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Satisfaction with e-Learning Systems during the COVID-19 Pandemic – A Comparative Study

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Satisfaction with e-Learning Systems during the COVID-19 Pandemic

– A Comparative Study

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Abstract:

Higher education institutions have increasingly been challenged in providing their core services of teaching and learning during the COVID-19 pandemic crisis. As such, many higher education institutions, if not all, have shifted towards distance learning and e-learning using learning management systems. In this paper, based on a comparative study among Finnish and South Korean university students, we aim to investigate students' level of satisfaction with e-learning during the COVID-19 pandemic. Building on a data set of 256 students from Finland and South Korea, the results of structural equation modelling (SEM) showed that all three of the COVID-19-related factors explored had a significant effect on students' level of satisfaction with e-learning. In addition, the SEM results showed that students' level of satisfaction with e-learning systems is affected by the level of students' information literacy skills as well as the information technology (quality and accessibility) used to access the e-learning systems. We also found interesting differences between Finnish and South Korean students, from the perspective of path model analysis. Theoretical and practical implications are discussed.

1. Introduction

Higher education institutions use information and communications technology (ICT) to deliver contents for education and learning, and e-learning – in the context of the COVID-19 pandemic crisis, – has become an emerging paradigm of modern education once again (Arafat et al., 2020; Sun et al., 2008). e-Learning relies on the use of advanced digital technologies such as learning management systems (e.g. Moodle) to deliver learning materials and contents. Given the relatively recent situation in terms of the global COVID-19 pandemic, e-learning and the use of learning management systems have become increasingly important and natural tools for providing distance learning and education (Radha et al., 2020). Since students' level of

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satisfaction with e-learning systems has a significant impact on their intention to use learning management tools (Ramayah and Lee, 2012), the objective of this paper is to explore factors relating to the COVID-19 pandemic, such as perceived challenges during the pandemic and awareness of COVID-19, in addition to more personal level factors such as the impact of information literacy on university students' level of satisfaction with e-learning systems. We believe that more research is needed to better understand the factors that influence students' level of satisfaction with e-learning. Furthermore, the pandemic crisis and quarantine have had a different impact on educational institutions from country to country. Hence, we aim to conduct a comparative empirical study, gathering data from Finnish and South Korean university students to evaluate factors that influence students' level of satisfaction with e-learning systems, and determine whether Finnish and South Korean students differ in their level of satisfaction with e-learning systems.

Recent contributions show that different factors impact students' level of satisfaction with e-learning (Lu and Chiou, 2010); however, new findings in relation to COVID-19 have recently emerged, showing a significant impact of the pandemic on students' e-learning satisfaction. The research questions guiding this study are as follows:

RQ1: What antecedent factors impact students' level of satisfaction with e-learning systems during COVID-19 quarantine?

RQ2: Do any differences exist between Finland and South Korea in terms of use of e-learning systems and students' level of satisfaction with e-learning?

This paper is organised as follows: Section 2 provides a literature review, develops hypotheses, and builds the research model. In Section 3, the methodology and data collection will be presented, followed by the description of the results at both measurement structural levels. Finally, Section 4 discusses the major findings and concludes with theoretical and practical contributions.

2. Literature Review

2.1. Satisfaction with e-Learning Systems

Satisfaction refers to customers' positive responses to services or products in the field marketing (Anderson et al., 1994). In the context of e-learning, some studies consider students as customers and aim to examine solutions to maintain or increase students' level of satisfaction with e-learning systems (Dominici & Palumbo, 2013; Pham et al., 2018). Satisfaction with the e-learning system is a crucial factor affecting students' academic performance (Dwidienawati

