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## EXAMINING GENDER DIFFERENCES IN STUDENT LEARNING DURING THE COVID-19 PANDEMIC: A MODEL FROM THE SWITCHING COSTS AND QUALITY- RELATED PERSPECTIVES

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### ABSTRACT

Aim/Purpose	The aim of this study is to address the research questions on: (1) what factors can significantly influence student learning in remote classes during the COVID-19 pandemic? and (2) what are the gender differences, if any, in this context? To do this, the authors developed a research model from the switching costs (defined as the time and effort students have been put to change from one learning platform to another) and quality-related perspectives. In addition, gender differences are examined and identified by testing the proposed research model on male and female students, respectively.
Background	The recent worldwide outbreak of COVID-19 has changed many aspects of people's lives, including higher education. To better protect students and faculty, many universities have moved most of their classes online. Such a sudden change could make significant impacts on student learning. Thus, this study aims to empirically examine factors that can influence student learning in remote classes during the COVID-19 pandemic, and to investigate potential gender differences in such a context.
Methodology	The survey method is used in this study. The survey invitation was sent to students in multiple classes that had switched from in-person learning to remote learning during the COVID-19 pandemic. The survey was distributed in the online format. In total, 428 students completed the survey, with 202 being males and 226 being females.

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Contribution	This study contributes to the current literature on student learning during emergency situations such as COVID-19 by developing a research model to systematically investigate potential factors that could influence their perceptions of academic performance and learning enjoyment. A second contribution is the integration of theoretical perspectives of switching costs and three types of quality-related constructs in the proposed research model. In addition, the authors also investigate gender differences based on the proposed research model, and some interesting differences have been found and reported in this study.
Findings	Data analysis indicates that perceived value has a significant impact on perceived academic performance for female but not male students. In addition, male students find information quality to be a significant factor in perceived academic performance, but not perceived learning enjoyment; on the contrary, their female counterparts find it to be significant in influencing perceived learning enjoyment, but not perceived academic performance. Also, female students perceive system quality to be influential on their learning enjoyment and support service quality to be influential on their academic performance, but no such significant perceptions are found among male students.
Recommendations for Practitioners	The results of this study could help bring some insights to educators on teaching remote classes during the COVID-19 pandemic (or potentially in other similar emergency situations). For example, when moving classes to the remote platform because of an emergency situation, in order to make sure a smooth transition and achieve a higher rate of student learning success, educators, as well as the institution, need to focus on reducing the costs and, in the meanwhile, increasing the benefits associated with such a change from the students' perspective. In addition, educators may need to keep in mind the gender differences identified in this study, which may help them better understand the learning needs of different gender groups.
Recommendation for Researchers	Researchers could validate and apply the proposed research model on students from different types of institutions (such as public universities vs. private universities) and students at different levels (such as undergraduate vs. graduate students). It could also be valuable to apply and extend the current model on students from other nations who have different cultural backgrounds.
Impact on Society	Understanding influential factors on student learning during the COVID-19 pandemic, as well as gender differences in this context, could help educators better adjust their teaching of remote classes in such an emergency situation, thus meeting the learning needs of students in both gender groups.
Future Research	Future research could further validate the research model proposed in this study by applying it to students in other institutions and other nations. Also, in addition to perceived academic performance and learning enjoyment, future research may expand the current model or create new models on other student learning-related dependent variables.
Keywords	COVID-19, remote learning, switching costs, information quality, system quality, support service quality

## INTRODUCTION

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Because of the serious consequences of COVID-19, to protect the health and safety of human beings, many aspects of our daily routines have been changed. For example, many companies have asked their employees to work at home; a lot of retail stores have closed (either partially or entirely) their physical presence and promoted their online e-commerce stores instead. In addition, many individuals have chosen to use telecommunication tools, such as Zoom, to connect to and communicate with their friends, family, customers, business partners, etc. As for the education system, due to the COVID-19 concerns, many institutions have moved their classes that are not in-person essential to the online format (Cao et al., 2020; Maatuk et al., 2021; Rizun & Strzelecki, 2020; Tiwari, 2020). However, in most cases, such a move could be sudden and mandatory, and may require the redesign of the class and the setup of supporting information technology and systems (Akram et al., 2021; Cheong et al., 2020; Maatuk et al., 2021). It could also require some level of effort from students to adapt to this new learning environment (Cheong et al., 2020).

Along this line, the current study aims to examine factors that could influence student learning in their remote classes during the COVID-19 pandemic. Specifically, the authors looked into the theoretical perspective of switching costs and combined it with different quality-related theoretical constructs to examine student learning in terms of perceived academic performance and perceived learning enjoyment. Based on it, a research model was developed and empirically tested. Existing research on student learning in the context of COVID-19 mainly focuses on measuring, assessing, and discussing student perceptions and related guidelines (Almaiah et al., 2020; Cao et al., 2020; Y. Chen & Roldan, 2021; Dunaway & Kumi, 2021; Johnson et al., 2020; Prentice et al., 2020). A few studies have been seen to develop research models to investigate student learning, but most of them applied existing models related to information systems acceptance and adoption (Alshammari, 2021; Rizun & Strzelecki, 2020; Shahzad et al., 2021; Tiwari, 2020). To the best of the authors' knowledge, the current study is the first to leverage the theoretical lenses of both switching costs and various types of qualities to assess student learning in this new context, and further examine gender differences based on it.

The remainder of this paper is organized as follows. The next section discusses the theoretical constructs and provides the hypothesis development. Then, the research method is presented. Following that, data analyses and results are reported. After that, the research contributions, implications, and future research directions are discussed. The paper concludes with a summary of the study.

