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Nikou, Shahrokh; Kim, Seongcheol

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STUDENTS' SATISFACTION WITH E-LEARNING SYSTEMS DURING THE COVID-19 PANDEMIC—AN INTERNATIONAL COMPARATIVE STUDY

SHAHROKH NIKOU¹ & SEONGCHEOL KIM²

¹ Åbo Akademi University, Faculty of Social Sciences, Business and Economics, Turku, Finland, and Stockholm University, Stockholm, Sweden; e-mail: shahrokh.nikou@abo.fi

² Korea University, Seoul, Korea; email: hiddentrees@korea.ac.kr

Abstract In response to the global COVID-19 situation, quarantine measures have been implemented at the educational institutions around the world. This paper aims to determine the antecedent factors predicting the university students' satisfaction with e-learning systems during the COVID-19 situation. We used structural equation modelling (SEM) and evaluated a conceptual model on the basis of a sample of university students from Finland (n = 131) and South Korea (n = 114). The SEM results showed that the COVID-19 related factors, i.e., COVID-19 awareness, perceived challenges during COVID-19 and the educational institutions' preparedness indirectly influence the satisfaction with e-learning systems. Moreover, we found a statistically significant moderating effect of course design quality, and instructor's teaching style between the COVID-19 related factors and the satisfaction with e-learning systems. The implications of these results for the management of e-learning systems are discussed.

Keywords: COVID-19, distance learning, e-Learning, higher education, learning management systems

1 Introduction

As a result of the introduction of emerging digital technology, new possibilities for learning and teaching have emerged (Aavakare and Nikou, 2020). Higher education institutions use information and communications technology (ICT) to deliver contents for education and learning (Nikou and Aavakare, 2021). Due to COVID-19 pandemic, e-learning 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 educational content. Given the relatively recent situation in terms of COVID-19 pandemic worldwide, e-learning and the use of learning management systems (LMS) have become increasingly important and a natural tool for providing distance learning/education (Radha et al., 2020). Literature shows that different factors impact students' satisfaction with e-learning systems. The factors include course design quality and instructors' teaching style, learning style (Lu and Chiou, 2010), content and interface of e-learning (Al-Rahmi et al., 2015), instruction medium and course content (Peng and Samah, 2006).

However, in relation to COVID-19, new factors such as COVID-19 awareness, perceived challenges during COVID-19 and educational institutions' preparedness have emerged, demonstrating a significant impact on the satisfaction of students with e-learning (Alea et al., 2020; Nikou and Maslov, 2021). Since students' satisfaction with e-learning system has a significant impact on the intention to use learning educational tools (Ramayah and Lee, 2012), the aim of this paper is to explore factors influencing the satisfaction of university students with e-learning systems. More importantly, we aim to explore factors, which are related to the COVID-19 pandemic. We argue that more research is needed to better understand the underlying impact of COVID-19 related factors in higher education. Hence, we conduct a comparative empirical research, collecting data from Finnish and South Korean university students to address this issue.

The research questions guiding this study are: "in relation to the COVID-19 pandemic, what factors are associated with the students' satisfaction with e-learning systems?" and "What are the similarities and differences between Finnish and South Korean university students in terms of their satisfaction with e-learning?" To address these RQs, we develop an integrated theoretical model that encompasses factors in

relation to COVID-19 situation and some other general factors and examine the model through structural equation modelling (SEM).

2 Literature Review and Hypotheses Development

E-learning, widely employed in many educational institutions, is an activity of self-learning and a paradigm of teaching and learning to complement face-to-face learning (Aboagye et al., 2021). It facilitates active and independent learning of the learners and provides many opportunities for self-learning. Several factors such as efficiency, reliability and quality of e-learning systems (Almaiah et al., 2020), accessibility and academic issues and the learner motivation (Aboagye et al., 2021) contribute to the usage of such systems and ultimately students' satisfaction level. Specifically, during COVID-19 pandemic where there is almost no physical presence nor social interactions between learners and instructors (Almaiah et al., 2020), the effect of such factors might become even more important. Alea et al. (2020) showed that there are multiple challenges in terms of the educational preparedness to facilitate distance and independent learning during the COVID-19. Moreover, ICT and Internet connection used by the educational institutions for e-learning may become unreliable and unable to meet the requirement for e-learning in this pandemic situation (Favale et al. 2020). Thus, instructors may have to adopt new teaching style to comply with the limitation and resections imposed by the current situation. As such, we discuss the factors associated with COVID-19 and linked to educational institutions, which are assumed to influence satisfaction with e-learning systems.

