

# The impact of perceived quality of online interaction on satisfaction of international student interactions in higher education

Xiaozhuan Wang, Aminuddin Bin Hassan, How Shwu Pyng, Han Ye & Ain Afiqah Aminuddin

To cite this article: Xiaozhuan Wang, Aminuddin Bin Hassan, How Shwu Pyng, Han Ye & Ain Afiqah Aminuddin (2024) The impact of perceived quality of online interaction on satisfaction of international student interactions in higher education, Cogent Education, 11:1, 2293454, DOI: [10.1080/2331186X.2023.2293454](https://doi.org/10.1080/2331186X.2023.2293454)

To link to this article: <https://doi.org/10.1080/2331186X.2023.2293454>



© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



View supplementary material [↗](#)



Published online: 10 Jan 2024.



Submit your article to this journal [↗](#)



Article views: 1187



View related articles [↗](#)



View Crossmark data [↗](#)



Received: 07 October 2023  
Accepted: 06 December 2023

\*Corresponding author: Aminuddin Bin Hassan, Faculty of Educational Studies, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia  
E-mail: [aminuddin@upm.edu.my](mailto:aminuddin@upm.edu.my)

Reviewing editor:  
Stephen Darwin, Universidad Alberto Hurtado, Chile

Additional information is available at the end of the article

## HIGHER EDUCATION | RESEARCH ARTICLE

# The impact of perceived quality of online interaction on satisfaction of international student interactions in higher education

Xiaozhuan Wang<sup>1</sup>, Aminuddin Bin Hassan<sup>1\*</sup>, How Shwu Pyng<sup>1</sup>, Han Ye<sup>2</sup> and Ain Afiqah Aminuddin<sup>3</sup>

**Abstract:** Online learning is a necessary teaching method for higher education institutions to cope with future unpredictable events. This study aims to investigate the impact of four forms of perceived quality in online interaction on the satisfaction of international students. The four types of online interaction considered are Teacher-Student Interaction (TSI), Student-Student Interaction (SSI), Student-Content Interaction (SCI), and Student-Interface Interaction (SII). Employing a quantitative research approach, we used a questionnaire for data collection in the investigation. The questionnaire underwent rigorous assessment for reliability and validity. The population of this study consists of a university in Zhejiang Province, China, with over 2,000 international students enrolled in 2019. Utilizing a stratified random sampling technique, we selected 320 international students exclusively participating in 100% online courses. Data analysis, conducted using SPSS 26.0, included descriptive analysis, correlation analysis, and multiple linear regression analysis. The research findings underscore the critical role of the perceived quality of three types of interactions—TSI, SSI, and SCI—in influencing student satisfaction with online learning interactions. This study contributes to enriching research on international student satisfaction with online interaction, providing valuable insights for educators and institutions aiming to enhance the quality of online learning experiences.

**Subjects:** Assessment; Open & Distance Education and eLearning

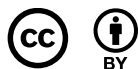
**Keywords:** online interaction; perceived quality; student satisfaction; online learning

### 1. Introduction

Online education provides teachers and students with synchronous or asynchronous teaching and has a wide scope of applications and a range of prospects (Simamora, 2020). As higher education institutions (HEIs) continue to expand college online course programs, educators and organizations are beginning to focus on improving the quality of online courses (Martin et al., 2019).

### ABOUT THE AUTHOR

Aminuddin Hassan is a distinguished scholar in the field of Philosophy of Education, currently affiliated with Universiti Putra Malaysia. With expertise in unraveling the philosophical underpinnings of education, he contributes significantly to the understanding of education's profound impact on society. You can reach him via email at [aminuddin@upm.edu.my](mailto:aminuddin@upm.edu.my).



Alqurashi (2019) mentioned that students' satisfaction (SS) is often an indispensable factor in online course quality assessment. Several previous studies have confirmed that interaction is an important topic in research on influencing student satisfaction (Baber, 2020; Mandernach et al., 2005). Muzammil et al. (2020) pointed out that this interaction can occur among students, between students and their teachers/tutors, and between students and course content. Wang and Tsai (2016) emphasised that researchers should also pay more attention to the learner-interface interaction. Wong and Chapman (2023) have noted that the existing literature has not adequately addressed the contributions of various forms of interaction to student satisfaction. While our previous research has demonstrated that online interaction perception quality is the most significant predictor of international student interaction satisfaction (Wang et al., 2023), there has been no in-depth exploration of the impact of the perceived quality of four different forms of online interactions on student satisfaction.

## 2. The importance of online interaction

For nearly 10 years, online interaction has been the focus of distance education and educational technology research perspectives (Vlachopoulos & Makri, 2019). Online interaction contributes to enhancing the quality of online education and serves as a practical criterion for evaluating online education models (Alhih et al., 2017). Additionally, it stands out as a key factor driving the success of online courses (Muthuprasad et al., 2021). Damary et al. (2017) argue that the primary concern prompting an increasing number of individuals to worry about the quality of education in online learning is the belief that online learning methods may lead to a "detriment to the quality of education" due to a lack of appropriate and effective interactive practices.