## THEORETICAL BACKGROUND AND HYPOTHESES

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### *PERCEIVED ACADEMIC PERFORMANCE AND PERCEIVED LEARNING ENJOYMENT*

The dependent variables of this study are perceived academic performance and perceived learning enjoyment, both of which have been used in previous literature to assess student learning.

Perceived academic performance is defined as students' own perceptions of their achieved academic performance (Islam, 2013). Previous literature has examined different levels of factors that could influence students' perceived academic performance in the e-learning environment (Islam, 2013; Lee & Lee, 2008). It was found that information quality, service quality, perceived usefulness, and ease of use could significantly influence students' learning satisfaction which, in turn, influenced their perceived academic performance (Lee & Lee, 2008).

Introduced as an important construct in the theory of TAM 3 (Venkatesh & Bala, 2008), perceived enjoyment is defined as the level of pleasure associated with an individual's intrinsic reward system derived from the use of information technology or system. When being applied to the context of education, perceived enjoyment (referred to as perceived learning enjoyment) is defined as the level of

pleasure students perceive intrinsically when leveraging a particular learning platform (remote learning in our case) to conduct their learning activities (Cheng, 2012; Padilla-Meléndez et al., 2013). Previous literature on e-learning acceptance found that various factors, such as information quality, system quality, service quality, and instructor characteristics, could significantly influence students' perceived learning enjoyment (Cheng, 2012). In addition, some specific system-related factors, such as system response, system interactivity, system functionality, were also found to be able to significantly influence perceived learning enjoyment (Cheng, 2011). Other factors that could influence perceived learning enjoyment on technology-supported learning include computer self-efficacy and facilitating conditions (Dang et al., 2016).

### ***SWITCHING COSTS, SWITCHING BENEFITS, AND PERCEIVED VALUE***

The switching costs theoretical perspective has been leveraged to understand users' adoption behavior when changing from one system or technology to another. In the context of this study, the authors apply it to help better understand students' learning behavior and perceptions when changing from in-person classes to remote classes during the COVID-19 pandemic.

When adopting a new system or technology, it is not uncommon to find some levels of user resistance in acceptance. Such resistance to change may be attributed to users' deep belief in the status quo due to their comfort with and loyalty to the prior system or technology (Nov & Ye, 2009). The switching costs theoretical perspective is often leveraged to study user resistance during the system transition process (Whitten & Wakefield, 2006). In general, there are two types of potential costs associated with system transition, including economic expenditures and intangible costs (Whitten & Wakefield, 2006). Economic expenditures refer to the monetary costs of setting up and implementing a new technology or system, while intangible costs refer to users' psychological or relational costs along the switching process (Whitten & Wakefield, 2006). Previous literature has examined switching costs on the transition of different types of information technology and systems, such as Web browsers (H.-W. Kim & Perera, 2008; Ye et al., 2008), enterprise systems (H.-W. Kim, 2011; H.-W. Kim & Kankanhalli, 2009), and email systems (G. Kim et al., 2006).

To better understand people's behavior during the switching process, previous literature has examined the relationship across switching costs, switching benefits, and perceived value, as well as their further impacts on systems adoption. For example, H.-W. Kim and Kankanhalli (2009) found that when switching to a new enterprise system, both switching costs and switching benefits could significantly influence the perceived value which, in turn, influenced user resistance to change. In another study about users' switching behavior on smartphone platforms, Hsu (2014) found that both switching costs and switching benefits had significant impacts on perceived value, which then influenced users' switching intention.

Adapted from existing literature, in our context of study, the authors define switching costs as the time and effort students have put to change from in-person learning to remote learning. Switching benefits is defined as the level of benefits that students can receive in remote learning. Perceived value is defined as the overall evaluation based on the comparison between benefits and costs associated with changing from in-person learning to remote learning. The authors believe the causal relationships from switching costs and switching benefits to perceived value that have been examined and validated in previous literature (Hsu, 2014; H.-W. Kim & Kankanhalli, 2009), also hold in the context of our study. That is, when students perceive a higher level of costs associated with changing from in-person learning to remote learning during the COVID-19 pandemic, they will be more likely to believe the value of such a change is low. Also, if they perceive a higher level of benefits associated with the learning platform change in this situation, it will be more likely for them to believe the value associated with the change to be high. Therefore, it is hypothesized that:

- H1: Switching costs could (in a negative way) significantly influence students' perceived value of changing to remote learning during the COVID-19 pandemic.

- H2: Switching benefits could (in a positive way) significantly influence students' perceived value of changing to remote learning during the COVID-19 pandemic.

Previous literature has studied the impact of perceived value in different contexts and found that it could significantly influence users' system switching intention (Hsu, 2014) in a positive way and their switching resistance (H.-W. Kim, 2011) in a negative way. It also was found to be a significant factor in influencing customer retention (Edward & Sahadev, 2011). When applying it to the context of education, it is expected that perceived value could significantly influence student learning. Specifically, if students perceive a higher level of value associated with the change from in-person learning to remote learning, it would be more likely for them to form a positive attitude (and potentially be more willing to devote effort) in their learning during the COVID-19 pandemic, thus leading to a higher level of perceptions on academic performance and enjoyment in learning. Thus, it is hypothesized that:

- H3: Perceived value associated with changing to remote learning during the COVID-19 pandemic could significantly influence students' perceived academic performance.
- H4: Perceived value associated with changing to remote learning during the COVID-19 pandemic could significantly influence students' perceived learning enjoyment.

### ***INFORMATION QUALITY, SYSTEM QUALITY, SUPPORT SERVICE QUALITY***

Based on the literature on information systems design, implementation, assessment, and adoption, there are three major types of quality-related constructs, including information quality, system quality, and service quality (DeLone & McLean, 1992, 2003).

