SDL.*

H5-2. *The impact of system quality on user satisfaction varies depending on the level of SDL.*

H5-3. *The impact of service quality on user satisfaction varies depending on the level of SDL.*

H5-4. *The impact of user satisfaction on the benefit of system use varies depending on the level of SDL.*

3. Materials and Methods

3.1. Sample

As hospitality employees in Korea often have irregular commuting hours, and schedules frequently change, it is hard for them to attend offline universities, resulting in their enrollment at a cyber university. Hence the survey was conducted on students who had enrolled in five major cyber universities in Korea. The number of students in those universities totals 53,373 (H Cyber University, 13,527; S Cyber University, 11,027; Cyber K University, 9998; K Cyber University, 8346; S Digital University, 10,475), which is 47% of all the students enrolled in cyber universities in Korea. The questionnaires, along with the URLs, were posted on the bulletin boards of courses operated by the hospitality-related majors such as hotel management and tourism management, as those departments are expected to have many students working in the hospitality industry. The cyber universities, listed above, enabled every class with a mobile app.

Prior to the survey, the respondents were asked to answer (1) What is your occupation? (2) What is the percentage of classes you take through mobile applications? Respondents not involved in the hospitality industry were excluded from the first question, and respondents who answered lower than 40% on the second question were also excluded. The survey period was from 1 to 27 November 2017. A total of 328 questionnaires were used for the analysis, excluding 16 questionnaires with missing data.

3.2. Measures

Valid and reliable measurement variables were adapted from prior studies with modification to fit the context of the conceptual model. Based on the literature review, measurement items considered appropriate for the study were identified and used to specify the constructs to be measured. The exogenous variables, the m-learning quality, included three dimensions from the Updated IS Success Model, namely, information quality, system quality, and service quality [12,23]. The information quality was defined as the quality of the contents that the cyber university provides and "information contents in m-learning app meets my needs" was included as an item in the questionnaire. The system quality indicated individual perception of the functions and quality provided by the mobile learning system, including the reliable operation of m-learning apps. The service quality is the degree of support service of the cyber university that operates the information system, and the availability of assistance with system difficulties was one of the items. The measurement of information quality, system quality, and service quality was adapted from Lwoga [32], Wang and Liao [24], and Lin [33]. User satisfaction refers to overall satisfaction of m-learning at cyber universities, and net benefit indicates the value the student gains by learning through m-learning. Items for user satisfaction and net benefit were adapted from Lwoga [32], Lin [33], Wang and Liao [24], and Mohammadi [15]. Finally, the ten items comprising SDL were adopted from Lounsbury et al. [26], which has been found to be an internally consistent measure [34]. All measurement items were rated using a five-point Likert-type scale ranging from "strongly disagree" (1) to "strongly agree" (5).

The initial questionnaire was developed in English and translated into Korean. To verify the accuracy of the translation, native Koreans who were fluent in English were asked to back-translate the Korean questionnaire into English. Then the two versions of the original questionnaire were compared and verified for the absence of errors. The revised questionnaires were given out to students in K Cyber University who were majoring in hotel restaurant management. Through their feedback, the questionnaire was refined and finalized.

4. Results

4.1. Descriptive Statistics

As shown in Table 1, the sample consists of an almost equal percentage of males and females (54.9% and 45.1%, respectively). The age of respondents ranged from 20- to 50-years-old, but the

majority were in their 20s (120; 36.6%) and 30s (96; 29.3%). About half of the respondents worked 8–10 h a day (168; 51.2%), followed by less than 8 h (104; 31.7%). In terms of the working conditions, 128 (39.0%) of the respondents' working hours changed based on their working schedule; 112 (34.1%) respondents had flexible work hours.

Table 1. The respondent profile (*n* = 328).