Many previous studies have pointed out the importance of online interaction for education. Baber (2020) emphasised the importance of interaction in online learning, and a high-quality educational experience includes interactive experience in the educational process. Interaction has become a key predictor of SS, and increased interaction has a positive impact on students' course satisfaction and learning outcomes (Alqurashi, 2019). Online educators are constantly striving to provide interactive opportunities for students participating in online learning to improve students' chances of success throughout the online course environment. Zeng et al. (2020) pointed out that high-quality student interactions can be effective in helping students achieve positive performance results. The online learning environment adds more interaction opportunities for teachers and learners, and those high-level socially consultative interactions tend to enhance the learning experience (Dakhi et al., 2020). Interaction can not only help learners meet performance expectations but also make judgments on learners' comprehension ability and mastery of knowledge information (Mason & Bruning, 2001; Yu & Liu, 2021). Hara and Kling (2001) explained in their research that if online interaction is ambiguous, students are often confused because they cannot judge their performance, and some students even feel anxious and unmotivated to learn. Research has shown that the high frequency of interaction has a significant effect on improving learners' academic performance (Alqurashi, 2019).

The success of an online course depends on the learner's perception of interaction (Muthuprasad et al., 2021). Driver's (2002) study found that the better the students' perception of interaction, the higher their overall satisfaction with online courses. In this study, student satisfaction refers to students' overall subjective perception and evaluation of online course interaction (Xiao & Li, 2021) after comparing their expectations before participating in online learning with the actual perceived learning experience effect. The perceived quality refers to students' feelings about the quality of education services (Lin et al., 2020). The online interaction perceived quality refers to students' actual subjective perception of the quality of online interaction after participating in online courses.

## 3. Four forms of online interaction

### 3.1. Teacher-Student Interaction (TSI)

The interaction between students and teachers is often referred to as TSI, which includes not only the exchange of teaching content in the classroom (Gunesequera et al., 2019) but also the

stimulation of learners' interest and motivation in the teaching process, guidance in organising learning activities, and support in completing the course (Sher, 2009; Tanis, 2020). There are many ways in which teachers maintain interaction with students, such as planning lessons, mentoring students, providing feedback, testing (both formal and informal), encouraging support, and providing counseling (El Alfy et al., 2017).

Online teaching provides a convenient communication environment where teachers often provide individual feedback to each student. Within this context of interaction, there may be positive or negative effects on the learner's learning of the new task (Martin et al., 2019). SS with online courses is affected by the quality of TSI (Alqurashi, 2019; Garrison, 2009). The findings of Lin et al. (2017) also show that the positive TSI has a positive impact on SS, which is consistent with the conclusion of Kuo et al. (2014). An important predictor of SS with online courses is TSI (Wong & Chapman, 2023), and it is necessary to purposefully create a teaching environment that supports teacher-student collaboration.

### **3.2. Student-Student Interaction (SSI)**

This refers to the communication that takes place between one student and other students. This type of communication allows students to feel motivated by each other (Moore & Kearsley, 2011). SSI shows interdependence, which is a higher-level skill than independence. SSI is essentially collaborative learning, and learners can get as much learning information as possible from textbooks and teachers by learning from each other (Tanis, 2020).

The interaction among students has captured the attention of researchers (Goh et al., 2017), and the fundamental concept of this interaction involves learners exchanging information and ideas with each other. This learning approach is grounded in a "maximum adherence to learner-centered" perspective, providing learners with more opportunities for autonomous knowledge construction (Gunwardena & McIsaac, 2004). Therefore, an effective indicator of learners' satisfaction with online courses is the learner-learner interaction method (Su & Guo, 2021). Aydin (2021) introduced the factors that affect SS with online education, and SSI is identified as a significant factor affecting satisfaction with online education.

### **3.3. Student-Content Interaction (SCI)**

This refers to learners actively interacting with online learning content. Learning content is usually the basis for learning and teaching that learners and teachers expect to learn and form within the knowledge, attitudes, and values of a specific topic or area of study (UNESCO-IBE, 2013). In general, learning content is often defined as topics, concepts, behaviors, and facts (Kumar et al., 2021). Each learner must actively and continuously interact with learning content as much as possible, and further build their knowledge system by adding the newly learned knowledge to the previous cognition. Kumar et al. (2021) state, "E-learning content may further be categorized into learning content and website content." "Learning content" refers to the provision of comprehensive and accurate learning materials to learners. "Website content" refers to the learning content provided through the website, and learners can retrieve the required knowledge anytime and anywhere in a convenient way. The learning content provided online is a major factor affecting online learning services (Udo et al., 2011). Learner-content interaction is a significant enabler for learners to achieve their expected learning success; findings from Bervell et al. (2020) and Aydin (2021) suggest that SCI is a significant variable influencing online SS.