Information quality is defined as the quality of information that a system can store, deliver, and generate (DeLone & McLean, 1992, 2003; Rai et al., 2002). It is a measure of the output of a system. System quality refers to the overall quality of the system itself (DeLone & McLean, 1992), and focuses on the technical success of the system (DeLone & McLean, 2003). Service quality refers to the quality of support services that a system can provide and deliver to users (DeLone & McLean, 2003).

In the context of education, previous literature found these three types of qualities to be important in influencing student learning in an e-learning platform. For example, Freeze et al. (2010) found that both information quality and system quality could significantly influence students' usage and satisfaction towards the e-learning system. In a more comprehensive study, Cheng (2012) found that all three types of qualities could significantly influence students' perceived usefulness, ease of use, and enjoyment of the e-learning system. Some other literature on technology-supported learning combined and treated the three types of qualities as a whole (i.e., as one theoretical construct) which is referred to as system functionality (Wu et al., 2010) or system characteristics (Y.-C. Chen, 2014), and examined its impact on student learning. Specifically, significant impacts were found about it on students' expected learning performance (Y.-C. Chen, 2014; Wu et al., 2010), learning satisfaction (Y.-C. Chen, 2014), and learning climate (Y.-C. Chen, 2014).

In the context of our study, these three types of qualities are particularly about the learning system that is used to support students' remote learning activities during the COVID-19 pandemic. To be consistent with existing literature on e-learning, the term support service quality (instead of a more general term of service quality) is used to specifically refer to the technical support services provided by the institution's support service technicians to assist students in their use of the e-learning system (Cheng, 2012).

Although previous literature examined and identified the significant impact of the three types of qualities as a whole (referred to as system characteristics) on students' perceived academic performance in e-learning (Y.-C. Chen, 2014), in this study, the authors expect that each one of them could also significantly influence students' perceived academic performance in such a setting. In addition, the authors also expect the significant impacts of the three types of qualities on students' learning

enjoyment, which have been reported in previous literature (Cheng, 2012), also hold in our context of the study. Therefore, it is hypothesized that:

- H5: Information quality of the remote learning system could significantly influence students' perceived academic performance.
- H6: Information quality of the remote learning system could significantly influence students' perceived learning enjoyment.
- H7: System quality of the remote learning system could significantly influence students' perceived academic performance.
- H8: System quality of the remote learning system could significantly influence students' perceived learning enjoyment.
- H9: Support service quality of the remote learning system could significantly influence students' perceived academic performance.
- H10: Support service quality of the remote learning system could significantly influence students' perceived learning enjoyment.

Figure 1 shows the proposed research model and hypotheses.

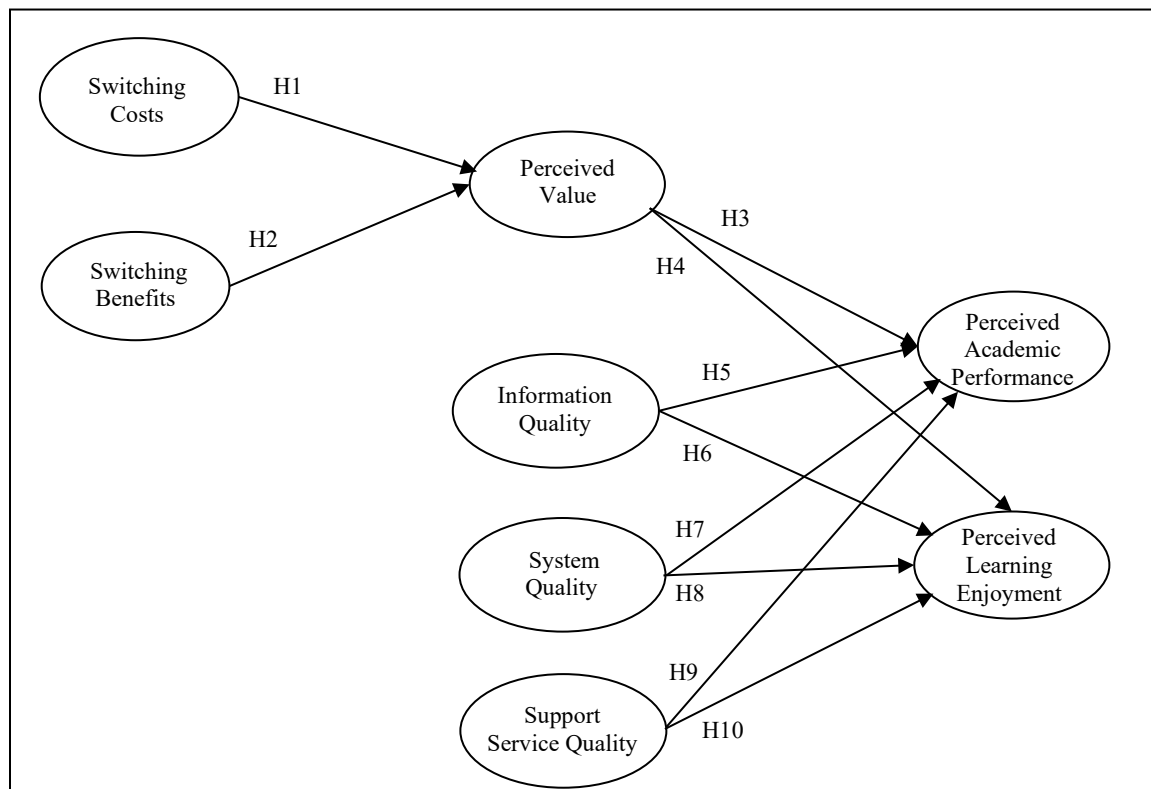


Figure 1. Research model

### ***TECHNOLOGY-RELATED GENDER DIFFERENCES***

Since the introduction of computer and information technology into our daily lives, researchers have made a significant effort to investigate and identify gender differences in various contexts about the adoption and usage of information technology and systems. For example, in the context of e-commerce, Van Slyke et al. (2002) examined gender differences related to customers' online shopping behavior and perceptions. They found that, in general, female customers tended to perceive online shopping as less favorable than male customers and provided detailed discussions and suggestions on improving female shoppers' online purchasing experience. In another study on online medical

forums, Seale et al. (2006) found significant usage differences between the two genders. Specifically, women tended to use the forums to give and/or receive emotional support, while men tended to discuss more about medical treatments and procedures.