Variables		*n*	%
Gender	Male	148	45.1
	Female	180	54.9
Academic year	1st year	56	17.1
	2nd year	68	20.7
	3rd year	120	36.6
	4th year	84	25.6
Age	20s	120	36.6
	30s	96	29.3
	40s	60	18.3
	50s	52	15.9
Admission year	2016	132	40.3
	2015	140	42.7
	2014	16	4.9
	Prior to 2013	40	12.2
Class hour during commuting	Never	172	52.4
	Less than 30 min	72	22.0
	31–50 min	36	11.0
	61–90 min	12	3.7
	91–120 min	8	2.4
	More than 121 min	28	8.5
Daily working hours	Less than 8 h	104	31.7
	8–10 h	168	51.2
	11–12 h	36	11.0
	More than 12 h	20	6.1
Working conditions	Working hours change based on working schedule	128	39.0
	flexible work hours	112	34.1
	Steady work hours	44	13.4
	Closing time differ by the amount of workload	44	13.4

4.2. Confirmatory Factor Analysis (CFA)

With AMOS 18.0, confirmatory factor analysis (CFA) was conducted to assess the adequacy of measurement for confirming the reliability, and convergent and divergent validity, followed by conducting structural equation modeling (SEM) to test the hypothesized relationships among study constructs. The CFA results provided an acceptable fit to the data: x^2 = 431.984 (p < 0.01), GFI = 0.874, NFI = 0.920, CFI = 0.935, RMR= 0.036. All the measures ranged from 0.692 to 0.981 (p < 0.001), and the average variance extracted (AVE) exceeded the threshold of 0.5 for all constructs, indicating sufficient convergent validity [35]. The composite reliability (CR) exceeded the cut-off level of 0.7, denoting sufficient internal consistency and reliability for all items for each construct [35]. Table 2 presents all measurement scales and their standardized factor loading from the CFA.

Table 2. Results of confirmatory factor analysis.

	Variables	Estimate	SE	*t* value	AVE	Composite Reliability
Information quality	Satisfactory in overall information provided	0.692	0.062	11.166	0.638	0.896
	Readable, clear and well-formatted	1				
	Precise information	0.953	0.049	19.317		
	Meets needs	0.846	0.044	19.192		
	Provides a complete set of information.	0.804	0.048	16.925		
System quality	Good structure of layout	0.981	0.053	18.348	0.663	0.907
	Reliable operation	0.716	0.048	14.921		
	Readily accessible	0.907	0.053	16.973		
	Easy to use	1				
	User friendly	0.927	0.051	18.084		
Service quality	Availability of assistance with system difficulties	0.97	0.052	18.488	0.668	0.909
	Respond promptly	1				
	Satisfactory support service	0.783	0.056	14.002		
	A sincere interest in solving a problem	0.934	0.052	17.944		
	Safe in transactions	0.916	0.049	18.669		
User satisfaction	Effectiveness	0.867	0.029	29.875	0.684	0.896
	Performance	1				
	Meets the expectation	0.882	0.022	40.572		
	Overall satisfaction of using mobile learning system	0.832	0.028	29.853		
Net benefit	Saves time	1			0.755	0.939
	Improves learning efficiency	0.98	0.041	23.711		
	Improves learning performance	0.877	0.041	21.218		
	Improves knowledge	0.861	0.041	21.108		
	Improves self-reliance	0.818	0.044	18.665		

In addition, the average values obtained from each variable's correlation square value and validity test were compared to verify the distinction validity among the variables. As shown in Table 3, the highest value among the correlation square value was 0.616, which is higher than the lowest average value of 0.638, showing enough distinction validity.

Table 3. Discriminant validity, correlation coefficient matrix, and square roots of average variance extracted (AVE).