### **3.4. Student-Interface Interaction (SII)**

SII refers to the interaction between learners and online media technology in the process of distance education (Hillman et al., 1994). SII occurs when learners use interfaces (Alhih et al., 2017). Online interactive technologies and diverse media provide online learning designers and participants with opportunities to discuss, communicate, and share learning content freely, and facilitate learners' interactions with teachers, peers, and learning materials. Monson (2003) pointed out that the study of SII mainly focuses on two aspects: one is the learner's ability to

master and operate the interface, and the other is the design content and use of the function of the online learning interface. Interfaces are often designed with learners in mind. More consideration is given to usability and ease of use (Jiang et al., 2021; Monson, 2003).

SII has received less attention than the other three types of interaction because the concept and role of the interface are often overlooked in technology-mediated education (Wang & Tsai, 2016). In the last 10 years, the focus of education has gradually shifted to the importance of interfaces, as researchers have discovered that interfaces can respond to students (Luckin & Cukurova, 2019). Artificial intelligence has promoted breakthroughs in online education interface technology, and SII will play a more important role in online education in the future (Kumar et al., 2019). Bringula et al. (2018) propose a vision for the future of SII, suggesting that it will become one of the core themes in educational technology over the next 15 years, particularly serving as a key milestone in responding to global emergencies.

#### **4. The purpose of the study**

This study is based on prior research and focuses on four forms of online interactions, aiming to explore the impact of these four student-perceived qualities of online interactions (TSI, SSI, SCI, and SII) on international student interaction satisfaction (SS).

#### **5. Research questions**

This study aims to address the following four questions:

- (1) How does the TSI influence the SS?
- (2) How does the SSI influence the SS?
- (3) How does the SCI influence the SS?
- (4) How does the SII influence the SS?

#### **6. Methodology**

##### **6.1. Participants**

A total of 320 international students completed the survey entirely. Among them, 20 questionnaires had outliers (consistent responses across all questions), which we dealt with by directly removing them.

The participants in this study are from a Chinese university named after science and technology. In general, there is a significant gender gap in the male-to-female ratio in Chinese universities named after science and technology, with a much higher number of male students. Additionally, in terms of subject settings, there is a predominant focus on science and engineering, resulting in a much larger enrollment in these fields compared to other disciplines. Among the 300 valid samples, the sample size of males (208) is much higher than that of females (92), which accounts for 69.3%. The sample size of “Science and Engineering” (217) is much higher than that of other majors (83), accounting for 72.3%. The sample data largely aligns with the characteristics of Chinese universities specializing in science and technology.

##### **6.2. Data collection**

In this study, the questionnaire was shared in the class groups of international students through the international student educational affairs system. The sample data is stratified according to the cumulative learning time of international students in Chinese universities, including two layers: less than half a year and more than half a year. This study only sampled international students who had participated in online learning for more than half a year.

**Table 1. Operational definitions**

Latent variable		Operational Definition	Number of measurement items	Reference
IV	TSI	The TSI considers five perspectives: questioning, answering, communication and discussion, organisation and management, and teacher evaluation.	5	Wang et al. (2023)
	SSI	The SSI considers four perspectives: questioning, collaborative learning, resource sharing, and peer evaluation.	4	
	SCI	The SCI considers the difficulty, flexibility, and richness of online content.	3	
	SII	The SII considers the responsiveness, simplicity, and comprehensiveness of the online interface.	3	
DV	SS	Satisfaction evaluation of four forms of online interaction after participating in online courses.	4	

### 6.3. Research instrument

This study adopts the widely used survey method (questionnaire survey) in quantitative research. The questionnaire for this study is derived from a well-established scale and adopts closed-ended questions. The questionnaire scale developed in the study by Wang et al. (2023) is based on six latent variables from their conceptual model, comprising a total of 33 measurement items. Among them, the latent variables that align with this study include PQ (with 15 measurement items) and SS (with 4 measurement items). The operational definitions of the four independent variables (IVs) and one dependent variable (DV) in this study are presented in Table 1:

### 7. Results

To address the research questions, this study utilized SPSS 26.0 for the analysis of the collected data. The analysis results encompass the assessment of the reliability and validity of the research instrument, as well as the findings of descriptive statistics analysis, correlation analysis, and multiple linear regression analysis.

