

Factors Influencing Students' Engagement in Virtual Classrooms and Their Impact on Satisfaction

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Abstract: During the COVID-19 pandemic, many universities switched to virtual classrooms. Online learning has benefits, but faculty and students have to overcome barriers to adjust to this new educational process. This research explores the factors most influencing students' engagement in online tertiary education, and examines their relation to instructors and students' satisfaction. Following a broad literature review for the factors that may affect engagement in online learning in general and virtual classrooms in specific, a quantitative descriptive survey was designed and pilot-tested to examine the impact of the extracted factors on students' engagement from the faculty and students' perspectives. This self-reported questionnaire was then distributed via Microsoft Forms to 273 students and 109 faculty members (382 total respondents). The results showed that the most significant factors affecting students' engagement from the perspectives of instructors and students are the behavioral and the learning-experience design. The results also revealed that satisfaction can be impacted greatly by only the technical factor and the behavioral factor from the instructors' perspectives, however from the students' perspectives it can be impacted by the psychological, behavioral, and learning experience design factors.

Keywords: virtual classrooms, interactive learning, online learning, teaching in higher education, online instructional design.

1 Introduction

During the COVID-19 pandemic, most businesses and schools shut their doors, while people maintained social distancing and stayed home. Schools and universities decided to continue the educational process by substituting virtual learning (synchronous online learning) for traditional learning. Asynchronous online learning is not new, as universities have long used it for distance learning. However, COVID-19 forced many students and teachers into virtual classrooms for the first time and caused numerous interruptions to education. Those interruptions were mostly caused by technical, academic, and communication challenges (Mahyoob, 2020). For example, Efriana (2021) recognized that technical problems commonly hinder students' engagement in virtual classrooms. Beside those challenges however, comes an affordance of the virtual classroom that made live education possible during the virus outbreak. Virtual classrooms got very popular among students and educators compared to typical asynchronous online learning.

Contrary to typical asynchronous online learning, virtual classrooms feature important tools that add life to online learning, and because students in typical asynchronous online learning usually complain of social isolation due to lack of real time interactions, the effective use of the virtual classrooms interactive tools leads to an increased sense of community among students (Mahyoob, 2020). The increased sense of community may regard virtual classrooms in the near future as an effective mode of learning. Therefore, a need to identify the factors of students' engagement in this rather new mode of learning became evident to get the most of its benefits and to detect and repair instructional gaps that may result from its ineffective use.

2 Literature Review

Several barriers can block students' engagement, including the irrelevance of the course content to students' real-life experiences, poor instructional and technical support, decreased student's confidence, and other external factors

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(e.g., family problems, health issues, socioeconomic status) (Farrell & Brunton, 2020). Reliance on outdated teaching styles (e.g., visual, auditory, kinesthetic) could limit the use of effective instructional materials and lower the engagement of online students (Palmer et al., 2017). Virtual classrooms, on the other hand, encompass interactive tools that can compensate for the decreased engagement usually experienced in typical asynchronous online learning.

2.1 Engagement in Virtual Classrooms

In general, engaging students during the learning process is critical for sustaining attention, motivating critical-thinking skills, and fostering productive learning. Kearsley and Schneiderman (1999) developed the Engagement Theory as a framework for technology-assisted learning and stated that learners must be effectively engaged by interacting with each other and completing worthwhile tasks. According to their theory, the use of emerging technologies in learning activities allows educators to engage students more effectively than traditional means of teaching. However, for a learning activity to be effective and engaging, it requires thoughtful instructional design. Specifically, it should be project-based, occur in groups of students, and have an authentic focus. These three elements of the engagement theory are addressed by Relate-Create-Donate components (Kearsley & Schneiderman, 1999). While, the Relate component focuses on teams and requires communication, social skills, and planning; the Create component makes activities purposeful, creative, and practical; and the Donate component allows learning activities to contribute to the community and society (Kearsley & Schneiderman, 1999). This theory makes engagement in learning an active task that allows the student to comprehend, apply, and donate knowledge.

Drawing on the Engagement Theory, O'Brien and Toms (2008) developed a conceptual framework to focus on how students are motivated by stimulating cognitive challenges and encouraging self-directed involvement with instructional materials and technologies. Because students' engagement in learning must be stimulated through appeals to attention, aesthetic and sensory skills, feedback, novelty, interactivity, and perceived user control, the framework suggests engaging students in technology-enhanced education through attention focus, curiosity, and intrinsic interest (O'Brien & Toms, 2008). Effectively engaged students are curious about activities, internally interested in learning, and attentive. Instructors should fuel these internal drivers of students' engagement by applying thoughtful instructional design techniques focusing on student centered learning strategies (Lee & Hannafin, 2016).