2.1 Instructors' Teaching Style

In the higher education, the instructors' teaching style is considered to be central in the success of the e-learning education. Al-Busaidi and Al-Shihi (2010, p. 1) argued that the success of e-learning relies on the instructors' acceptance of the learning management systems, which in turns promotes learners to use LMSs. Moreover, Volery and Lord (2000) argued that, for the students' satisfaction with e-learning systems, instructors must have several competences such as a good control over IT used for teaching and learning as well as to possess sufficient technical abilities to solve potential students' IT-related technical issues. Moreover, an instructor is

required to adopt interactive teaching style and encourage students to interact with their peers, hence, we make a hypothesis that:

H1: *Instructors' teaching style has a positive effect on the students' satisfaction with e-learning systems*

2.2 Course Design Quality

The quality of the course design depends on what is involved in the course, such as course data, educational goals, course layout (Wrigh, 2003). It has been found that course design quality might influence the satisfaction with the e-learning systems (Martín-Rodríguez et al., 2015). Liu and Chu (2010) argued that design quality can be used as a measure of the information quality and the course content quality. Moreover, Uppal et al. (2018) and Garavan et al. (2010) showed that the supportiveness of the overall service, information quality, system quality, content quality and learner support are different aspects of e-learning quality; thus, impacting the use of and the satisfaction with e-learning systems. Hence, we make a hypothesis that:

H2: *Course design quality has a positive effect on the students' satisfaction with e-learning systems*

2.3 COVID-19 Related Factors

Alea et al. (2020) examined the perception of teachers about the preparedness and challenges faced by higher education institutions when e-learning is implemented and found several antecedent factors including (i) COVID-19 awareness, (ii) the educational institutions preparedness to conduct distance learning, and (iii) perceived challenges during COVID-19 in distance learning education. In this study, based on literature discussions provided earlier, and following the recent study conducted by Alea et al. (2020), we use all three COVID-19 related constructs to examine the students' satisfaction with e-learning systems. In addition, in higher education, factors associated with COVID-19 are understood both as factors associated with the individual's background, requiring one to engage solely in distant e-learning, and as intermediate factors that affect how the e-learning process is conducted. Thus, we include other factors such as (i) instructors' teaching style and (ii) course design quality in our proposed conceptual model. Hence, we make the following hypotheses that:

H3a: COVID-19 awareness has a positive effect on the instructors' teaching style

H3b: COVID-19 awareness has a positive effect on the course design quality

H4a: Perceived challenges during COVID-19 has a negative effect on the instructors' teaching style

H4b: Perceived challenges during COVID-19 has a negative effect on the course design quality

H5a: The educational institutions' preparedness has a positive effect on the instructors' teaching style

H5b: The educational institutions' preparedness has a positive effect on the course design quality

However, in all the above stated hypotheses and as a null hypothesis, we assume that there is no difference between Finnish and South Korean students in any of the measured factors/constructs.

2.4 Satisfaction with e-Learning Systems

Student–student interaction, effective support, learning materials, teaching style, education and learning environment all can influence students' satisfaction with e-learning systems (Benigno and Trentin, 2000). Moreover, Almaiah et al. (2020), asserted that the provision and usage of online learning materials in e-learning system becomes the main challenge for many universities during COVID-19 pandemic. The authors further demonstrate that, there are four general challenges in relation to the use of e-learning systems and students' performance and consequently their satisfaction: technological challenges, individual challenges, cultural challenges and course challenges. In our proposed conceptual model, students' satisfaction with e-learning systems is the dependent variable (see Figure 1).