### 8. Assessment of the reliability and validity of the questionnaire

Hair et al. (2011) pointed out that in addition to Cronbach's alpha coefficient (CA), the reliability test method should also incorporate composite reliability (CR) to assess the internal consistency among various latent variables. The CA of each variable exceeds the critical value (0.7), and the CR of each variable is greater than 0.7 (See Table 2), which can determine the reliability of the questionnaire to be good (Hair et al., 2019). The three main parameters of convergent validity

**Table 2. Reliability & validity of the questionnaire**

Latent Variable	Items	Factor loading	AVE	CR	CA
TSI	TSI1	0.79**	0.597	0.881	0.881
	TSI2	0.758**			
	TSI3	0.756**			
	TSI4	0.798**			
	TSI5	0.761**			
SSI	SSI1	0.753**	0.635	0.874	0.874
	SSI2	0.81**			
	SSI3	0.808**			
	SSI4	0.814**			
SCI	SCI1	0.876**	0.751	0.9	0.9
	SCI2	0.849**			
	SCI3	0.874**			
SII	SII1	0.784**	0.679	0.864	0.861
	SII2	0.846**			
	SII3	0.84**			
SS	SS1	0.756**	0.59	0.852	0.851
	SS2	0.781**			
	SS3	0.749**			
	SS4	0.787**			

include factor loading, average variance extraction(AVE), and CR. The factor loading (>0.7), AVE value (>0.5), and CR (>0.7) of each measurement item (See Table 2) satisfy the reference value (Hair et al., 2011, 2017), which means that convergent validity of this questionnaire is better.

### 9. The results of descriptive statistics analysis

This study uses SPSS 26.0 to perform descriptive statistics on the five latent variables to understand the respondents' attitudes toward each latent variable. The perceived quality of students' online learning interaction includes four latent variables (TSI, SSI, SCI, and SII). Among them, the lowest average score is the TSI, and the corresponding measurement item results (See Table 3) show that the online course teacher has the lowest score in the real-time answering question item. This seems to be related to the characteristics of online courses (the spatial and temporal separation between teachers and students). The average score of the SCI is the highest, which seems to be related to the continuous improvement and enrichment of online course resources.

Student satisfaction with online interaction includes 4 measurement items (See Table 3), namely SS1, SS2, SS3, and SS4. Students' overall satisfaction with the online course learning interaction was above the average level, with the lowest mean score of the measurement item SS1, further indicating that students' satisfaction with teacher-student interaction was low compared to the other three forms of online interaction.

### 10. The results of correlation analysis

Correlation analysis takes the Pearson coefficient as the most widely used test index, which is suitable for the preliminary test of the correlation between hypothesized variables. If there is an \* in the upper right corner of the result, it means there is a relationship; otherwise, there is no relationship (Hauke & Kossowski, 2011). In this study, correlation analysis was used to investigate the correlation between TSI, SSI, SCI, SII, and SS. The specific analysis shows a correlation among TSI, SSI, SCI, SII, and SS (See Table 4).



**Table 3. Descriptive statistics**

Latent Variable	Items	Mean	SD	Mean	SD
TSI	TSI1	3.40	1.31	3.40	1.17
	TSI2	3.38	1.25		
	TSI3	3.27	1.36		
	TSI4	3.42	1.37		
	TSI5	3.50	1.30		
SSI	SSI1	3.46	1.38	3.54	1.48
	SSI2	3.54	1.44		
	SSI3	3.63	1.44		
	SSI4	3.54	1.45		
SCI	SCI1	3.61	1.51	3.60	1.93
	SCI2	3.54	1.54		
	SCI3	3.65	1.53		
SII	SSI1	3.51	1.44	3.45	1.81
	SSI2	3.42	1.64		
	SSI3	3.43	1.49		
SS	SS1	3.42	1.57	3.47	1.55
	SS2	3.51	1.44		
	SS3	3.45	1.55		
	SS4	3.48	1.44		

**11. The results of multiple linear regression analysis**

This study uses SPSS26.0 software, takes TSI, SSI, SCI, and SII as IVs, SS as the DV, and chooses the “forced entry” strategy to perform multiple linear regression Analysis (in Tables 5, 6 , and 7).

The model successfully passed the F test (Sig=.000 < 0.05), indicating the meaningfulness of the research model (Giretti et al., 2021). The R<sup>2</sup> value for the model is 0.285, which means that “TSI, SSI, SCI, and SII” can explain the reason for the change of the SS in “28.5%”. The variables are independent of each other from the Durbin-Watson value of the model (1.799). The VIF values in the model are all less than 5, which means that there is no collinearity problem and the model is better (Purwanto, 2021). The regression coefficient values of “SSI, SCI, and SII” are 0.283, 0.186, and 0.183, and they show significance at the level of 0.000 (p < 0.01), which means that “SSI, SCI, and SII” will produce a significant and positive influence on the SS. However, the Sig. value for TSI is 0.146, indicating it does not exert a significant and positive influence on SS (Giretti et al., 2021).

**12. Discussion**

The previous study has indicated that online interactive perceived quality is the most influential factor affecting student satisfaction with interactions (Wang et al., 2023). Building upon prior research, this study focuses on the four forms (TSI, SSI, SCI, and SII) of online interactive perceived quality to explore their impact on student satisfaction with online interactions.