et al., 2020) and has been considered as an indicator for improving the quality of teaching and learning delivered through e-learning systems (Gray & DiLoreto, 2016). Based on the importance of satisfaction with e-learning systems, many studies have been conducted to identify the determinants of level of satisfaction. For instance, Pham et al. (2019) carried out a survey involving 1232 university students in Vietnam and found that the quality of the overall e-learning system positively impacts students' level of satisfaction and loyalty to it. Following the emergence of the COVID-19 pandemic, demand for e-learning systems has dramatically increased (Hess, 2021). Accordingly, many studies have analysed the factors influencing students' level of satisfaction with e-learning during the pandemic crisis. One research conducted in Malaysia demonstrated that the quality of information provided by the e-service and e-system are the key factors that have a positive effect on students' level of satisfaction with e-learning systems (Shahzad et al., 2020). Baber (2020) argued that Korean and Indic university students' perceived learning outcomes directly impact on their level of satisfaction with e-learning systems. He also stated, through this learning outcome, that students' engagement-related variables – such as interaction and motivation and e-learning related variables, course structure, and instructors' facilitation and knowledge – may also have a positive effect on students' level of satisfaction with e-learning systems indirectly. Furthermore, from a study carried out in Indonesia, learners' goal orientation has been verified to have a positive impact on students' level of satisfaction with e-learning systems (Dwidienawati et al., 2020).

To understand the perception of e-learning systems comprehensively, Almaiah et al. (2020) conducted a qualitative interview with university students and experts in e-learning system. They asserted that how students respond to certain challenges, including technical issues, change management issues, and financial issues, can vary depending on the students' readiness (preparedness) to tackle such challenges, and these coping strategies should be managed well for learners to more easily adopt the e-learning system. This means that educational institutions should be well prepared to provide satisfying e-learning system experiences to learners, especially during the current pandemic, when preparedness should be recognised as an important requirement for the institution (De Rooij et al., 2020). It has been stated that educational institutions should not only provide sufficient course materials to supplement online classes but also establish their own communication system and policies or regulations to achieve their educational objectives (Alea et al., 2020). Thus, these findings call for research that views institutional preparedness as an important factor affecting students' level of

satisfaction with e-learning systems.

COVID-19 has changed the paradigm of education, and the social attention surrounding, and demand for, e-learning has increased (Ali, 2021). From the literature review, it seems that numerous studies suggesting solutions to help enhance students' satisfaction with e-learning systems have been conducted. Above all, previous studies undertaken to identify the factors affecting satisfaction with e-learning have mainly emphasized learner-, instructor-, and course-related variables. Given that e-learning systems provide education contents through the online, administrative, and technical aspects of the systems, these factor aspects have also been considered as other meaningful variables which can be related to students' use and satisfaction with e-learning during the current pandemic.

Some studies, however, have been conducted to determine whether satisfaction with e-learning systems may vary under different conditions. From a comparative study between university students in Korea and China, system quality – which is related to the technical seamlessness of the e-learning system – was found to have an impact on only the Chinese students' level of satisfaction with the e-learning system, and not on the Korean students' level of satisfaction (Bae & Shin, 2020). The authors explained that different levels of each country's infrastructure may account for that difference. In addition, a study of 1185 Spanish university students taking online classes found that female students felt more satisfied with e-learning systems than male students, and e-service quality did significantly impact female students' level of satisfaction with e-learning systems but not the male students' level of satisfaction (González-Gómez et al., 2012). These findings indicate that students' level of satisfaction with the e-learning system and its determinants could depend on gender, culture, and national infrastructure. It follows, therefore, that examining the level of satisfaction with e-learning systems should be conducted in diverse contexts, and comparative studies may offer an effective approach to this.

2.2. e-Learning Systems in South Korea and Finland

In this section, we look at comparative studies to explore the difference in levels of satisfaction with e-learning systems between South Korea and Finland which share some common attributes in national infrastructure and education (Jang et al., 2020; Jang et al., 2021; Lee et al., 2009). In terms of ICT infrastructure, South Korea and Finland are at the top of the list among 193 UN members (Department of Economic and Social Affairs, 2020). In terms of education, both countries also have a common ground of excellence in students' academic performance relative to other countries, though there are some differences in direction and

philosophy in education as well (Lee et al., 2009). Based on these similarities and differences, a broad range of comparative studies on education in South Korea and Finland have been conducted (Davis et al., 2020; Kesici & Ceylan, 2020; Lee et al., 2009).

After the emergence of the COVID-19 pandemic, even though the South Korean and Finnish governments have succeeded in transitioning from offline education to e-learning systems relatively well, students in both countries continue to express dissatisfaction with the e-learning systems (Hatch, 2021; Kalenzi et al., 2020). In Finland, for example, students' willingness to participate in e-learning during a university campus lockdown resulting from a COVID-19 outbreak was determined by their opinions on the utility and convenience of use of their learning management systems (Nikou and Maslov, 2021). Moreover, Adnan and Anwar (2020) discovered that the desired results of students' engagement in e-learning during the current pandemic are influenced by a number of critical elements, including students' internet connection and the lack of face-to-face engagement with their instructor. Baber (2021) conducted an empirical study in South Korea among 375 students and found that perceived ease of use, perceived usefulness, perceived severity of pandemic COVID-19, and the attitude and competency of their instructor and tutor all influenced the behavioural intention to use and accept the e-learning system during the pandemic for South Korean students.