	Information Quality	System Quality	Service Quality	User Satisfaction	Net Benefit
Information quality	1	0.724 **	0.294 **	0.630 **	0.677 **
System quality	*0.524*	1	0.329 **	0.785 **	0.504 **
Service quality	*0.086*	*0.108*	1	0.427 **	0.217 **
User satisfaction	*0.397*	*0.616*	*0.182*	1	0.567 **
Net benefit	*0.458*	*0.254*	*0.047*	*0.321*	1

The underlined numbers represent the squared correlation coefficient. ** $p < 0.01$

4.3. Testing of the Structural Model

SEM was conducted by using a maximum-likelihood parameter that assessed the hypothesized conceptual model of the study. The overall fit indices indicate that the proposed model provided a satisfactory fit to the data: x^2 = 13.774 ($p < 0.01$), GFI = 0.983, NFI = 0.985, CFI = 0.987, RMR = 0.025.

As shown in Table 4, the results revealed that all three quality variables of m-learning (information quality, system quality, and service quality) have a significant effect on user satisfaction (β_{H1} = 0.111, t = 2.625, $p < 0.001$; β_{H2} = 0.670, t = 15.715, $p < 0.001$; β_{H3} = 0.219, t = 6.944, $p < 0.001$). Thus, H1, H2, and H3 were supported. The results indicated that the information, system, and service qualities of m-learning are fundamental features in enhancing user satisfaction. Likewise, user satisfaction of cyber university m-learning was strongly associated with net benefit (β_{H4} = 0.517, t = 11.400, $p < 0.001$), supporting H4. This suggests that when learners feel satisfied with m-learning, they perceive themselves as benefiting from it by improving learning efficiency or outcomes.

Table 4. Estimate and test of hypotheses.

No.	Paths	Estimate	Standardized Estimate	CR	R^2	Result
H1	Information quality → User satisfaction	0.126	0.111	2.625 **	-	Supported
H2	System quality → User satisfaction	0.643	0.67	15.715 **	-	Supported
H3	Service quality → User satisfaction	0.252	0.219	6.944 **	72.8%	Supported
H4	User satisfaction → Net benefit	0.559	0.517	11.400 **	30.2%	Supported

** $p < 0.01$

4.4. Exploratory Factor Analysis (EFA)

Exploratory factor analysis was conducted on a ten-item measure of SDL using the principal component method with varimax rotation. For this, the SPSS version 18.0 for Windows software was used. To ensure its suitability for conducting factor analysis, the study used the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity. The KMO test measures the adequacy of a sample in terms of the distribution of values for the execution of factor analysis; Bartlett's test of sphericity determines if the correlation matrix is an identifying matrix [36]. The result of the KMO test was 0.920; Bartlett's test of sphericity was 1453.31($p < 0.01$). Both tests indicated the suitability of the variables for factor analysis. Only a factor with an eigenvalue greater than one explained 54.718% of the variance on the SDL scale. The Cronbach's alpha for a construct showed a relatively high value of 0.920. The results are tabulated in Table 5.

Table 5. Results of exploratory factor analysis.

Constructs and Scale Items	Standardized Loading	Cronbach's α
I regularly learn things on my own outside of class	0.739	
I am very good at finding out answers on my own for things that the teacher does not explain in class	0.722	
If there is something I don't understand in a class, I always find a way to learn it on my own	0.773	
I am good at finding the right resources to help me do well in school	0.758	
I view self-directed learning based on my own initiative as very important for success in school and in my future career	0.663	0.920
I set my own goals for what I will learn	0.770	
I like to be in charge of what I learn and when I learn it	0.768	
If there is something I need to learn, I find a way to do so right away	0.715	
I am better at learning things on my own than most students	0.773	
I am very motivated to learn on my own without having to rely on other people	0.707	

4.5. Difference in Path Coefficients According to SDL

Based on the SDL scores of the respondents, they were divided into subgroups using k-mean cluster analysis. Based on the respondents' SDL levels, two subpopulations were identified: High SDL and Low SDL. There were 236 respondents ($M = 4.018$, $SD = \pm 0.3262$) in the high SDL group and 96 respondents ($M = 2.960$, $SD = \pm 0.4002$) in the low SDL group. The reason why the number of groups with high SDL is greater is because the characteristics of cyber universities are parallel to the workplace and it is necessary for students to lead their own academic studies in order to proceed with their studies. Besides, despite the relatively low tuition fees compared to regular universities, they pay tuition from their salaries, so people with high SDL tend to apply to cyber universities. The *t*-test result showed a significant difference in SDL between the two groups (t-value = 22.44, $p < 0.001$).