The results of the descriptive analysis demonstrate that among the four forms of online interactive perceived quality, students expressed the lowest satisfaction with TSI. As pointed out by Ong and Quek (2023) in their research, most teachers in online courses face the challenge of how to engage students due to the inability to provide face-to-face supervision and guidance.

The results of multiple linear regression analysis reveal the impact of three IVs (SSI, SCI, and SII) on the DV (SS). SSI significantly and positively influences SS, which is consistent with the findings of



**Table 4. Pearson Correlation analysis results**

		<b>TSI</b>	<b>SSI</b>	<b>SCI</b>	<b>SII</b>	<b>SS</b>
TSI	Pearson Correlation	1	.335**	.346**	.344**	.302**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	300	300	300	300	300
SSI	Pearson Correlation	.335**	1	.377**	.370**	.447**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	300	300	300	300	300
SCI	Pearson Correlation	.346**	.377**	1	.392**	.392**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	300	300	300	300	300
SII	Pearson Correlation	.344**	.370**	.392**	1	.388**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	300	300	300	300	300
SS	Pearson Correlation	.302**	.447**	.392**	.388**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	300	300	300	300	300

Correlation is significant at the 0.01 level (2-tailed).

**Table 5. Model summary**

**Model Summary<sup>b</sup>**

<b>Model</b>	<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>Std. Error of the Estimate</b>	<b>Durbin-Watson</b>
1	.543a	.295	.285	4.22093	1.799

a. Predictors: (Constant), SII, TSI, SSI, SCI

b. Dependent Variable: SS

**Table 6. Anova**

**ANOVA<sup>a</sup>**

<b>Model</b>		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
1	Regression	2194.145	4	548.536	30.789	.000b
	Residual	5255.785	295	17.816		
	Total	7449.930	299			

a. Dependent Variable: SS

b. Predictors: (Constant), SII, TSI, SSI, SCI

most related research (Aydin, 2021; Su & Guo, 2021). SCI positively and significantly affects SS, aligning with the findings of Bervell et al. (2020) and Aydin (2021). Aydin (2021) further emphasised in their study that SCI is the strongest predictor of SS and recommended researchers pay attention to this research finding. SII positively and significantly influences SS, similar to

**Table 7. Coefficients  
Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics
	B	Std. Error				
1						
	(Constant)	3.782	.991	3.815	.000	
	TSI	.073	.050	1.458	.146	1.248
	SSI	.289	.057	5.080	.000	1.294
	SCI	.223	.067	3.312	.001	1.324
	SII	.226	.069	3.262	.001	1.317

a. Dependent Variable: SS

Laurillard's et al. (2018) perspective. Therefore, In the field of online courses, the effects of these three factors become very apparent. Encouraging student-student interactions online, enhancing the diversity of online learning content, and promoting interaction between students and online learning interfaces all may contribute to improving student satisfaction with interactions. However, the IV (TSI) does not significantly and positively influence the DV (SS), which differs from the findings of most previous related studies (Alqurashi, 2019; Kuo et al., 2014). This could be because previous research did not explore the impact of different interaction forms on students' interaction satisfaction from the perspective of interaction perceived quality.

### 13. Conclusion and future research

This study addresses the four proposed questions. The findings indicate that TSI does not significantly and positively impact SS; SSI has a significant and positive influence on SS; SCI significantly and positively affects SS; and SII has a significant and positive effect on SS. Thus, enhancing student satisfaction with online learning interactions requires to particular focus on the perceived quality of three types of interactions (SSI, SCI, and SSI). It is recommended that researchers of online courses and educators devise interactions that are more relevant to encourage student engagement in mutual assessment and collaborative learning. They should also strive to diversify the content uploaded to online learning platforms and organize it based on retrieval systems. Additionally, simplifying the functions of online learning interfaces as much as possible and providing learners with corresponding instructions or video operation guides is advised.

This study contributes to enriching research on international student satisfaction with online interactions, particularly by incorporating student-interface interactions into the study (Wang & Tsai, 2016). Furthermore, the research targets international students in Chinese universities, offering a fresh perspective on interactions in online international courses. Future research should further explore how student gender, majors, language proficiency, and interaction tools moderate the effects on perceived quality and satisfaction with online interactions.

#### Funding

This work was not supported by any funding.

#### Author details

Xiaozhuan Wang<sup>1</sup>

ORCID ID: <http://orcid.org/0000-0002-8218-5728>

Aminuddin Bin Hassan<sup>1</sup>

E-mail: [aminuddin@upm.edu.my](mailto:aminuddin@upm.edu.my)

ORCID ID: <http://orcid.org/0000-0001-8680-8489>

How Shwu Pyng<sup>1</sup>

ORCID ID: <http://orcid.org/0000-0003-1299-1174>

Han Ye<sup>2</sup>

ORCID ID: <http://orcid.org/0000-0003-1931-7211>

Ain Afiqah Aminuddin<sup>3</sup>

<sup>1</sup> Faculty of Educational Studies, Universiti Putra Malaysia, Serdang, Selangor, Malaysia.