At this point, comparative research on the level of satisfaction of South Korean and Finnish students with the e-learning systems is expected to contribute to the cross-country research in the education field and to identify any significant factors affecting learners' satisfaction with the e-learning system during the current pandemic.

3. Theoretical Background and Hypothesis Development

To answer the stated research question, based on the discussion provided in the previous section, we have developed a conceptual model by integrating factors in relation to the COVID-19 pandemic crisis (awareness of COVID-19, perceived challenges of COVID-19, and educational institutions' preparedness). In addition, some of the antecedent factors of e-learning satisfaction (information technology [quality and accessibility] and information literacy) were added to the model. The independent variable in this research is students' level of satisfaction with e-learning during the pandemic (see Figure 1).

3.1. COVID-19-Related Factors

The research on the COVID-19 pandemic is new at the time of writing this paper, as it is a

relatively recent incident. As a result, the exploratory goal is to uncover potential characteristics that may influence students' level of satisfaction with e-learning systems during quarantine; as such, we intend to review the most recently published studies on this topic. For example, one recent study was conducted to examine instructors' perceptions of the preparedness of universities for e-learning, and problems in embracing e-learning, during quarantine (Alea et al., 2020). The authors used awareness of COVID-19, the preparedness of the educational institution (i.e. teachers and schools) to conduct distance learning, and the perceived challenges in distance learning education. However, because we are surveying students rather than teachers or instructors in our study, we have adapted the same survey questions and slightly modified them to meet the context of our research into COVID-19-related factors, in order to examine the students' level of satisfaction with the e-learning systems. These three factors are important to understand, because the COVID-19 quarantine circumstance is viewed as both a factor determining the person's setting, requiring them to participate entirely in distant e-learning, and an intervening variable defining how the e-learning process is carried out. Hence, we propose the following hypotheses:

H1: Awareness of COVID-19 has a positive effect on students' level of satisfaction with e-learning systems.

H2: Perceived challenges during the COVID-19 pandemic have a positive effect on students' level of satisfaction with e-learning systems.

H3: Educational institutions' level of preparedness has a positive effect on students' level of satisfaction with e-learning systems.

3.2. Information Technology (Accessibility and Quality)

Because e-learning is mostly carried out through the use of information technology, a lack of access to the necessary IT resources may influence e-learning (Benigno & Trentin, 2000). Selim (2007) indicated that the level of satisfaction with e-learning systems is influenced by the convenience of on-campus internet access and the effectiveness of the information technology infrastructure. Ahmed (2010) found that learners' adoption of hybrid e-learning courses was greatly influenced by the IT infrastructure. Moreover, Alsabawy et al. (2016) argued that in order to retrieve the essential information, students participating in e-learning may rely heavily on the quality of the IT infrastructure. Hence, we hypothesise that:

H4: Information technology (accessibility and quality) has a positive effect on students' level of satisfaction with e-learning systems.

3.3. Information Literacy

Bawden (2008, p. 52) defined information literacy as “knowing when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner”. Information literacy has been considered as an influential factor in different research settings, such as in terms of the intention to use digital technology (Nikou et al., 2020), higher education (Aavakare & Nikou, 2020; Nikou & Aavakare, 2021), and generational differences (Nikou et al., 2019). Kiliç-Çakmak (2010) noted that learners’ ability to assist independent learning, self-directed learning, and e-learning is dependent on their level of information literacy. Moreover, it has been argued that information literacy can be acquired through e-learning programmes (Kratochvíl, 2013). As a result, it is possible to claim that information literacy and e-learning are two phenomena that are intertwined. Hence, we hypothesise that:

H5: Information literacy (accessibility and quality) has a positive effect on students’ level of satisfaction with e-learning systems.