Previous literature also examined differences in factors that could influence the adoption and acceptance of information technology and systems between the two genders. For example, Venkatesh and Morris (2000) found that ease of use and social norms were more influential on women than on men when impacting their intention to use a new information system. In the context of mobile banking, Nel and Raleting (2012) found that ease of use was more influential in determining women's intention to use the services, while perceived usefulness was more influential toward men's usage intention.

In the context of technology-supported learning, previous literature also identified significant gender differences. For example, when studying the role of emotional intelligence on students' team collaboration in information systems-related projects, Dunaway (2013) identified significant gender differences in the relationship between a team member's awareness of his or her own emotions, management of others' emotions, and team effectiveness. Previous literature also reported that, compared with male students, female students generally tended to have a lower level of computer self-efficacy (Beyer, 2008; He & Freeman, 2010), but with a more positive attitude toward their information technology and systems courses and the instructors of those courses (Beyer, 2008). In addition, when assessing factors that could influence student learning in blended classes, previous literature found computer self-efficacy to be a significant factor in influencing female students' perceived accomplishment and perceived learning enjoyment, but no such significant impacts were found on male students (Dang et al., 2016). In another study on the digital literacy of graduate and professional students, Owens and Lilly (2017) found that gender was the most influential factor than other demographic factors (such as academic discipline and race). In a more recent study, Zahedi et al. (2021) examined the gender differences in the context of using online gamified tools for student learning and found that gamification was a gender-neutral learning engagement strategy that improved female students' performance as much as male students.

## ***RESEARCH GAP***

In this study, the authors aim to investigate and identify potential gender differences in student learning during the COVID-19 pandemic, about which little effort has been made yet in the existing literature. In a recent study, Elumalai et al. (2020) examined the impacts of several factors on e-learning quality during the COVID-19 pandemic and assessed the moderating effect of gender. However, examining gender differences was not the main focus of their study, and thus they didn't specifically compare gender differences based on their proposed research model. To address this gap in current research, as well as move our understanding a step further, in this study, the authors follow the method utilized in previous literature (Dang et al., 2016; Padilla-Meléndez et al., 2013) to specifically assess gender differences by testing the proposed research model on the two gender groups separately.

## **METHOD**

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### ***RESEARCH PROCESS AND DATA COLLECTION***

The study was conducted at a major public university located in the United States. The survey method was used. The survey invitation was sent to students in various levels of Information Systems classes (from freshman-level to senior-level) that had switched from in-person learning to remote learning during the COVID-19 pandemic. Extra credit was provided as an incentive for students' voluntary participation. The survey was provided in the online format. Each participant accessed it via the provided URL and completed it with a set of questions using a 7-Likert scale, with 1 being "strongly disagree" and 7 being "strongly agree." The survey was conducted towards the end

of the semester when students had gained the experience of and been familiar with using the e-learning platform to complete their learning activities. In total, 428 students completed the survey, with 202 being males and 226 being females. The response rate was around 50%. The average age of participants was 19.80. On average, they had been at college for 2.18 years.

### ***MEASURES OF CONSTRUCTS***

To measure the constructs in the proposed research model, the authors leveraged existing literature on technology-supported learning. Specifically, the literature was about empirical studies with constructs that were the same as, or very similar to, the ones used in this current study, but in different contexts. In detail, to measure switching costs, the authors adapted items from (Edward & Sahadev, 2011; H.-W. Kim et al., 2013; H.-W. Kim & Kankanhalli, 2009). Items on switching benefits and perceived value were adopted from (H.-W. Kim & Kankanhalli, 2009) with wording changes to fit the context of our study. Measures on information quality and system quality were adopted from (Freeze et al., 2010). To measure support service quality, the authors adapted items from (Cheng, 2012) with changes to fit our context. Items on perceived academic performance were adopted from (Islam, 2013), and items on perceived learning enjoyment were adopted from (Cheng, 2012). Detailed measurement items can be found in the Appendix.

## **DATA ANALYSIS AND RESULTS**

### ***DESCRIPTIVE STATISTICS***

Table 1 shows the descriptive statistics on all constructs based on the two groups of students, respectively. Detailed model testing results are presented in the following sub-sections.

**Table 1. Descriptive statistics**

CONSTRUCT	MALE (202 STUDENTS)		FEMALE (226 STUDENTS)	
	MEAN	STD. DEV.	MEAN	STD. DEV.
Information Quality	4.741	1.372	4.820	1.342
Perceived Learning Enjoyment	4.061	1.746	4.147	1.625
Perceived Academic Performance	4.668	1.627	5.100	1.484
Perceived Value	3.863	1.646	4.074	1.654
Support Service Quality	4.927	1.290	5.271	1.199
Switching Benefits	3.528	1.622	3.618	1.518
Switching Costs	3.634	1.690	3.410	1.637
System Quality	5.450	1.204	5.529	1.117

### ***MEASUREMENT MODEL ASSESSMENT***

Structural equation modeling (SEM) techniques were used to assess the research model. Specifically, Smart PLS 2.0 (M3) beta (Ringle et al., 2005) was utilized to conduct the analyses. To assess the measurement model, both reliability and validity tests were conducted for the latent constructs in the research model. Table 2 shows the reliability test results based on the two gender groups, respectively. All item loadings are greater than the threshold value of 0.7 (Au et al., 2008), and statistically significant. In addition, the Cronbach's alpha values for all constructs (for both male and female students) are greater than the 0.7 guideline (Hair et al., 1998; Nunnally, 1978).