<sup>2</sup> Faculty of Humanities and International Education, Zhejiang University of Science and Technology, Hangzhou, China.

<sup>3</sup> Faculty of Education, National University of Malaysia, Bangi, Selangor, Malaysia.

#### Disclosure statement

No potential conflict of interest was reported by the author(s).

#### Authors' contributions

XW is responsible for writing the paper, and ABH is responsible for supervising and directing the entire research. XW and HY are responsible for the collection of empirical data and data analysis. ABH and HSP oversaw and directed the data analysis process and results. All authors participated in the literature review, discussion and conclusion of this study.

#### Data availability statement

The datasets analysed during the current study are not publicly available as the permission for data sharing is not taken from the respondents.

#### Supplementary data

Supplemental data for this article can be accessed online at <https://doi.org/10.1080/2331186X.2023.2293454>

#### Citation information

Cite this article as: The impact of perceived quality of online interaction on satisfaction of international student interactions in higher education, Xiaozhuan Wang, Aminuddin Bin Hassan, How Shwu Pyng, Han Ye & Ain Afiqah Aminuddin, *Cogent Education* (2024), 11: 2293454.

#### References

- Alhih, M., Ossiannilsson, E., & Berigel, M. (2017). Levels of interaction provided by online distance education models. *Eurasia Journal of Mathematics*, 13(6), 2733–2748. <https://doi.org/10.12973/eurasia.2017.01250a>
- Alqurashi, E. (2019). Predicting student satisfaction and perceived learning within online learning environments. *Distance Education*, 40(1), 133–148. <https://doi.org/10.1080/01587919.2018.1553562>
- Aydin, B. (2021). Determining the effect of student-content interaction, instructor-student interaction and student-student interaction on online education satisfaction level. In W. B. James, C. Cobanoglu, & M. Cavusoglu (Eds.), *Advances in global education and research* (Vol. 4, pp. 1–9). USF M3 Publishing. <https://www.10.5038/9781955833042>