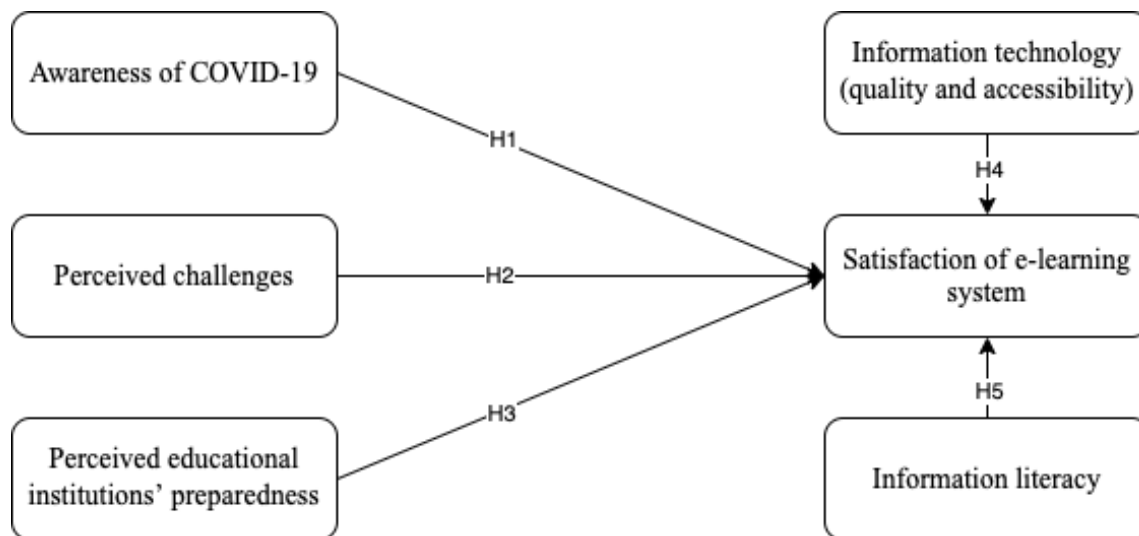


Figure 1. Proposed conceptual model

4. Methodology

In this research, we are interested in comparing students’ level of satisfaction with e-learning systems during the COVID-19 pandemic. More importantly, as this a comparative study, we collected data from one Asian country (South Korea) and one Northern European country (Finland). We believe these two countries are frontrunners in using digital technology in relation to education. However, South Korea and Finland seem to differ in their educational

systems, even though both countries exhibit a very high interest and level of competitiveness regarding education and educational systems. While Korea focuses on relative rankings in education, Finland is committed to equal and personalised education. Therefore, it seems to be meaningful to compare these two countries – and specifically, to assess and examine how higher education institutions in these two countries have managed and addressed the challenges imposed by the COVID-19 pandemic within their own environments. For this purpose, we mainly focus on university students and collected data regardless of their educational level or programmes. We only allowed participants who are currently university students to enrol in this comparative study.

4.1. Data Collections

Data was gathered from both Finland and South Korea. Data were collected from South Korea in January 2021 ($n = 114$) and from Finland in August 2020 ($n = 131$). We used an online survey to collect data from both countries. The survey questions were divided into two sections. In section one, we collected background and demographic information; in addition, we gathered data on the average use of e-learning systems. In section two, we asked questions regarding the factors involved (i.e. level of satisfaction with COVID-19–related and e-learning factors); all survey items were derived from validated indicators supported by the literature. Finally, to examine and assess the path relationships proposed in our research model, we used PLS-SEM (partial least squares structural equation modelling).

4.2. Measures

In this paper we used previously validated items to measure the six constructs in the model. The items for measuring COVID-19 related factors were all derived from the study by Alea et al. (2020). Three items were used to measure information literacy and obtained from Ahmad et al. (2020). Information technology was measured using four items derived from the study by Selim (2007, p. 410-411). Finally, four items were used to measure students' level of satisfaction with e-learning systems, derived from the study by Arbaugh (2000).