**Table 2. Reliability test results**

CONSTRUCT	CRONBACH'S ALPHA	ITEM	MALE		FEMALE	
			LOADING	T-STATS	LOADING	T-STATS
Perceived Academic Performance	Male: 0.896; Female: 0.875	AP1	0.935	73.203	0.934	81.271
		AP2	0.966	223.057	0.951	147.374
Information Quality	Male: 0.866; Female: 0.866	IQ1	0.901	65.862	0.905	88.840
		IQ2	0.872	44.105	0.891	58.849
		IQ3	0.891	60.449	0.865	49.875
Perceived Learning Enjoyment	Male: 0.955; Female: 0.938	PE1	0.958	116.411	0.953	103.477
		PE2	0.964	186.328	0.951	103.654
		PE3	0.951	120.528	0.925	82.951
Perceived Value	Male: 0.941; Female: 0.943	PVL1	0.944	106.692	0.954	99.087
		PVL2	0.949	135.736	0.943	74.373
		PVL3	0.944	118.545	0.947	110.545
Switching Costs	Male: 0.923; Female: 0.896	SC1	0.918	67.145	0.888	35.808
		SC2	0.944	72.872	0.898	36.734
		SC3	0.930	74.047	0.940	143.848
System Quality	Male: 0.858; Female: 0.793	SQ1	0.820	27.447	0.763	20.410
		SQ2	0.916	62.620	0.876	44.874
		SQ3	0.906	93.022	0.875	49.274
Support Service Quality	Male: 0.942; Female: 0.920	SSQ1	0.935	77.328	0.905	50.180
		SSQ2	0.952	134.290	0.958	105.186
		SSQ3	0.953	153.241	0.920	54.683
Switching Benefits	Male: 0.948; Female: 0.942	SWB1	0.941	90.947	0.946	104.199
		SWB2	0.971	223.339	0.959	125.632
		SWB3	0.943	113.911	0.934	80.924

Table 3 shows the composite reliability, average variance extracted (AVE), square root of AVE, and correlations among constructs. For both male and female students, the composite reliability values are all above the recommended level of 0.70, indicating adequate internal consistency between items (Au et al., 2008). Convergent validity is demonstrated as the AVE values for all constructs are higher than the suggested threshold value of 0.50, which is the same as the requirement of the square root of AVE to be at least 0.707 (Gefen et al., 2000). Comparing the square root of AVE with the correlations among the constructs indicates that each construct is more closely related to its own measures than to those of other constructs, and discriminant validity is therefore supported (Chin, 1998).

**Table 3. Validity test results**

Male										
	Composite Reliability	AVE	1	2	3	4	5	6	7	8
1-Information Quality	0.918	0.788	<b>0.888</b>							
2-Perceived Learning Enjoyment	0.971	0.917	0.592	<b>0.958</b>						
3-Perceived Academic Performance	0.949	0.904	0.529	0.569	<b>0.951</b>					
4-Perceived Value	0.962	0.894	0.688	0.711	0.433	<b>0.946</b>				
5-Support Service Quality	0.963	0.897	0.625	0.461	0.417	0.506	<b>0.947</b>			
6-Switching Benefits	0.967	0.906	0.612	0.651	0.417	0.813	0.378	<b>0.952</b>		
7-Switching Costs	0.951	0.866	-0.369	-0.309	-0.239	-0.291	-0.193	-0.150	<b>0.931</b>	
8-System Quality	0.913	0.777	0.676	0.472	0.414	0.490	0.671	0.359	-0.376	<b>0.881</b>
Female										
	Composite Reliability	AVE	1	2	3	4	5	6	7	8
1-Information Quality	0.918	0.788	<b>0.888</b>							
2-Perceived Learning Enjoyment	0.960	0.890	0.601	<b>0.943</b>						
3-Perceived Academic Performance	0.941	0.888	0.393	0.515	<b>0.942</b>					
4-Perceived Value	0.964	0.898	0.546	0.685	0.479	<b>0.948</b>				
5-Support Service Quality	0.949	0.861	0.530	0.283	0.338	0.261	<b>0.928</b>			
6-Switching Benefits	0.963	0.896	0.457	0.590	0.362	0.793	0.177	<b>0.947</b>		
7-Switching Costs	0.934	0.826	-0.403	-0.413	-0.403	-0.445	-0.266	-0.297	<b>0.909</b>	
8-System Quality	0.877	0.705	0.620	0.436	0.359	0.363	0.597	0.258	-0.299	<b>0.840</b>

Note: Diagonal elements in bold are the square root of average variance extracted (AVE) by latent constructs from their indicators; off-diagonal elements are correlations among constructs.

### ***STRUCTURAL MODEL ASSESSMENT AND HYPOTHESIS TESTING***

Figures 2 and 3 show the PLS testing results of the research model on the two gender groups, respectively. For both groups of students, it was found that switching costs had significantly negative impacts on perceived value (path coefficients of -0.173 for male and -0.230 for female students). Thus, H1 was supported in both groups. In addition, switching benefits had significantly positive impacts on perceived value (with path coefficients of 0.787 for male and 0.724 for female students), in support of H2.