Another important framework used in designing student-centered online learning is the Community of Inquiry (COI) framework. It addresses learners' engagement through three

types of presences; social, teaching, and cognitive to maintain effective learning experiences (Befus, 2016). COI was used by John Dewey and Jane Addams to unite groups of individuals committed to sharing ideas, addressing common issues, and discussing problems or interests by sharing a scientific research method (Bektashi, 2018). The three elements of COI create a student centered learning experience involving various learners engaged in a dynamic environment where all of their cognitive, social, and mentoring needs are being satisfied. This framework could be applied when designing virtual learning because of the existence of varying tools in virtual classrooms that can support the three presences and therefore foster and maintain engagement.

2.2 Virtual Classrooms Interactive Tools

In traditional f2f learning environments, educators have a multitude of tools for facilitating student engagement, but in typical asynchronous online learning environments, these tools could be limited. The disadvantage of typical asynchronous online learning compared to traditional f2f learning is due to lack of direct contact between learners and instructors. When presenting content online, instructors often struggle to notice and address students' motivation. Moreover, when facilitating distance-learning activities, recognizing poor engagement is even more difficult (Palmer et al., 2017). However, engagement in this online learning environment is possible through effective utilization of real-time interactive tools available in virtual classrooms based on instructors' thoughtful design of the online learning experience.

Online interactive tools have successfully increased the number of students' responses and improved average marks by 20% (Lokare et al., 2021). Real-time interactive classroom tools can also dramatically increase students' interest in the course to maintain their learning engagement (Francescucci & Foster, 2013). When Liu and Moeller (2019) analyzed the capabilities of such interactive tools as WeChat, iBook Author, and Spark Video, they found them effective in contextualizing the online learning environment, improving the online learning experiences, and creating a novelty precedent to increased student interest in learning. Online interactive learning models used to teach aviation courses, have been found to successfully build positive relationships between educators and students, increase mutual engagement, and encourage students' participation in the virtual classroom (Rossydi & Masita, 2021).

2.3 Teaching Strategies and Sense of Community

Interactive tools and teaching strategies related to their use facilitate communication between classmates and educators and engage students in learning. For example, Martin and Bolliger (2018) analyzed students' perception of engagement in the learning environment and found that learner-to-instructor engagement strategies were most effective. Students recognized introductory icebreakers and

online teamwork as essential for their online engagement. Interactive tools in most learning management systems engage students' cognitive capabilities (Teng & Wang, 2021). Students willingly engage in online learning if they were encouraged to use the tools for interacting with their peers and teachers. Engagement in online learning could be improved by designing effective learning experiences and encouraging suitable instructor and students' behaviors. For instance, nonverbal immediacy behaviors can improve the efficacy of virtual learning. When students are encouraged to react to presented content using emojis, their interest toward the content increase as well as their engagement. Therefore, students' behavioral patterns could be critical in engaging them in online learning (Dixson et al., 2017). Educators also have to behave in specific ways in virtual classrooms. When educators maintain strong, meaningful relationships with students in virtual classrooms, students can attain academic success (Bigné et al., 2018). Thus, educators have to participate to motivate and engage students.

Interaction, teamwork, and collaboration reflect the students' need for a sense of community when learning. Berry (2019) interviewed students learning online and found that they struggle to maintain a sense of community; educators thus need to reach out to students regularly, limit lecture time, and use engaging forms of interaction (e.g., chat, video, play) to engage students. In short, online social presence is important to students (Ngoyi et al., 2014).

Because sense of community strongly correlates with students' level of engagement, educators need to foster meaningful connections among students in the classroom (Young & Bruce, 2011). Students need to share their experiences, communicate with their peers, and interact with their educators in meaningful ways (Young & Bruce, 2011). Community is critical when students are involved in virtual education experiences that help them to interact, provide instant feedback, and encourage each other (Gedera et al., 2015). Consequently, educators could choose teaching methods that allow all members of the educational process to interact freely by providing feedback, asking questions, debating and discussing, and sharing their reflections on the virtual learning experience. The level of a students' engagement can determine their academic productivity by improving satisfaction and perceived learning (Gray & DiLoreto, 2016). Students' engagement is linked not only to external factors, but also to internal factors such as personality, attitude, effort, motivation and self-confidence (Barua et al., 2020). When students remain motivated, their desire to learn is stimulated and they actively engage in their education (Barua et al., 2020).