4.3. Descriptive Results

The initial results at the measurement model level showed that all internal validity test results adhered to the recommended threshold values. Table 1 shows the details of the item loadings. Internal consistency reliability refers to the statistical consistency across survey items

(indicators). Hair et al. (2019) argued that such assessment can be done through analysis of Cronbach's alpha (α) and composite reliability (CR) tests. The results showed that all constructs used in this paper had acceptable values for (α) and CR – all above 0.70 (Hair et al. 2019) – indicating good internal consistencies. We also assessed the average variance extracted (AVE) and all values obtained were above the recommended value of 0.50. The degree to which two measures of constructs that should theoretically be related are truly related is referred to as convergent validity. Moreover, the results showed that all item loadings (except three items: IT-3, PCHA-2, and EPRE-5) had satisfied the recommended loading values of 0.70 or higher (Hair et al. 2019). We then proceeded with the next step in the PLS-SEM analysis.

Table 1. Reflective indicator loadings and internal consistency reliability.

Construct	Items	Loadings	Mean	Std.	α	rho_A	CR	AVE
COVID-19 Awareness	AWA-1	0.90	6.80	0.66	0.82	0.88	0.92	0.85
	AWA-2	0.94	6.69	0.82				
Information technology (quality and accessibility)	IT-1	0.76	4.25	1.52	0.78	0.82	0.86	0.61
	IT-2	0.85	4.89	1.38				
	IT-3	0.61	4.29	2.03				
	IT-4	0.89	4.39	1.67				
Information literacy	IL-1	0.88	5.25	1.40	0.74	0.79	0.85	0.66
	II-2	0.74	6.02	1.08				
	II-3	0.82	5.43	1.24				
Perceived challenges during COVID-19	PCHA-1	0.75	5.11	1.86	0.80	0.85	0.86	0.61
	PCHA-2	0.64	4.58	1.83				
	PCHA-3	0.87	5.05	1.86				
	PCHA-4	0.85	5.44	1.77				
Educational institutions preparedness	EPRE-1	0.86	4.28	1.84	0.89	0.93	0.92	0.65
	EPRE-2	0.90	4.49	1.71				
	EPRE-3	0.88	4.93	1.66				
	EPRE-4	0.71	4.74	1.70				
	EPRE-5	0.67	4.82	1.70				
	EPRE-6	0.80	4.55	1.73				
Satisfaction of e-learning systems	SAT-1	0.90	3.87	1.76	0.90	0.91	0.93	0.77
	SAT-2	0.92	4.02	1.81				
	SAT-3	0.86	3.57	1.87				
	SAT-4	0.84	3.26	2.03				

4.4. Convergent Validity and Discriminant Validity

The degree to which a construct differs from other constructs is measured by discriminant validity (Hair et al. 2019) and the Fornell–Larcker criterion can be used to report the results. In this assessment, the AVE scores of a construct should be lower than the shared variance for all model constructs. In our analysis, all AVE scores satisfied this condition. As such, we could argue that the discriminant validity was established based on the results shown in Table 2 and according to the evaluation of the Fornell–Larcker criterion (Fornell & Larcker, 1981).

Table 2. Discriminant validity.

Constructs	AWA	IT	IL	PCHA	PREP	SAT
COVID-19_Awareness	0.92					
Information technology (quality and accessibility)	0.16	0.78				
Information literacy	0.14	0.32	0.81			
Perceived challenges during COVID-19	0.16	-0.18	-0.12	0.78		
Educational institutions preparedness	0.15	0.52	0.20	-0.14	0.81	
Satisfaction of e-learning systems	0.17	0.55	0.36	-0.38	0.43	0.88

As we used PLS-SEM approach to perform data analysis, discriminant validity was also assessed through the heterotrait-monotrait (HTMT) ratio of correlations. In this approach, the discriminant validity is considered to be not established if the HTMT values are above 0.90. However, as shown in Table 3, establishing the discriminant validity was not an issue, even when adopting the HTMT approach.

Table 3. Discriminant validity (HTMT ratio of correlations).

Constructs	AWA	IT	IL	PCHA	PREP	SAT
COVID-19_Awareness						
Information technology (quality and accessibility)	0.20					
Information literacy	0.18	0.40				
Perceived challenges during COVID-19	0.22	0.22	0.16			
Educational institutions preparedness	0.18	0.60	0.25	0.16		
Satisfaction of e-learning systems	0.19	0.65	0.42	0.42	0.44	

4.5. Conceptual Results

The descriptive statistics results showed that 45 (29%) of the South Korean respondents had used e-learning systems for less than a year, whereas the remaining respondents indicated that they had used such systems for more than a year. Interestingly, and rather surprisingly, 69 (45%) of the Finnish students indicated that they had used e-learning systems for less than a year, whereas the remaining Finnish respondents indicated that they had used such systems for more than a year. This clearly indicates that differences exist between South Korea and Finland, although both countries make extensive use of digital learning management systems in their education setting.