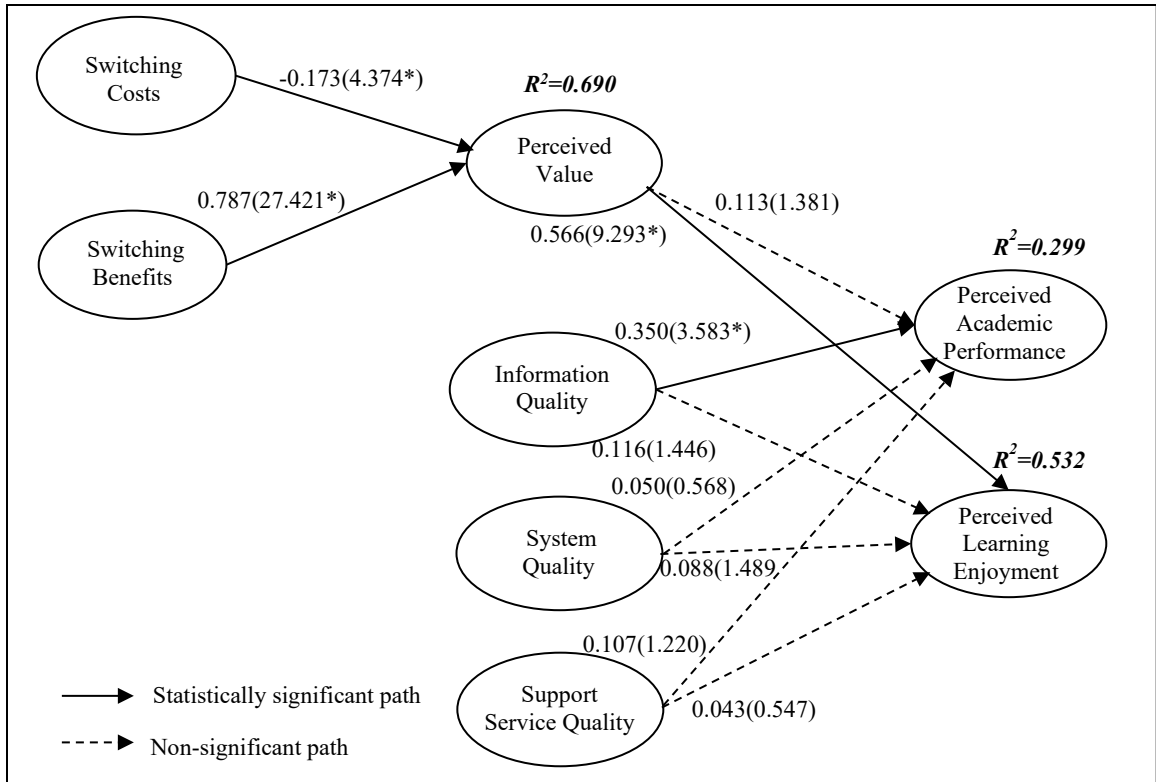


Figure 2. Model test results for males (N = 202)

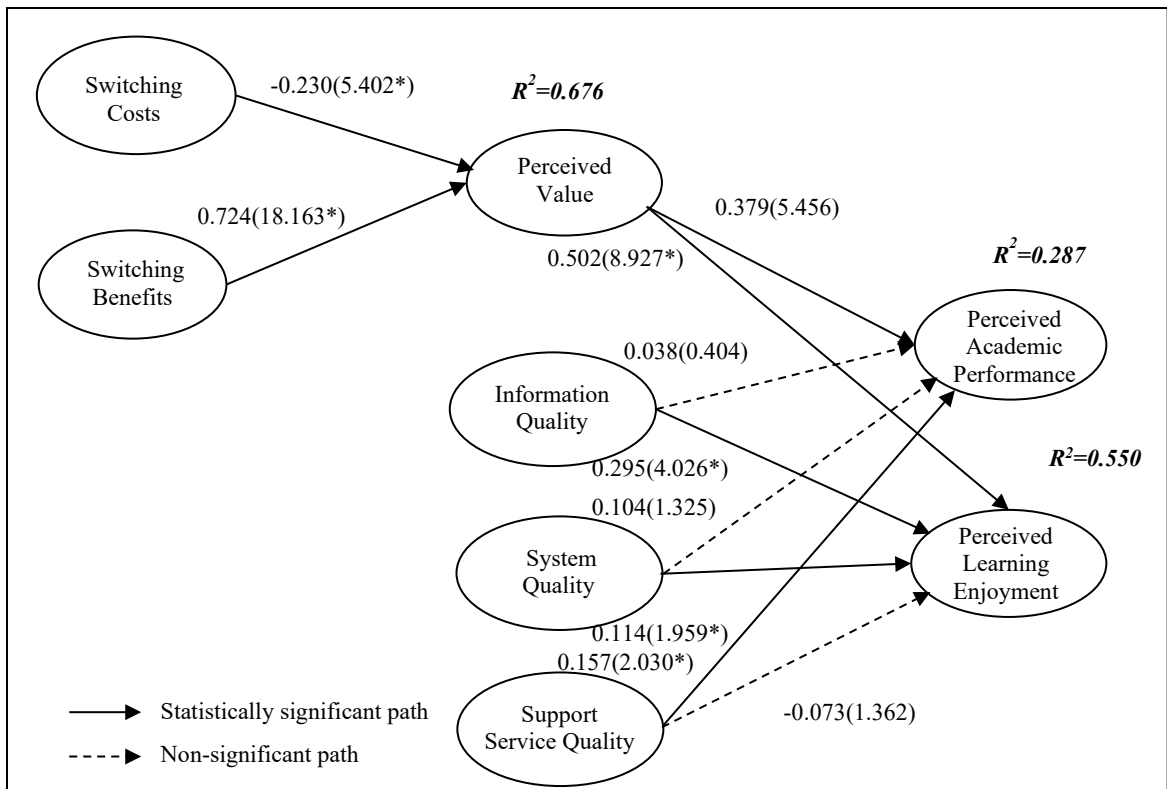


Figure 3. Model test results for females (N = 226)