The focus of this study is to find whether there is a difference in the perception of the cyber university's mobile LMS depending on the SDL. Therefore, the study conducted a multi-group analysis to determine whether there is a significant difference in the path coefficient values suggested by the study model according to SDL. Through the method proposed by Vinzi et al. [37] and Chin [38], the difference in the coefficients of two path models was verified. The formula for calculating the *t*-value for verifying the path difference is as follows.

$$t = \frac{Path_{sample1} - Path_{sample2}}{\sqrt{\frac{(m-1)^2}{(m+n-2)} \times s.e._{sample1}^2 + \frac{(n-1)^2}{(m+n-2)} \times s.e._{sample2}^2} \times \sqrt{\frac{1}{m} + \frac{1}{n}}} \sim t_{m+n-2}$$

$Path_{sample1, 2}$ represents the path coefficient in subsamples; *m* and *n* indicate the number of cases in subsamples. In addition, s.e. $_{sample1, 2}$ means standard error of the path coefficient in subsamples.

Table 6 shows the difference in path coefficient between the groups with higher SDL and lower SDL. First, in the case of the high SDL group ($\beta = 0.148$, $p < 0.05$), user satisfaction with the information provided by the mobile LMS was found to have a significant positive effect, but not in the group with lower SDL ($\beta = -0.119$, $p < 0.05$). The *t*-value showing the difference of the path coefficient between two groups was 2.408 ($p < 0.05$), so H5-1 was supported.

Second, there was no significant difference between the two groups in terms of the effect of the system quality on user satisfaction (high SDL group = 0.679, $p < 0.01$; low SDL group = 0.672, $p < 0.01$). There was no significant difference in the *t*-value (*t*-value = 0.067) hence, H5-2 was not supported.

Third, it was analyzed that the low SDL group had a higher influence relationship than the high SDL group in the effect of service quality on user satisfaction. The path coefficient of the high SDL group was 0.106 ($p < 0.05$) and that of the low SDL group was 0.326 ($p < 0.01$). The *t*-value that verified the difference of the path coefficient was −2.145, which was significant at $p > 0.05$, so H5-3 was supported.

Lastly, the effect of user satisfaction on net benefits was 0.657 ($p < 0.01$) in the high SDL group and 0.445 ($p < 0.01$) in the low SDL group. The result of verifying the difference of the path coefficient is significant at 0.05 level (*t*-value = 2.218), thus the H5-4 was supported.

Table 6. Standardized path coefficients, *t*-values, and coefficients of determination for subgroups.

		H5-1	**H5-2**	**H5-3**	**H5-4**
High SDL group	coefficient	0.148	0.679	0.106	0.657
	S.E.	0.05	0.054	0.055	0.053
	t-value	2.14 *	10.865 **	2.09 *	10.368 **
Low SDL group	coefficient	−0.119	0.672	0.326	0.445
	S.E.	0.124	0.095	0.088	0.087
	t-value	−0.686	5.353 **	3.247 **	3.805 **
Difference		0.267	0.007	−0.22	0.212
t-statistics		2.408 *	0.067	−2.145 *	2.218 *
R^2		High SDL: user satisfaction (77.7%), net benefit (42.2%) Low SDL: user satisfaction (51.8%), net benefit (13.0%)			
Result		Supported	Not supported	Supported	Supported

* $p < 0.05$, ** $p < 0.01$.

The mean value of each variable according to SDL is analyzed as shown in Table 7. Overall, a group with lower SDL showed a higher satisfaction level than a group with higher SDL. However, only the system quality and user satisfaction were statistically significant at the 0.05 level.