In this section, we first report the PLS-SEM results for the overall sample, which included both the Finnish and the South Korean ($n = 256$) respondents. Then, we provide the results of our

multi-group analysis (MGA), where the path relationships were assessed and compared between the Finnish and the South Korean respondents.

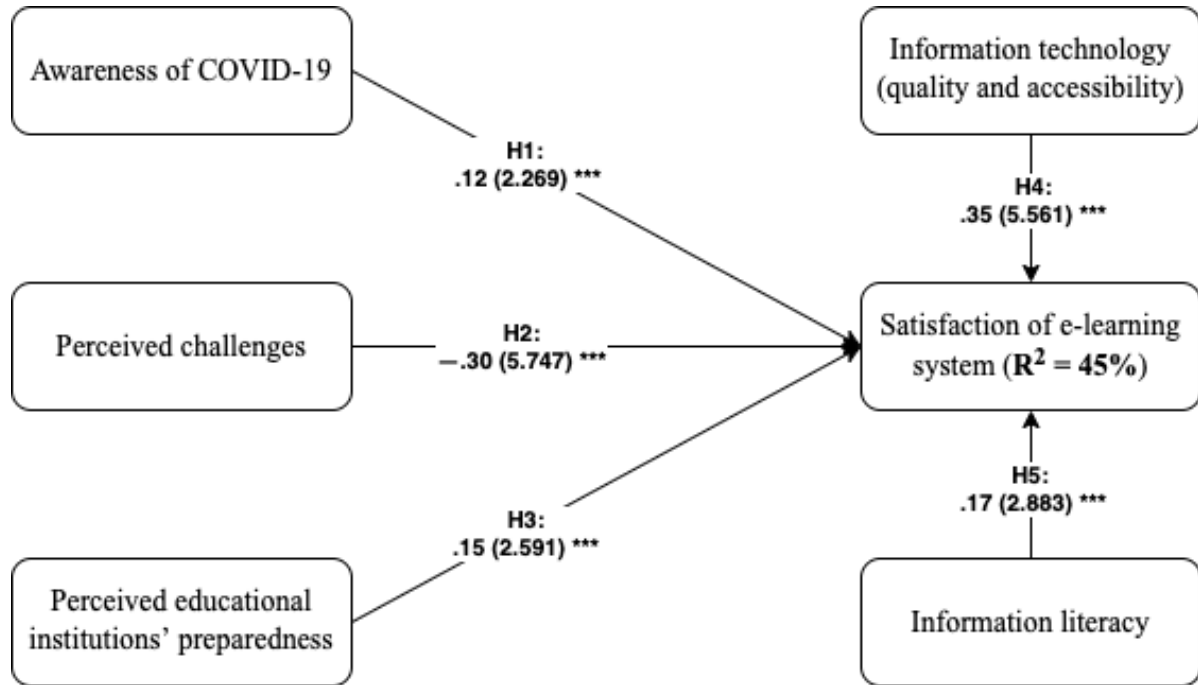


Figure 2. Conceptual results

The structural results showed that the dependent variable in this research (i.e. students' level of satisfaction with e-learning systems during the COVID-19 pandemic) showed a variance of 45%. Moreover, the SEM results showed that all three COVID-19-related factors had a significant effect on the students' level of satisfaction with their e-learning system. For example, the path between awareness of COVID-19 and satisfaction was significant ($\beta = .12$; $t = 2.269$; $p = .001$), thus providing theoretical support to accept H1 in the model. In addition, as we predicted, while the path between perceived challenges during the COVID-19 pandemic to satisfaction with e-learning systems was significant, the effect (as we also predicted) was negative ($\beta = -.30$; $t = 5.747$; $p = .001$), therefore, providing theoretical support to accept H2 in the model. We also found a positive and significant relationship between perceived educational institutions' preparedness and students' level of satisfaction with e-learning systems ($\beta = .12$; $t = 2.269$; $p = .001$), thus providing support to accept H3 in the model. These results indicate that all COVID-19-related factors significantly affect students' learning outcomes during the pandemic. Furthermore, we also found theoretical support that both