However, the lack of external factors stimulating engagement could decrease the effectiveness of internal motivation. Irrelevant or unengaging lessons, poorly chosen instructional materials and failure to engage students can all lower motivation and willingness to learn

(Baker et al., 2016). By identifying factors of students' engagement, teachers can adapt their methodology and practices to the level of motivation, attitude and personality (Baker et al., 2016).

When inner variables stimulate students to engage in the classroom, the absence of exterior variables promoting engagement can lower the internal motivation of students. In traditional classrooms, educators have many devices for promoting students' engagement, but in online classrooms, these could be limited. Numerous barriers block students' engagement, for example, the irrelevance of course material to trainees' real-life experiences, poor support that does not address the demands of different students, decreased trainee confidence, and exterior factors.

The above literature analysis has revealed the fact that students' engagement can be influenced by multitude of factors. Four groups of factors that could affect students' engagement in virtual classrooms were identified in the literature: (1) technical (technology and related issues); (2) learning-experience design (instructional design related issues); (3) psychological (stress, mood, and mental wellbeing of students); and (4) behavioral (instructors' virtual classroom management). The current study aims to identify the degree of influence of those factors on students' engagement in virtual classrooms from the perspectives of instructors and students and explore the difference between those two perspectives. The study also aims to measure the satisfaction of instructors and students and explore the impact of the studied engagement factors on their perceived satisfaction level.

Research Questions

1. What factors do instructors and students perceive as most influencing students' engagement in virtual classrooms? And is there a difference between instructors and students' perceptions?
2. How satisfied are instructors and students with the virtual classroom teaching and learning experience compared to the F2F experience? And is there a difference between their satisfaction levels?
3. What is the relation between the factors influencing students' engagement and the satisfaction of instructors and students toward teaching and learning in virtual classrooms?

2 Methodologies

A quantitative descriptive research design has been used for the purpose of this study. Moreover, a self-reported survey was used to collect primary data. The engagement factors identified in the literature review were grouped into a self-reported questionnaire with 30 items having a Likert scale ranging from 5 (strongly agree) to 1 (strongly disagree). A single 5-point Likert scale item ranging from 5 (very satisfied) to 1 (very dissatisfied) was used to identify the degree of satisfaction on the learning experience in the virtual classrooms based on the instructors' and students' perspectives.

The instrument was content validated by a jury of expert faculty members. To establish its internal consistency, the questionnaire was test-piloted on 25 students and 25 instructors from outside the main sample. Corrected item-total correlations between items and their factors varied between 0.48 and 0.74. Cronbach α was calculated for the pilot data to establish the reliability of the factors questionnaire, all reliability coefficients was satisfactory ranging from 0.83 to 0.89.

The survey was carried out online and administered via

Microsoft forms. It was completed by 382 instructors and students at Saudi universities.

The majority of the participants were (71.5%) students at both undergraduate and postgraduate levels. They were predominantly consisted of female (79.8%) students and instructors, who study or taught in various disciplines of humanities (78.3%). Moreover, they came from different universities located at different regions of the country. The total percentage coming from the middle region was (57.6%), whereas it was (29.3%) from the western region. Both regions represent the largest groups among study participants as illustrated in Table 1.

Table 1: Demographic characteristics of the participants.

Demographic		n	%
Role	Student	273	71.5%
	Instructor	109	28.5%
Gender	Female	305	79.8%
	Male	77	20.2%
Disciplines	Humanities	299	78.3%
	Scientific	83	21.7%
University Region	Middle	220	57.6%
	West	112	29.3%
	Other	50	13.1%

3 Results

To analyze the data, IBM SPSS 25.0 statistical package was used. Instructors and students' perceptions were described in terms of means and standard deviations, and compared using independent sample t-test. Correlation coefficient was employed to study the relationship between instructors and students' satisfaction level and their perception on the impact of the factors influencing students' engagement in virtual classrooms. Finally, to determine the simultaneous effect of the students' engagement influencing factors perceptions on satisfaction level, a multiple regression analysis was used with satisfaction level as independent variable, and perceptions on the impact of the factors influencing students' engagement as dependent variables.

Instructors and students' perceptions on the impact of the factors influencing students' engagement:

1- Technical Factors

The results showed a high level of agreement on the impact of technical factors on students' engagement among both instructors and students (Table 2). Instructors had a significantly higher mean score for the impact of "insufficient students training on using virtual classroom interface" (item 3) and "lack of the devices and equipment" (item 4) on students' engagement in virtual classrooms. Both instructors and students agreed that "high traffic on the internet connection" (item 1) has the highest impact on students' engagement, while they placed their level of "training on using virtual classroom" as the lowest factor to influence students' engagement (items 2, and 3).