As for perceived value, it was found to be able to significantly influence perceived learning enjoyment (path coefficient of 0.566), but not perceived academic performance, for male students. However, for female students, a significant impact was found for the perceived value on both perceived academic performance and perceived learning enjoyment (path coefficients of 0.379 and 0.502, respectively). Thus, H3 was supported on female students only, and H4 was supported on both gender groups. Such a difference may indicate that, in general, male students did not perceive that the value associated with switching to remote learning during the COVID-19 pandemic could influence their academic performance; on the contrary, female students believed the value associated with switching to remote learning during the COVID-19 pandemic could positively influence their academic performance.

For information quality, clear differences were found between the two gender groups. Specifically, male students found it as a significant factor in influencing their perceived academic performance (path coefficient of 0.350), but not perceived learning enjoyment; in reverse, female students found it as a significant factor in influencing their perceived learning enjoyment (path coefficient of 0.295), but not perceived academic performance. Thus, H5 was supported on male students only, and H6 was supported on female students only. This gender difference could indicate the difference in the role of information quality on student learning between the two gender groups – that is, a higher level of information quality presented in the remote learning system could lead male students to perceive better academic performance, and female students to gain a higher level of enjoyment in learning.

For system quality, no significant impact was found from it to either perceived academic performance or perceived learning enjoyment on male students. But it was found to be significant on perceived learning enjoyment for female students (path coefficient of 0.114). Therefore, H7 was not supported on either of the gender groups, and H8 was supported on female students only. Similarly, support service quality was found to have no significant impact on either perceived academic performance or perceived learning enjoyment on male students. But it could significantly influence female students' perceived academic performance (path coefficient of 0.157). Therefore, H9 was supported on female students only, and H10 was not supported on either of the gender groups. These results may indicate that male students believed system quality and support service quality of the remote learning system to have little influence on either their academic performance or enjoyment in learning. For female students, a higher level of quality associated with the remote learning system could make their learning process more enjoyable, and a higher level of quality in support services around the use of the remote learning system could help increase their perception of better academic performance.

Overall, the model test results on male students showed that switching costs and switching benefits together explained 69.0% ( $R^2 = 0.690$ ) of the variance of perceived value. For perceived academic performance, the model explained 29.9% ( $R^2 = 0.299$ ) of its variance. For perceived learning enjoyment, the model explained 53.2% ( $R^2 = 0.532$ ) of its variance. The model test results on female students showed that switching costs and switching benefits together explained 67.6% ( $R^2 = 0.676$ ) of the variance of perceived value. For perceived academic performance, the model explained 28.7% ( $R^2 = 0.287$ ) of its variance. For perceived learning enjoyment, the model explained 55.0% ( $R^2 = 0.550$ ) of its variance.

## DISCUSSION

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This study aims to investigate factors that could influence student learning in the current and on-going COVID-19 pandemic. Because of the fast spread and significant consequences of COVID-19, to better protect the health and safety of students and faculty, many institutions have switched the majority of their in-person classes to the remote learning platform. Such a sudden and mandatory change could significantly influence student learning. Thus, a better understanding of factors that can significantly impact student learning in such a new and emergent situation is important and could

potentially help in increasing student learning success at this difficult moment. Along this line, the current research has made several research contributions.

First, to help educators and researchers better understand student learning during the COVID-19 pandemic, potential factors that could influence their perceptions of academic performance and learning enjoyment were systematically investigated. A research model was developed and tested with a relatively large sample size. Since the breakout of COVID-19 was pretty recent, relatively fewer studies have been done yet on assessing student learning in this situation, especially those focusing on creating and validating research models that can help better understand its impact on student learning. Therefore, the authors believe the current study could contribute to the existing literature on this topic.

Second, in this study, the authors looked into the theoretical perspective of switching costs and combined it with the three types of quality-related constructs to systematically investigate their impacts on student learning during the COVID-19 pandemic. To the best of our knowledge, this is the first study to leverage the switching costs perspective to examine student learning during the COVID-19 pandemic. Our data analysis results showed the significant impact of switching costs-related factors on student learning in this context. The relationship that has been identified between switching costs and switching benefits with perceived value is consistent with what was found in previous literature (Hsu, 2014; Kim & Kankanhalli, 2009), but in different contexts. This study has contributed to the existing literature by extending our knowledge on this relationship to a new context. As to the relationship between information quality and system quality with perceived learning enjoyment, the positive impacts found in this study (significant only on females) are consistent with findings identified in previous literature on technology-supported e-learning (Cheng, 2012; Freeze et al., 2010). As to the impacts of the three aspects of quality on perceived academic performance, the results showed that information quality had a significant impact on male students' perceived academic performance, while support service quality had a significant impact on female students' perceived academic performance. This is largely consistent with what was reported in previous literature (Y.-C. Chen, 2014), in which the three types of quality were not evaluated separately but assessed as a whole.

Third, the authors also investigated gender differences in the context of student learning during the COVID-19 pandemic based on the proposed research model. Some interesting differences have been found between the two gender groups in terms of significant factors that could influence their learning in this situation, especially about their perceptions of academic performance and learning enjoyment. Little research has been seen in specifically investigating gender differences in student learning during the COVID-19 pandemic. Thus, this study makes a contribution in addressing such a gap.