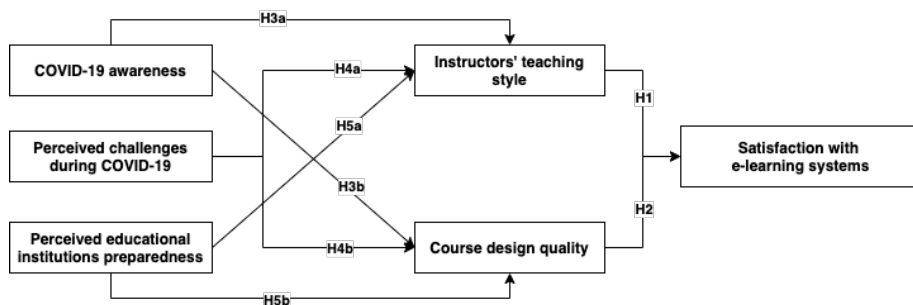


Figure 1: Conceptual Model.

3 Research Methodology

3.1 Data Collection and Instrument

This is an international comparative study and we collected data from Finland and South Korea. The main reason for selecting these two countries is due to the fact that they are frontrunner in using digital technology in their educational systems, in addition to many other similarities in the use of advanced technologies and digital infrastructures (Jang et al., 2021). We collected data only from university students, two university from Finland and one university from South Korea. Students were from difference subjects such as social sciences and natural sciences. The Finnish data was collected in August 2020 ($n = 131$) and The Korean data was collected in January 2021 ($n = 114$). We used an online survey to collect data from both countries. All survey items were derived from validated measures supported by literature.

The items have been slightly changed to fit the study context, if needed. Items for measuring COVID-19 awareness (three items), perceived challenges during COVID-19 (four items) and educational institutions preparedness to conduct distance learning (six items) all were derived from Alea et al. (2020, p. 134-136). Items for measuring course design quality (3 items) and instructors' teaching style (4 items) were derived from Wright (2003). Finally, items for measuring students' satisfaction with e-learning (four items) were derived from Arbaugh (2000, p. 41).

4 Results

4.1 Descriptive Results

The average age of the respondents was 25.8 years-old for the Finnish sample (26.55 years-old for the South Korean sample). In the Finnish sample, there were 73 females and 56 males, and two students preferred not to indicate their gender. In the South Korean sample there were 69 females and 45 males. The use of e-learning systems in the Finnish sample was (< 1 a year $n = 61$), (1-3 years $n = 37$), and (> three years $n = 32$) and one student indicated never used it, whereas the use of e-learning systems in the South Korean sample was (< a year $n = 31$), (1-3 years $n = 51$), and (> three years $n = 32$).

We used PLS-SEM to assess the path relationships proposed in our research model. PLS-SEM results showed that all factor loadings (except for few items) were above the recommended value of .70. In total, we used 24 items to measure the six constructs and retained 19 items for further analysis. All internal reliability and validity assessments such as Cronbach's alpha (α), Composite Reliability (CR) and the Average Variance Extracted (AVE) for all constructs were consistent with the recommended threshold values of .70, .70 and .50, respectively (Hair et al., 2019). However, the observed slightly low value of Cronbach's alpha (α) for COVID-19 awareness (.61). However, as Cronbach's alpha is a very conservative test, the CR value should instead be used to assess the internal reliability. The result showed the CR value for the COVID-19 awareness satisfied the recommend value, thus we establish the internal validity for this construct. The lowest value of CR was for COVID-19 awareness (.80) and the highest for satisfaction with e-learning systems (.93). Regarding the AVE values for the constructs, the lowest value was .66 and the highest was .80, see Table 1.

Table 1: Descriptive Statistics

Construct	Items	Loadin g	Mean	Std.	α	CR	AVE
COVID-19 awareness	CVID2	.82	6.73	.80	.61	.80	.66
	CVID3	.81	6.48	1.01			
Instructors' teaching style	ITS2	.86	4.42	1.58	.76	.86	.68
	ITS3	.77	4.88	1.48			
	ITS4	.84	4.45	1.63			
Course design quality	CDES1	.84	4.91	1.74	.82	.89	.74
	CDES2	.90	4.79	1.47			
	CDES3	.83	4.1	1.66			
Perceived challenges during COVID-19	PCHA2	.79	4.81	1.79	.72	.84	.64
	PCHA3	.88	4.82	1.95			
	PCHA4	.72	5.18	1.85			
	PEIP2	.88	4.59	1.74			
Educational institutions preparedness	PEIP3	.86	4.81	1.66	.88	.91	.67
	PEIP4	.81	4.91	1.67			
	PEIP5	.77	4.77	1.72			
	PEIP6	.75	4.6	1.74			
Satisfaction with e-learning	ESAT2	.91	3.98	1.83	.88	.93	.80
	ESAT3	.92	3.71	1.87			
	ESAT4	.86	3.42	1.84			