Table 2: Instructors and students' perceptions of the impact of technical factors on students' engagement.

Technical factors	Instructors		Students		t	Sig.
	Mean	SD	Mean	SD		
1. High traffic on the internet connection affects virtual classrooms accessibility	3.3	1.2	3.5	1.0	-1.16	0.25

2. Insufficient training of instructors on using virtual classrooms interface	2.5	1.2	2.8	1.3	-1.65	0.10
3. Insufficient training of students on using virtual classrooms interface	3.2	1.1	2.5	1.3	5.11 *	<0.001
4. Lack of devices and equipment required for accessing virtual classrooms	2.9	1.3	2.6	1.3	2.19 *	0.03
5. Frequent technical failures in devices running virtual classroom platform	3.3	1.2	3.4	1.3	-0.70	0.48
6. Frequent technical failures in virtual classroom platform	3.2	1.2	3.4	1.2	-1.84	0.07

* Statistically significant difference at 0.05 level.

2- Learning Experience Design Factors

With regard to the impact of learning experience design factors, the results revealed that instructors had significantly higher mean scores for 7 out of 8 items compared to students (Table 3). From instructors' perspective “receiving immediate feedback from instructor on performance during the session” (item 13) had the highest impact on students' engagement in virtual

classroom, while “using poll tool to check understanding of presented information” (item 12) had the lowest impact. Both instructors and students agreed about the impact of “supportive multimedia” (item 9), “setting participation rules to ensure respect of all opinions” (item 11), and “using additional teaching methods beyond lecturing” (item 8). Students placed “supportive multimedia” (item 9), and “starting with an engaging activity” (item 7) as the highest and lowest factor affecting their engagement in virtual classrooms, respectively.

Table 3: Instructors and students' perceptions of the impact of learning experience design factors on students' engagement.

Learning experience design factors	Instructors		Students		t	Sig.
	Mean	SD	Mean	SD		
7. Starting with an engaging activity to draw attention and boost motivation	3.8	1.0	2.9	1.3	7.76 *	<0.001
8. Using additional methods beyond lecturing, such as discussion	4.3	0.8	3.6	1.2	6.65 *	<0.001
9. Using supportive multimedia (videos, pictures) to facilitate deep understanding of content	4.2	0.9	3.8	1.2	3.58 *	<0.001
10. Using virtual classroom interactive tools (polls, whiteboard, breakout rooms) to enhance interaction	3.6	1.1	3.0	1.4	4.26 *	<0.001
11. Setting participation rules to ensure respect of all opinions	4.1	0.9	3.7	1.3	3.58 *	<0.001
12. Using the polling tool (virtual classrooms interactive tool) to check understanding of presented information	3.4	1.2	3.2	1.5	1.82	0.07
13. Receiving immediate feedback from the instructor on performance during the session	4.4	0.8	3.4	1.4	8.88 *	<0.001
14. Meeting different educational needs, including those of students with special needs	3.8	1.3	3.3	1.5	2.84 *	0.01

* Statistically significant difference at 0.05 level

3- Psychological Factors:

The results showed no significant differences between instructors and students' perceptions on the impact of psychological factors except for three items (Table 4). Instructors had significantly higher mean score for “feeling shy and stressed due to recording virtual classrooms sessions” (item 21), and “fear of acquiring diseases that may affect concentration during sessions” (item 20), while students score significantly higher on “stress due to lack of confidence in technical capabilities to learn via virtual classrooms” (item 18).

Both instructors and students agreed that “stress due to lack of confidence in the evaluation methods” (item 22), and “stress due to lack of confidence in communication methods” (item 17) has the highest impact on students' engagement. However, they disagree about the factor with the lowest impact; as instructors see that “stress due to lack of confidence in technical capabilities to teach via virtual classrooms” (item 18) has the lowest impact, while students see that “stress due to recording virtual classrooms sessions” (item 21) has the lowest impact on their engagement.

Table 4. Instructors and students' perceptions of the impact of psychological design factors on students' engagement.