- Baber, H. (2020). Determinants of students' perceived learning outcome and satisfaction in online learning during the pandemic of COVID-19. *Journal of Education and E-Learning Research*, 7(3), 285–292. <https://doi.org/10.20448/journal.509.2020.73.285.292>
- Bervell, B., Umar, I. N., & Kamilin, M. H. (2020). Towards a Model for Online Learning Satisfaction (MOLS): Re-considering non-linear relationships among personal innovativeness and modes of online interaction. *Open Learning*, 35(3), 236–259. <https://doi.org/10.1080/02680513.2019.1662776>
- Bringula, R. P., Alvarez, J. N., Evangelista, M. A., & So, R. B. (2018). Learner-interface interactions with mobile-assisted learning in mathematics: Effects on and relationship with mathematics performance. In K. P., Mehdi, C., Steve, J., Murray, B., Annie, & A., Ari-Veikko. (Eds.), *K-12 STEM education: Breakthroughs in research and practice* (pp. 305–321). IGI Global.
- Dakhi, O., Jama, J., & Irfan, D. (2020). Blended learning: A 21st century learning model at college. *International Journal of Multi Science*, 1(8), 50–65.
- Damary, R., Markova, T., & Pryadilina, N. (2017). Key challenges of on-line education in multi-cultural context. *Procedia-Social and Behavioral Sciences*, 237, 83–89. <https://doi.org/10.1016/j.sbspro.2017.02.034>
- Driver, M. (2002). Exploring student perceptions of group interaction and class satisfaction in the web-enhanced classroom. *The Internet and Higher Education*, 5(1), 35–45. [https://doi.org/10.1016/S1096-7516\(01\)00076-8](https://doi.org/10.1016/S1096-7516(01)00076-8)
- El Alfy, S., Gómez, J. M., & Ivanov, D. (2017). Exploring instructors' technology readiness, attitudes and behavioral intentions towards e-learning technologies in Egypt and United Arab Emirates. *Education and Information Technologies*, 22(5), 2605–2627. <https://doi.org/10.1007/s10639-016-9562-1>
- Garrison, D. R. (2009). Communities of inquiry in online learning. In P. L. Rogers, G. A. Berg, J. V. Boettcher, C. Howard, L. Justice, & K. D. Schenk (Eds.), *Encyclopedia of distance learning* (2nd ed., pp. 352–355). IGI Global.
- Giretti, I., Correani, A., Antognoli, L., Monachesi, C., Marchionni, P., Biagetti, C., Bellagamba, M. P., Cogo, P., D'Ascenzo, R., Burattini, I., & Carnielli, V. P. (2021). Blood urea in preterm infants on routine parenteral nutrition: A multiple linear regression analysis. *Clinical Nutrition*, 40(1), 153–156. <https://doi.org/10.1016/j.clnu.2020.04.039>
- Goh, C., Leong, C., Kasmin, K., Hii, P., & Tan, O. (2017). Students' experiences, learning outcomes and satisfaction in e-learning. *Journal of E-Learning and Knowledge Society*, 13(2), 117–128. <https://doi.org/10.20368/1971-8829/1298>
- Gunsekera, A. I., Bao, Y., & Kibelloh, M. (2019). The role of usability on e-learning user interactions and satisfaction: A literature review. *Journal of Systems & Information Technology*, 21(3), 368–394. <https://doi.org/10.1108/JSIT-02-2019-0024>
- Gunwardena, C. N., & McIsaac, M. S. (2004). Distance education. In D. H. Jonassen (Ed.), *Handbook of research for educational communication and technology* (pp. 355–395). Lawrence Erlbaum.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., & Thiele, K. O. (2017). Mirror, mirror on the wall: A comparative evaluation of composite-based structural equation modeling methods. *Journal of the Academy of Marketing Science*, 45(5), 616–632. <https://doi.org/10.1007/s11747-017-0517-x>
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed, a silver bullet. *Journal of Marketing Theory & Practice*, 19(2), 139–152. <https://doi.org/10.2753/MTP1069-6679190202>
- Hair, J. F., Sarstedt, M., & Ringle, C. M. (2019). Rethinking some of the rethinking of partial least squares. *European Journal of Marketing*, 53(4), 566–584. <https://doi.org/10.1108/EJM-10-2018-0665>
- Hara, N., & Kling, R. (2001). Student distress in web-based distance education. *Educause Quarterly*, 24(3), 68–69.
- Hauke, J., & Kossowski, T. (2011). Comparison of values of Pearson's and Spearman's correlation coefficients on the same sets of data. *Quaestiones Geographicae*, 30(2), 87–93. <https://doi.org/10.2478/v10117-011-0021-1>
- Hillman, D. C., Willis, D. J., & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *American Journal of Distance Education*, 8(2), 30–42. <https://doi.org/10.1080/08923649409526853>
- Jiang, H., Islam, A. Y. M., Gu, X., & Spector, J. M. (2021). Online learning satisfaction in higher education during the COVID-19 pandemic: A regional comparison between Eastern and Western Chinese universities. *Education and Information Technologies*, 26(6), 6747–6769. <https://doi.org/10.1007/s10639-021-10519-x>
- Kumar, A., Mylapilli, S. P., & Reddy, S. N. (2019). Thermogravimetric and kinetic studies of metal (Ru/Fe) impregnated banana pseudo-stem (*Musa acuminata*). *Bioresource Technology*, 285, 121318. <https://doi.org/10.1016/j.biortech.2019.121318>
- Kumar, P., Saxena, C., & Baber, H. (2021). Learner-content interaction in E-learning—the moderating role of perceived harm of COVID-19 in assessing the satisfaction of learners. *Smart Learning Environments*, 8(1), 1–15. <https://doi.org/10.1186/s40561-021-00149-8>
- Kuo, Y. C., Walker, A. E., Schroder, K. E., & Belland, B. R. (2014). Interaction, Internet self-efficacy, and self-regulated learning as predictors of student satisfaction in online education courses. *The Internet and Higher Education*, 20, 35–50. <https://doi.org/10.1016/j.iheduc.2013.10.001>
- Laurillard, D., Kennedy, E., Charlton, P., Wild, J., & Dimakopoulos, D. (2018). Using technology to develop teachers as designers of TEL: Evaluating the learning designer. *British Journal of Educational Technology*, 49(6), 1044–1058. <https://doi.org/10.1111/bjet.12697>
- Lin, L., Huang, Z., Othman, B., Luo, Y., & Dragan, D. (2020). Let's make it better: An updated model interpreting international student satisfaction in China based on PLS-SEM approach. *PLoS One*, 15(7), e0233546. <https://doi.org/10.1371/journal.pone.0233546>
- Lin, C. H., Zheng, B., & Zhang, Y. (2017). Interactions and learning outcomes in online language courses. *British Journal of Educational Technology*, 48(3), 730–748. <https://doi.org/10.1111/bjet.12457>
- Luckin, R., & Cukurova, M. (2019). Designing educational technologies in the age of AI: A learning sciences-driven approach. *British Journal of Educational Technology*, 50(6), 2824–2838. <https://doi.org/10.1111/bjet.12861>
- Mandernach, B. J., Donnell, E., Dailey, A., & Schulte, M. (2005). A faculty evaluation model for online instructors: Mentoring and evaluation in the online classroom. *Online Journal of Distance Learning Administration*, 3(2), 1–10. <https://doi.org/10.9743/JEO.2006.2.3>
- Martin, F., Ritzhaupt, A., Kumar, S., & Budhrani, K. (2019). Award-winning faculty online teaching practices:

- Course design, assessment and evaluation, and facilitation. *The Internet and Higher Education*, 42, 34–43. <https://doi.org/10.1016/j.iheduc.2019.04.001>
- Mason, B. J., & Bruning, R. (2001). *Providing feedback in computer-based instruction: What the research tells us*. <http://dwb.unl.edu/Edit/MB/MasonBruning.html>
- Monson, J. A. (2003). *The importance of human interaction in online learning: Learner and instructor perceptions and expectations*. Indiana University.
- Moore, M. G., & Kearsley, G. (2011). *Distance education: A systems view of online learning*. Cengage Learning.
- Muthuprasad, T., Aiswarya, S., Aditya, K. S., & Jha, G. K. (2021). Students' perception and preference for online education in India during COVID-19 pandemic. *Social Sciences & Humanities Open*, 3(1), 100101. <https://doi.org/10.1016/j.ssaho.2020.100101>
- Muzammil, M., Sutawijaya, A., & Harsasi, M. (2020). Investigating student satisfaction in online learning: The role of student interaction and engagement in distance learning university. *Turkish Online Journal of Distance Education*, 21(Special Issue-IODL), 88–96. <https://doi.org/10.17718/tojde.770928>
- Ong, S. G. T., & Quek, G. C. L. (2023). Enhancing teacher-student interactions and student online engagement in an online learning environment. *Learning Environments Research*, 26(3), 681–707. <https://doi.org/10.1007/s10984-022-09447-5>
- Purwanto, A. (2021). Partial least squares structural equation modeling (PLS-SEM) analysis for social and management research: A literature review. *Journal of Industrial Engineering & Management Research*, 2(4), 114–123. <https://doi.org/10.7777/jiemar.v2i4.168>
- Sher, A. (2009). Assessing the relationship of student-instructor and student-student interaction to student learning and satisfaction in web-based online learning environment. *Journal of Interactive Online Learning*, 8(2), 102–120.
- Simamora, R. M. (2020). The challenges of online learning during the COVID-19 pandemic: An essay analysis of performing arts education students. *Studies in Learning & Teaching*, 1(2), 86–103. <https://doi.org/10.46627/silet.v1i2.38>
- Su, C. Y., & Guo, Y. (2021). Factors impacting university students' online learning experiences during the COVID-19 epidemic. *Journal of Computer Assisted Learning*, 37(6), 1578–1590. <https://doi.org/10.1111/jcal.12555>
- Tanis, C. J. (2020). The seven principles of online learning: Feedback from faculty and alumni on its importance for teaching and learning. *Research in Learning Technology*, 28, 28. <https://doi.org/10.25304/rlt.v28.2319>
- Udo, G. J., Bagchi, K. K., & Kirs, P. J. (2011). Using SERVQUAL to assess the quality of E-learning experience. *Computers in Human Behavior*, 27(3), 1272–1283. <https://doi.org/10.1016/j.chb.2011.01.009>
- UNESCO-IBE. (2013). *Glossary of curriculum terminology*. [http://www.ibe.unesco.org/fileadmin/user\\_upload/Publications/IBE\\_GlossaryCurriculumTerminology2013\\_eng.pdf](http://www.ibe.unesco.org/fileadmin/user_upload/Publications/IBE_GlossaryCurriculumTerminology2013_eng.pdf)
- Vlachopoulos, D., & Makri, A. (2019). Online communication and interaction in distance higher education: A framework study of good practice. *International Review of Education*, 65(4), 605–632. <https://doi.org/10.1007/s11159-019-09792-3>
- Wang, X., Hassan, A. B., Pyng, H. S., & Ye, H. (2023). Development and empirical study of international student satisfaction model of online course learning interaction in chinese universities. *Education and Information Technologies*, 28(12), 1–27. <https://doi.org/10.1007/s10639-023-11752-2>
- Wang, Y. L., & Tsai, C. C. (2016). Taiwanese students' science learning self-efficacy and teacher and student science hardiness: A multilevel model approach. *European Journal of Psychology of Education*, 31(4), 537–555. <https://doi.org/10.1007/s10212-015-0285-2>
- Wong, W. H., & Chapman, E. (2023). Student satisfaction and interaction in higher education. *Higher Education*, 85(5), 957–978. <https://doi.org/10.1007/s10734-022-00874-0>
- Xiao, Q., & Li, X. (2021). Exploring the antecedents of online learning satisfaction: Role of flow and comparison between use contexts. *International Journal of Computers Communications & Control*, 16(6). <https://doi.org/10.15837/ijccc.2021.6.4398>
- Yu, S., & Liu, C. (2021). Improving student feedback literacy in academic writing: An evidence-based framework. *Assessing Writing*, 48, 100525. <https://doi.org/10.1016/j.asw.2021.100525>
- Zeng, J., Parks, S., & Shang, J. (2020). To learn scientifically, effectively, and enjoyably: A review of educational games. *Human Behavior and Emerging Technologies*, 2(2), 186–195. <https://doi.org/10.1002/hbe2.188>