4.2 Convergent validity and discriminant validity

We also assessed the convergent validity to make sure that all measures within each construct which are theoretically expected to relate to one another, were in fact related to each other. Regarding the convergent validity, the values of average variance extracted (AVE) were used to establish the convergent validity in this research. As shown in Table 2, all the AVE values were above the recommended threshold of .50. As per discriminant validity assessment to establish that a construct is different from other constructs, we used the Fornell Larcker criterion. As such, we assessed the AVE scores, all values were lower than the shared variance for all model constructs, see Table 2. Therefore, the discriminant validity was established in this research based on Fornell Larcker criterion (Fornell and Larcker 1981).

Table 2: Discriminant Validity

	CVID	CDES	ITS	PCHA	PEIP	ESAT
COVID-19 awareness	.813					
Course design quality	.270	.857				
Instructors' teaching style	.230	.570	.823			
Perceived challenges during COVID-19	.083	-.189	-.211	.798		
Educational institutions preparedness	.229	.559	.535	-.129	.817	
Satisfaction with e-learning	.218	.549	.462	-.404	.426	.897

4.3 Structural Results

It should be mentioned that when we report on the structural results, values for the South Korean sample are illustrated in the bracket.

The SEM results showed that the satisfaction with e-learning systems was explained by variance of 28% for the Finnish sample [45% South Korean sample], followed by instructors' teaching style 26% for the Finnish sample [56% South Korean sample] and course design quality 39% for the Finnish sample [34% South Korean sample], see Figure 2. According the SEM results, we found that both (i) the instructors' teaching style ($\beta = .19; t = 2.381; p = .005$ [$\beta = .24; t = 3.101; p = .005$]) and (ii) course design quality ($\beta = .40; t = 4.693; p = .001$ [$\beta = .52; t = 6.404; p = .001$]) significantly impact the satisfaction with e-learning; thus H1 and H2 were supported by the model and we did not find any differences between two samples.

Moreover, the results showed that while COVID-19 awareness had no significant effect on the instructors' teaching style for both samples; thus, rejecting H3a by the model, it had a significant effect on the course design quality ($\beta = .17; t = 1.997; p = .005$ [$\beta = .19; t = 3.110; p = .001$]) for both sample; thus, supporting the H3b. Unlike our expectations, perceived challenges during COVID19 negatively impact both instructors' teaching style ($\beta = -.17; t = 2.224; p = .005$) and course design quality ($\beta = -.19; t = 2.537; p = .005$) for the Finnish sample only; therefore, H4a and H4b were both rejected by the model. Finally, perceived educational institutions preparedness directly and positively influenced both the instructors' teaching style

($\beta = .40$; $t = 3.884$; $p = .001$ [$\beta = .69$; $t = 13.191$; $p = .001$]) and course design quality ($\beta = .51$; $t = 6.647$; $p = .001$ [$\beta = .50$; $t = 5.847$; $p = .001$]); thus, supporting the H5a and H5b.

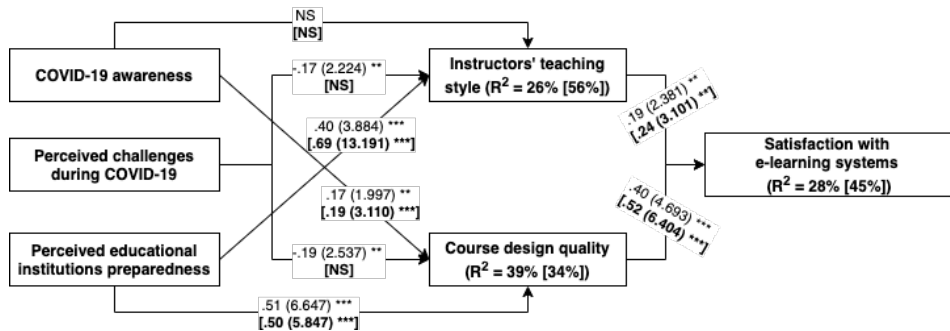


Figure 2: Structural model results (Korean results are presented in the brackets and bold)