Psychological factors	Instructors		Students		t	Sig.
	Mean	SD	Mean	SD		
15. Feeling stressed due to fear of security problems on some virtual classrooms platforms	3.1	0.6	3.0	0.6	0.76	0.45
16. Feeling stressed due to lack of confidence in virtual teaching or learning method	3.1	0.6	2.9	1.5	1.43	0.15
17. Feeling stressed due to lack of confidence in the virtual classroom communication methods	3.2	1.2	3.1	1.5	0.34	0.73
18. Feeling stressed due to lack of confidence in technical capabilities to teach or learn via virtual classrooms	2.5	1.2	2.8	1.4	-2.30 *	0.02
19. Feeling lonely because of social isolation and physical separation inherent in virtual classrooms	3.1	1.2	3.0	1.5	0.48	0.63
20. Feeling afraid of acquiring diseases that may affect concentration during sessions	2.8	1.2	2.5	1.4	2.20 *	0.03
21. Feeling shy and stressed due to recording virtual classroom sessions	2.7	1.2	2.1	1.3	3.58 *	<0.001
22. Feeling stressed due to lack of confidence in the evaluation methods of virtual classrooms	3.2	1.2	3.1	1.6	0.57	0.57

* Statistically significant difference at 0.05 level

4- Behavioral Factors Related to Virtual Classroom Management:

Results revealed that instructors had significantly higher mean scores for all behavioral Factors compared to students (Table 5). From instructors' perspective “varies voice pitch and tone during the virtual lecture” (item 24) has the highest impact on students' engagement, while “using annotation tools” (item 25) has the lowest impact.

Students placed “continuously tracking feedback and questions in the chat area” (item 30) as the highest factor to affect their engagement, while they see that “using annotation tools”, “using instant feedback tool”, and “Instructor interacts with students every three to five minutes throughout the session” (items 25, 26, and 27) has the lowest impact on their engagement in virtual classrooms.

Table 5. Instructors and students' perceptions of the impact of behavioral design factors on students' engagement.

Behavioral factors	Instructors		Students		t	Sig.
	Mean	SD	Mean	SD		
23. The instructor greets all students at the start of session and calls students by name throughout session	4.2	1.0	3.7	1.3	4.42 *	<0.001
24. The instructor varies voice pitch and tone during the virtual lecture	4.3	1.1	3.7	1.3	4.60 *	<0.001
25. The instructor uses annotation tools to highlight important information or comment on presented content	3.7	1.1	3.4	1.4	2.33 *	0.02
26. The instructor uses the instant feedback tool to track students' reactions to content	4.0	1.1	3.4	1.4	4.60 *	<0.001
27. The instructor interacts with students every three to five minutes throughout the session	4.0	1.1	3.4	1.3	4.57 *	<0.001
28. The instructor gives students sufficient time to respond or discuss	4.1	1.1	3.8	1.2	3.08 *	<0.001
29. The instructor organizes and manages verbal discussions during class to limit disruptions and interruptions	4.1	1.1	3.6	1.3	3.41 *	<0.001
30. The instructor continuously tracks students' feedback and questions in the chat area	4.1	1.1	3.9	1.2	2.21 *	0.03

* Statistically significant difference at 0.05 level

Contrast of instructors and students' satisfaction level and their perceptions on the impact of the factors influencing students' engagement:

In general, the results indicate low impact on students' engagement for the psychological factors compared to moderate impact for behavioral factors, learning experience design factors, and technical factors (Table 6). There was consensus among both instructors and students regarding the order of the factors influencing students' engagement according to their impact. Behavioral factors were placed as the highest factors to impact students' engagement in virtual

classrooms followed by learning experience design factors, technical factors, and finally psychological factors as the lowest factor to impact students' engagement (Figure 1). However, the results revealed significantly higher impact for behavioral factors and learning experience design factors from instructors' perspective compared to students. In addition, the results established a moderate level of satisfaction with the virtual classroom learning experience. Nevertheless, the instructors showed significantly higher satisfaction level compared to students.

Table 6: Contrast between instructors and students' perceptions.

	Overall		Instructors		Students		T	Sig.
	Mean	SD	Mean	SD	Mean	SD		
Behavioral factors	3.73	0.93	4.07	0.83	3.60	0.94	4.81*	<0.001
Learning experience design factors	3.52	0.92	3.94	0.64	3.35	0.97	7.07*	<0.001
Technical factors	3.04	0.94	3.08	0.96	3.03	0.93	0.50	0.654

Psychological factors	2.85	0.88		2.93	0.73		2.82	0.93	1.28	0.201
Satisfaction level	3.14	1.10		3.44	1.08		3.02	1.09	3.40*	0.001