The authors hope the results of this study can bring some insights to educators on teaching remote classes during the COVID-19 pandemic (or potentially in other similarly emergency situations). As shown in the analysis results, both groups of students found switching costs related factors (including switching costs, switching benefits, and perceived value) to be significant in influencing their learning. Therefore, when moving classes to the remote platform because of an emergency situation such as COVID-19, in order to reassure a smooth transition and achieve a higher rate of student learning success, educators as well as the institution need to focus on reducing the costs and, in the meanwhile, increasing the benefits associated with such a change from the students' perspective. It is also important to emphasize to students the value associated with such a change. For example, they may present to students both the pros and cons of remote learning, and then make clear why the pros could outweigh the cons under such a special situation.

When moving classes online, the remote learning system could become essential in student learning. The results found in this study indicate that there exist gender differences on the impact of different types of qualities (including information, system, and support service qualities) related to the remote learning system on student learning. Educators may need to keep these gender differences in mind, which may help them better understand the learning needs from different gender groups. For

example, for male students, information quality seems to be more important in influencing their learning success in this situation. However, for female students, all three types of qualities could be of some level of importance during their learning process. Specifically, better information and system qualities may help improve the level of enjoyment during their learning process under this situation, while support service quality may help increase their perceived academic performance.

This study also has some limitations that future research can further improve. First, the study was done based on students in one institution (although from various classes). To further validate the research model, future research could apply it to students in other institutions and other nations. In this study, student learning in terms of their perceived academic performance and learning enjoyment was examined. Future research could develop models based on other dependent variables.

## CONCLUSION

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This study examined factors that could significantly influence student learning in remote classes during the COVID-19 pandemic. Specifically, the authors looked into factors on switching costs and quality-related theoretical perspectives. A researched model was developed and tested on the two gender groups separately, with the purpose of further investigating gender differences in this situation. The data analysis results showed that, for both gender groups, switching costs and switching benefits could significantly influence perceived value which, in turn, significantly influenced perceived academic performance (for female students) and learning enjoyment (for both gender groups). In terms of the impacts of the three aspects of qualities, the results showed that information quality could significantly influence perceived academic performance (for male students) and perceived enjoyment (for female students). System quality had a significant impact on perceived learning enjoyment (for female students). In addition, support service quality was found to be a significant factor in influencing perceived academic performance (for female students).

The model test results also indicated clear gender differences. Specifically, perceived value had a significant impact on perceived academic performance for female students, but not male students. In addition, male students found information quality to be a significant factor on perceived academic performance, but not perceived learning enjoyment; on the contrary, their female counterparts found it to be significant on influencing perceived learning enjoyment, but not perceived academic performance. Also, female students perceived system quality to be influential on their learning enjoyment and support service quality to be influential on their academic performance, but no such significant perceptions were found among male students.

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## APPENDIX: MEASUREMENT ITEMS

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### Switching Costs

- SC1: It has taken me a lot of time and effort to change and adapt to remote learning.
- SC2: It is costly in both time and effort for me to change and adapt to remote learning.
- SC3: In general, it is a hassle for me to change to remote learning.

### Switching Benefits

- SWB1: Changing to remote learning can enhance my learning task performance.
- SWB2: Changing to remote learning can enhance my learning effectiveness.
- SWB3: Changing to remote learning can improve the quality of my learning.

### Perceived Value

- PVL1: Overall, changing to remote learning is worthwhile.
- PVL2: Overall, changing to remote learning is of good value.
- PVL3: Overall, changing to remote learning is beneficial to me.

### Information Quality

- IQ1: The remote learning technology (such as Blackboard Collaborate Ultra/Zoom) provides information that is exactly what I need in my learning.
- IQ2: The remote learning technology (such as Blackboard Collaborate Ultra/Zoom) provides information that is relevant to my learning.
- IQ3: The remote learning technology (such as Blackboard Collaborate Ultra/Zoom) provides information that is easy to understand.

#### System Quality

SQ1: The remote learning technology (such as Blackboard Collaborate Ultra/Zoom) is always available.

SQ2: The remote learning technology (such as Blackboard Collaborate Ultra/Zoom) is user-friendly.

SQ3: The remote learning technology (such as Blackboard Collaborate Ultra/Zoom) has sufficient functions to support my learning.

#### Support Service Quality

SSQ1: The institution provides prompt support services on the remote learning technology (such as Blackboard Collaborate Ultra/Zoom).

SSQ2: The institution provides adequate support services on the remote learning technology (such as Blackboard Collaborate Ultra/Zoom).

SSQ3: The institution provides satisfactory support services on the remote learning technology (such as Blackboard Collaborate Ultra/Zoom).

#### Perceived Academic Performance

AP1: During the coronavirus (COVID-19) pandemic, I anticipate good grades in such courses where the remote learning technology (such as Blackboard Collaborate Ultra/Zoom) is heavily used.

AP2: I anticipate that I will be satisfied with my academic performance in such courses where the remote learning technology (such as Blackboard Collaborate Ultra/Zoom) is used.

#### Perceived Learning Enjoyment

PE1: I find using the remote learning technology (such as Blackboard Collaborate Ultra/Zoom) to be enjoyable.

PE2: The actual process of using the remote learning technology (such as Blackboard Collaborate Ultra/Zoom) is pleasant.

PE3: I have fun using the remote learning technology (such as Blackboard Collaborate Ultra/Zoom).

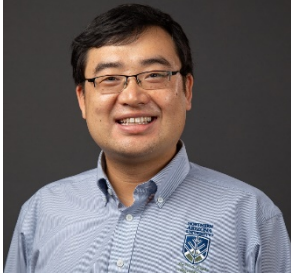
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