Table 7. Result of *t*-test.

		Mean	**Std. Deviation**	**t-value**
Information quality	High SDL	3.121	0.8849	−1.371
	Low SDL	3.228	0.3019	
System quality	High SDL	3.147	0.9453	−2.836 *
	Low SDL	3.406	0.4746	
Service quality	High SDL	3.610	0.6919	1.268
	Low SDL	3.514	0.4873	
User satisfaction	High SDL	3.210	0.8812	−2.352 *
	Low SDL	3.428	0.5630	
Net benefit	High SDL	3.405	0.9518	−1.461
	Low SDL	3.558	0.6743	

* $p < 0.05$

5. Conclusions

This study attempts to examine the features affecting the user satisfaction and net benefit of the mobile LMS for cyber university students using the updated DeLone and McLean model of information systems success. The result of SEM showed that information quality, system quality, and service quality have positive effects on user satisfaction, and the subsequent user satisfaction has a positive effect on net benefits. At the same time, we tried to verify the difference according to SDL, which is considered an important variable in adult learning. Many respondents in this study were found to have a relatively high level of SDL (72%, 236). This is because cyber university students share the trait of attending school with a job after graduating from a two-year college or high school, so many of

them work and study. Most of them are paying the tuition fee with their own money so they are more inclined to lead their own studies, and this situation can be interpreted as having a sharper perspective on the LMS provided by cyber universities. The statistical analysis showed that there were differences between the subgroups. For high SDL groups, all the paths were significant, whereas for low SDL groups, a path between information quality and user satisfaction was not statistically supported.

The mean of the group with high SDL is lower than the group with low SDL. The result indicated that it is important to strengthen the system quality of the mobile LMS for them to recognize that the mobile LMS of cyber university is helpful in their own environment. At the same time, it is necessary to establish a system to support various services related to learning progress. The information quality provided by LMS appears to be the least influential, not because it is less correlated with the quality of content provided by cyber universities, but rather that the information deemed necessary by the user is not provided due to the limited environment of the mobile platform. The satisfaction regarding the information content seems to be higher in the group with high SDL (high SDL = 3.24 ± 0.961, low SDL = 3.14 ± 0.851), which can be interpreted as the need to improve the way of providing learning, not the content itself. However, the difference of satisfaction level according to the provided information by cyber university LMS was found to be the difference between subgroups. In the low SDL group, the quality of information did not affect user satisfaction, but it was significant in the high SDL group. This may be because the high SDL group is sensitive to the information provided by the mobile LMS, as learners who have high SDL are relatively enthusiastic about learning. On the other hand, it can be inferred that the low SDL group is less critical in responding to the information quality provided by the mobile LMS due to their non-dominant learning style.

System quality was analyzed as the most important factor that affects user satisfaction, meaning that it is a fundamental factor that must be considered over information quality or service quality. For those students who do not have regular commuting hours or make time to study while working, a stably operated mobile LMS is crucial. Moreover, system quality is considered equally important in the high SDL group and the low SDL group, indicating that it is an imperative variable regardless of individual SDL.

The quality of the service provided by the universities to solve any problems that arise during study has been found to affect overall satisfaction. However, the influence of service quality was higher in the low SDL group than in the high SDL group. This difference occurs because the group with the high SDL level tends to solve the problem themselves rather than relying on the service provided by the school, so the effect on the mobile LMS system is minimal. However, the group with the low SDL level tends to ask for help from the department that supports classes rather than trying to solve the problem themselves. Therefore, the problem of whether the school provides these services efficiently has a great impact on overall system satisfaction.

User satisfaction resulting from exogenous variables of the Updated IS Success Model was found to give net benefits to learners taking the course through the cyber university mobile LMS. The high SDL group showed higher level of influence and relatively high motivation to achieve academically. For instance, in the high SDL group, 68 students (28.8%) received A^+, 96 students (40.7%) received A^0, and, in the low SDL group, 12 students (13.0%) received A^+ and 28 students (30.4%) received A^0. The use of mobile LMS is expected to grow within high SDL groups as they want to take classes efficiently and increase the learning effect to get better grades.