* Statistically significant difference at 0.05 level

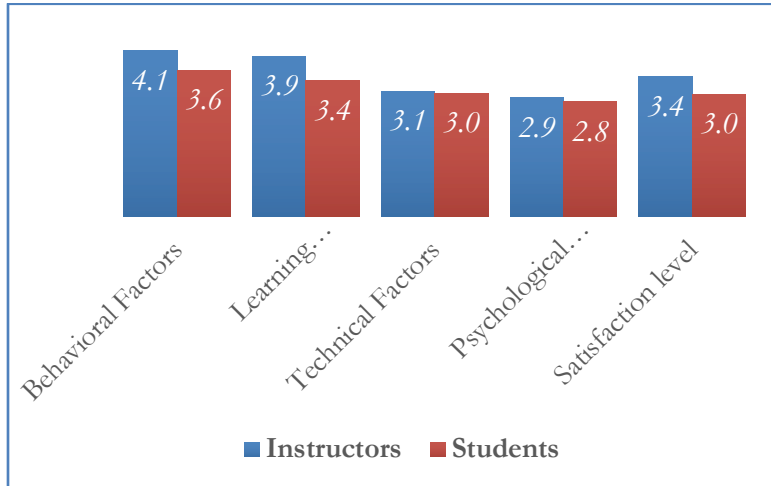


Fig.1: Contrast between instructors and students' perceptions.

Association between instructors and students' satisfaction level and their perceptions toward the impact of the factors most influencing students' engagement:

As it was expected, the results of correlation coefficients in Table (7), showed negative correlation between participants' perceptions on the impact of the technical factors, and the psychological factors and their satisfaction level, where as their perceptions on the impact of learning experience design factors, and behavioral factors were positively correlated with their satisfaction level. All the correlation coefficients were statistically significant at 0.05 level, strongest association to satisfaction level were found

with psychological factors (-0.44), followed by behavioral factors (0.4), technical factors (-0.39), and the weakest association with learning experience design factors (0.3).

Among students, similar results emerged as we found that the psychological factors has the strongest association to satisfaction level (-0.51), while the other factors has the same degree of association (± 0.34). However, the results showed that instructors' satisfaction level has a significant correlation with all the factors except for learning experience design factors. The strongest association was found between satisfaction level and the technical factor (-0.55), while the weakest association with psychological factor (-0.35).

Table 7: Correlation coefficient between satisfaction level and students' engagement factors.

	Instructors	Students	Overall
Technical factors	-0.55 *	-0.34 *	-0.39 *
Learning experience design factors	0.08	0.34 *	0.30 *
Psychological factor	-0.35 *	-0.51 *	-0.44 *
Behavioral factors	0.48 *	0.34 *	0.40 *

* Statistically significant at 0.01 level

To determine the simultaneous relationship between satisfaction level and the perceptions on the factors influencing student engagement, a multiple linear regression was employed. Table (8) presents the summary of the regression analysis for the whole sample of instructors, and students. In the whole sample, all standardized coefficient were significant, indicating that participants' perceptions on the impact of the factors influencing students' engagement significantly affect their satisfaction level. The psychological factors had the highest impact on satisfaction level (-0.29), followed by the

behavioral factors (0.24), then technical factors (-0.19) and learning experience design factors (0.18).

Among students, the results showed that their perceptions toward the impact of the factors influencing engagement have a significant impact on satisfaction level except for the technical factors. The psychological factors had the highest impact on satisfaction level (-0.40), followed by the behavioral factor (0.19), and learning experience design factor (-0.17). On the other hand, the results showed that instructors' satisfaction level is significantly affected by only technical factor (-0.41), and behavioral factor (0.31).

Table 8: Summary of the regression analysis.

Factors	Instructors		Student		Overall	
	β	Sig.	β	Sig.	β	Sig.
Technical factor	-0.41 *	<0.001	-0.08	0.175	-0.19 *	<0.001
Learning Experience Design factor	0.07	0.357	0.17 *	0.003	0.18 *	<0.001
Psychological factor	-0.14	0.11	-0.40 *	<0.001	-0.29 *	<0.001
Behavioral factor	0.31 *	<0.001	0.19 *	0.001	0.24 *	<0.001

β : Standardized regression coefficient

* Statistically significant at 0.01 level

4 Discussions

The main objective of the study was to explore the factors that might influence students' engagement in virtual classroom from the perspective of both students and instructors. Our findings showed consensus among both instructors and students regarding the order of the factors influencing students' engagement according to their impact. Both students and instructors identify the behavioral factors as the highest factors impacting students' engagement in virtual classrooms followed by learning experience design factors, technical factors, and finally psychological factors as the lowest factor to impact students' engagement.