information technology (its quality and accessibility) and students' perceptions of their information literacy skills influence how they evaluate e-learning systems when physical in-class learning activities are limited or are not an option during COVID-19 quarantine. For example, the SEM results revealed that the level of accessibility to quality information technology infrastructure positively affects ($\beta = .35$; $t = 5.561$; $p = .001$) students' level of satisfaction with e-learning systems, therefore giving support to accepting H4 in the model. In fact, IT had the strongest effect on the students' level of satisfaction with e-learning systems. Finally, the predicted positive association between information literacy and students' level of satisfaction with e-learning systems was confirmed. The SEM results revealed that IL positively affects student' level of satisfaction with e-learning systems ($\beta = .12$; $t = 2.269$; $p = .001$), thus providing support to accepting H5 in the model.

Regarding the differences between the Finnish and the South Korean students, the multi-group analysis (MGA) revealed interesting results. The results showed that the path between the perceived educational institutions' preparedness and the students' level of satisfaction with e-learning systems was significantly ($\beta = -.26$; $p = .01$) different between the Finnish and the South Korean students. The result of the parametric test was ($\beta = -.26$; $t = 2.463$; $p = .01$) and the result of the Welch–Satterthwaite test was ($\beta = -.26$; $t = 2.434$; $p = .01$).

However, we found an additional path difference between the Finnish and the South Korean students when we examined the proposed model based on the individual samples. For example, we found that the path between the perceived educational institutions' preparedness and the students' level of satisfaction with e-learning systems was only significant ($\beta = .34$; $t = 4.094$; $p = .001$) for the South Korean students and not for the Finnish students. In addition, the individual group path analysis showed that the paths between COVID-19 awareness ($\beta = .17$; $t = 2.409$; $p = .05$) and IT ($\beta = .40$; $t = 5.648$; $p = .001$) and the students' level of satisfaction with e-learning systems were only significant for the Finnish students. Finally, the SEM analysis revealed that the path between perceived challenges during the COVID-19 pandemic and the students' level of satisfaction was only significant ($\beta = -.38$; $t = 6.413$; $p = .001$) for the Finnish students, but as expected the effect was negative. Based on this understanding, we may be able to suggest several implications to policymakers and other stakeholders in higher education institutions to better prepare for situations such as the COVID-19 pandemic, should such a scenario arise again in the future.

5. Discussion and Conclusion

In this paper we examined Finnish and South Korean university students' level of satisfaction with e-learning systems. The PLS-SEM results showed that our research model was strongly validated by the results in predicting the Finnish and South Korean university students' level of satisfaction with e-learning systems. Our results contribute to the literature by showing that all three COVID-19-related factors had a significant effect on the students' level of satisfaction with e-learning systems. In addition, our findings show that both information technology (its quality and accessibility) and information literacy skills had a positive effect on the students' level of satisfaction with e-learning systems.

In the meantime, the intergroup comparisons revealed that university students in Finland and South Korea display some differences in factors affecting their satisfaction with e-learning systems. For the South Korean students only, the perceived educational institutions' preparedness directly affected the students' level of satisfaction with e-learning systems. This result may have a few important social implications. For example, in South Korea, universities should pay more attention to their e-learning systems and try to be more prepared for e-learning to enhance their students' level of satisfaction with such systems. In addition, the results showed that the paths between (i) COVID-19 awareness and (ii) information technology (accessibility and quality) and students' level of satisfaction with e-learning systems was only significant for the Finnish students

This study is not without its limitations. First, the sample size of this study was relatively small. With a larger sample, we could examine any demographic differences between South Korean and Finnish students. In addition, to expand this research, there is a need to conduct further comparative research in other countries. Despite these limitations, however, the findings of this research suggest there are a few consequences to enhancing students' level of satisfaction with e-learning systems during the COVID-19 pandemic. We expect that the results of this study will help our understand of the importance of educational institutions' preparedness for such scenarios. Universities and other stakeholders should invest more heavily in information technology (its quality and accessibility) and in enhancing information literacy skills; additionally, they should make more efforts towards developing programmes that increase awareness of COVID-19. Furthermore, they should endeavour to solve the challenges related

to e-learning systems. They should remember that their efforts or programmes should be country specific, in light of the differences we found between the South Korean and Finnish groups in this study.

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