We also examined the model to see if the instructors' teaching style and course design quality mediate the paths between COVID-19 related factors to satisfaction with e-learning systems. The mediation test results revealed interesting results. For example, we found that the path between the perceived educational institutions preparedness to satisfaction with e-learning systems was partially mediated by both instructors' teaching style and course design quality for both samples. Also, we found that the path between perceived challenges during the COVID-19 to satisfaction with e-learning was partially mediated by the course design quality for the Finnish sample. For the South Korean sample, the path between COVID-19 awareness to satisfaction with e-learning systems was partially mediated by the course design quality.

5 Discussions

According the SEM results, we could conclude that both intermediate factors (instructors' teaching style and course design quality) that affect how the e-learning process is conducted impact both the Finnish and the South Korean students in a similar manner. This finding indicates, although, we found different results when we examined the impact COVID-19 related factor, for both groups these factors are considered to be important elements of the satisfaction with e-learning systems. Moreover, we also found that, for both groups of students, the effect of COVID-

19 awareness to instructor's teaching style is not significant. In fact, the effect of this factor was only significant to the course design quality. Nonetheless, through the mediation test, we found that the effect of COVID-19 awareness to satisfaction with e-learning is indirect and mediated through course design quality. The SEM results show that the effect of perceived educational institutions preparedness to both instructors' teaching style and course design quality is significant and positive for both groups of students. This is rather important finding, because it shows the importance of the educational institutions and their readiness to provide distance education during the COVID-19. Finally, the effect of perceived challenges during COVID-19 to instructors' teaching style and course design quality was significant only for the Finnish sample. This is rather surprising, as it indicates that for the South Korean sample all COVID-19 related factors such as perceived challenges during the COVID-19 were not important. However, intermediate factors, e.g. educational institutions preparedness seems to be important and significant, as it had the strongest effect on the instructors' teaching style and course design quality effect.

6 Conclusion and Limitations

This paper investigates factors that impact students' satisfaction with e-learning systems during the lockdown of the COVID-19 pandemic. We theoretically contribute to literature in threefold manners. First, we develop and empirically investigate an integrated theoretical model, where not only conventional factors (e.g. instructors teaching style) are incorporated into the model, but also a more contextual related factors in relation to the COVID-19 situation are conceptualised in the model. The results show that contextual factors may directly or indirectly impact students' satisfaction with e-learning systems. Second, by conducting an international comparative research, we contribute to literature by showing different perceptions towards COVID-19 related factors between the Finnish and the South Korean students and how these factors impact their satisfaction with e-learning systems. For instance, for the Finnish students perceived challenges during the COVID-19 is considered to be important but the effect is negative on both instructors' teaching style and course design quality. Also, for the South Korean sample, the school readiness to facilitate the distance learning is considered to be positively associated with both instructors' teaching style and course design quality. Thirdly, regardless of the importance of technology in education, the educational

institutions preparedness to implement and execute e-learning played a central role in boosting students' satisfaction with e-learning systems.

From a more practical standpoint, the results provide useful and new insights for decision-makers at the educational institutions on how advanced learning tools (e.g. LMS) can be used to conduct distance learning and e-learning, while taking contextual factors into account. This is important, because online courses have been available to some extent in both Finnish and South Korean universities. However, due to COVID-19 circumstances it is inevitable that most lectures should be given online. Therefore, it is recommended that educational institutions should have additional efforts and measures to enhance students' satisfaction with e-learning. There are some limitations in this paper too. For example, all participants self-reported that they were students at the time the data was collected, and we were unable to verify this issue as the survey was conducted online. Also, we only collected data from students; however, we believe that teachers' perceptions must also be further studied. Finally, we cannot claim that the results can be generalised and might be applicable only to context of this research.

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