Our findings showed no significant differences between students and instructors perspectives, regarding the degree to which both technical and psychological factors affect students' engagement. However, the results established a significantly higher impact on students' engagement for behavioral factors and learning experience design factors among instructors. This concludes that instructors and students evaluated predominantly different factors that can affect students' engagement in virtual classrooms, perhaps because instructors and students play different roles and have different objectives and therefore perceive the factors differently based on their personal interests and objectives. Among the psychological factors, findings from this study showed that students and instructors rated stress due to lack

of confidence in the virtual classroom security and communication methods as the strongest factor impacting students' engagement. This may be related to the hacking incidences that happened in Zoom early 2020 (Zoom bombing) when hackers were able to break the privacy and security of the platform and login into running sessions with anonymous identities showing pornographic or hate materials (Ling, Balci, Blackburn, & Stringhini, 2021). These incidences may have created a negative attitude in students toward the security capabilities of some virtual classrooms.

With respect to technical factors, the findings suggest that internet connection, and technical failures in either the devices running virtual classroom platform or the platform itself as the strongest factor impacting students' engagement. After the outbreak of COVID-19, students were abruptly transferred to virtual learning and due to that sudden change not much preparation and adaptation on the technical capacity were done to accommodate the sudden increased demand. For example, some students lacked the needed devices required or lacked the internet connection or speed needed for successful connection. Also, the technical specifications of the platforms were not ready to accommodate and serve the huge number of users at a same time. All of those challenges were reported and may have affected smooth learning and teaching (Busto, Dumbser, & Gaburro, 2021).

The highest learning experience design factors influencing student engagement according to both students and instructors was receiving immediate feedback from instructor on performance, using additional teaching methods, and using supportive multimedia during the session. Satisfying those factors through applying thoughtful instructional design guidelines can create cognitively supportive and socially dynamic learning environment that can compensate for the lack of f2f physical presence. According to the community of inquiry model social, teaching, and cognitive presences are imperative elements for the success of online learning (Bektashi, 2018). The results of this study stress the importance of feedback among students and instructors in virtual classrooms. Lima et al. (2020) found that skills, emotions, participation, and performance are critical elements of feedback that inform teachers about student engagement in virtual classrooms, and the current study recognizes these as secondary factors affecting engagement.

Among behavioral factors, varying voice pitch and greeting students has the highest impact on students' engagement from instructors' perspective. On the other hand, from students' perspective, continuously tracking their feedback and questions in the chat area by the instructor, and getting sufficient time to respond or discuss were identified as the highest factors affecting their engagement in virtual classrooms. All those factors and more have long been regarded in the literature as important antecedents for drawing and maintaining students' attention and increasing engagement especially in an isolated online learning environment like the virtual classroom (Arbaugh, 2001). However, what is interesting in this result is the difference in perception between the instructors and students. The instructors thought that their lecturing skill (varying voice pitch and greeting students) can save the day in a virtual classroom much as it usually does in a f2f classroom. On the other hand, students were in doubt of their learning and; therefore, were longing for acknowledgement and assurance of correct knowledge acquisition which were expressed in their continuous demand for feedback. This result may be explained by the increased loneliness feeling in students caused by the learning medium which instructors seem to be not aware of.

In addition to investigating the factors that influence student engagement, the current study aimed to study the relationship between these factors and instructors and students' satisfaction toward teaching and learning in virtual classrooms. Our findings suggest an overall moderate level of satisfaction with the virtual classroom learning experience, however, instructors showed significantly higher satisfaction level compared to students. This relatively average satisfaction result was exhibited in other studies that measured satisfaction of the virtual teaching and learning experience following the COVID-19 outbreak (Yekefallah, Namdar, Panahi, & Dehghankar, 2021), and it

may be related to the abrupt use of the virtual classroom without much planning and preparation. The difference in this study, however, is the varying perceptions of instructors and students. Instructors seem to be more satisfied than students and this may also be explained by their unawareness of the emotional and social struggles students are going through during this abrupt change in learning.

Regarding the relationship between the engagement factors and satisfaction, a negative relationship was found between students and instructors' perceptions on the impact of technical factor, and psychological factor, whereas a positive relationship was found with the learning experience design factor, and behavioral factor. This specific result was expected because of the different nature of the factors. An increase in the concerns related to the psychological and technical factors can lead to a decrease in instructors and students' satisfaction. However, an increase in the issues related to the design of the virtual class learning experience and to the management behaviors of the instructor can lead to an increase in instructor and student satisfaction.