6. Discussion

This study presents implications from the theoretical perspective. First, many studies have used Updated IS Success Model for subjects that involve technical problems. In the field of education, the results were verified by e-learning. However, many of these studies were PC-based e-learning. The research using the Updated IS Success Model in education through mobile devices has been relatively limited and importantly, research on cyber universities in Korea that offer a four-year degree and a master's degree, has not taken place. Thus, this study suggests further study on mobile LMSs.

Second, SDL, which is an important variable in the pedagogical field, was applied to the mobile education environment. In studies on online education, research has shown that high levels of SDL lead to positive outcomes. However, this study used SDL as a variable to understand the characteristics of the population, not as an exogenous variable. It was not for general university students aged between 19 and 25, but for students in cyber universities who also work in a tourism and hospitality industry where the work fluctuates. Therefore, it requires an expansion of research on university students.

In this study, we propose some implications to improve user satisfaction and the net benefit of the cyber university LMS system through a mobile platform, which is expected to be expanded in the future. First, it is proven that system quality is the most important factor in overall satisfaction for all users in mobile LMS. This means that to provide a stable education service, it is necessary to build a mobile LMS that operates stably regardless of the user's smartphone. To provide stable mobile LMS in the operating system environment of smartphones, which is divided into iPhone and Android operating systems, all learners should be configured to be able to use mobile LMS reliably, regardless of the operating system or device type. It is a priority to have a configuration for stable operation rather than requiring frequent updates of applications.

Second, since the information quality provided by the mobile LMS is somewhat low in the high SDL group, it is important to construct an architecture that can provide optimal information to the users on a small screen. It should also emphasize the importance of user-friendly design, allowing users to easily find the information they need related to their classes. However, in the low SDL group, there was no relationship between the quality of information provided and user satisfaction. It would be appropriate to interpret that it is not sensitive to the information that is currently being offered, not because they are not interested in studying. Therefore, methods of organizing the information provided on the relatively small mobile screen should be newly constructed based on the requirements of the high SDL group.

Third, the number of support personnel in a cyber university in relation to the operation of the mobile LMS is ultimately linked to operating costs. To secure enough personnel to provide services is somewhat remote from the reality of cyber universities in Korea, which are operated by relatively low tuition rates without government support. The results show that service quality has a relatively low impact on user satisfaction in the high SDL group. Considering these tendencies, it is necessary to provide a system that can solve the problem, before asking the school for support services. It is important to encourage students in the high SDL group to minimize their dissatisfaction with service quality by providing an environment that helps an exchange of information between students before they contact the school, or that helps them solve problems on their own. In addition, the low SDL group is expected to show a tendency to ask the school to solve problems rather than trying to solve problems on their own, so it would be useful to build a mobile LMS support service suitable for them. Giving an immediate and serious response ensures the school cares about their problems, and the attempts to solve the problem will improve overall satisfaction of mobile LMSs.

7. Limitations and Further Research Directions

Despite its implications, some limitations of the study deserve consideration. This study was conducted for students enrolled in cyber universities in Korea, who also work in the tourism and hospitality industry. Many of them work and study but it is impossible to say they all work in a similar environment. Therefore, the results may not be generalizable to students in other majors in cyber universities. In addition, the Updated IS Success Model, used as a tool to analyze the LMS in this study, is known as a suitable model for measuring the technical part of the system. The technical aspects of the system are important for mobile education, but given the fact that students who want to continue their studies in difficult environments attend cyber universities, the lectures offered by cyber universities cannot be overlooked. Therefore, it is recommended that future research be carried out on these limitations to provide a meaningful contribution to an extension of the current body of knowledge in mobile LMSs of cyber universities.

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