When examining the difference between instructors and students' perceptions and their relationship to satisfaction, it was found that students' perceptions on the impact of all factors has a significant impact on their satisfaction level except for the technical factors. In specific, the psychological factors had the highest impact on satisfaction level, followed by the behavioral factor, and learning experience design factor. The relatively high effect of the psychological factors shows the importance of the psychological wellbeing of students and its impact on satisfaction, and consequently their acceptance of the learning medium. On the other side, the results showed that instructors' satisfaction level is significantly affected by only the technical factor, and the behavioral factor. This raised another important finding that is how satisfaction can be impacted by different factors other than the factors that impact engagement. We've seen in this research that instructors and students' perspectives of engagement were mostly affected by the learning experience design factors and classroom management behavioral factors; however, students' satisfaction was mostly impacted by the psychological factors, whereas for instructors it was impacted mostly by the technical factors. This may highlight the fact that satisfaction is strongly related to the psychological wellbeing of a person. If a person feels threatened as the case of instructors being threatened by the instability of the technical aspect of the teaching medium and students feel threatened by the insecurity of the learning mode, this may greatly affect their satisfaction level even if all other factors were met.

In general, the results support the analyzed literature. For instance, the results partially confirm the findings of Barua et al. (2020), who investigated internal and external factors affecting student engagement, including attitude,

motivation, and self-confidence. The results confirm the findings of Baker et al. (2016) and Farrell and Brunton (2020), who found that poor lesson design, improper instructional materials, and lack of instructional effort could impede engagement in virtual classrooms. This study also supports the claims of Martin and Bolliger (2018) that instructor-student interaction in virtual classrooms is critical for engagement. The current research shows that students are more engaged when they can interact with peers and instructors by using their experiences and learning behavioral patterns, which is also recognized by Dixson et al. (2017), who claimed that nonverbal behaviors improve virtual learning.

Interaction with classmates and instructors is critical for engaging learners in virtual classrooms. Thus, this study supports the findings of Berry (2019) and Ngoyi et al. (2014), who insisted that students require a sense of community and collaboration in virtual classrooms. In the current research, students show that they value interaction with and feedback from instructors, as well as having a learning environment that helps them to communicate (Berry 2019; Gedera et al. 2015; Ngoyi et al. 2014; Young and Bruce 2011). Educators must understand the affordances of virtual classrooms and organize their lessons accordingly, which was reported by Martin et al. (2013), who revealed the significance of high-quality instructions in virtual classrooms.

This study has several limitations. First, the responses to the self-reported questionnaire could be biased. Second, the study did not analyze a specific type of virtual classroom, even though different virtual classrooms have different technical characteristics, designs, and user features. Thus, feedback from faculty and students reflects an array of virtual classrooms, some more effective than others, so the results may be less precise. Moreover, the study suggests factors that could affect the engagement of students in virtual classrooms, but may have omitted other important features that affect this process.

Future research in this area may encompass measuring engagement. Online teachers could measure students' engagement by analyzing login data, time spent online, views of learning modules, self-reported information from students, and reflections (Gray & DiLoreto, 2015). Regular assessment of students' engagement is critical for helping educators apply relevant practices in online classrooms and for removing barriers to students' engagement. Educators can survey students informally or formally and analyze the results in order to improve instruction for future students. Educators could assess engagement by exploring students' acquired skills, emotions, participation, and performance to recognize errors in their teaching methods (Lima et al., 2020). Virtual classrooms give teachers interactive tools (e.g., polls, breakout rooms, reactions, and chat) to formally and informally assess student engagement. Evaluating students' engagement in online learning gives educators the

control to oversee the course's efficacy and students' interest, motivation, and academic productivity.

5 Conclusions

The overall results show that engagement in virtual classrooms is affected more by behavioral, and learning-experience design factors, and less by technical psychological factors. The opinions of faculty and students sometimes differed and sometimes agreed. In general, engagement within virtual classrooms requires proper training, effective learning-experience design, and behavioral patterns for classroom management compared to those of traditional classrooms. Many students and educators accustomed to traditional classrooms first used virtual classrooms during the COVID-19 pandemic, and thus, experienced significant challenges. This study recognizes that engagement in virtual classrooms has both stimulating and impeding factors. Students appreciated when they could freely communicate with each other and with their instructors and when the instructor responds to their continuous need for acknowledgment through immediate feedback. Both students and instructors appreciated learning how to use virtual classrooms before actively engaging in them.

Educational institutions may implement virtual learning and technologies for different reasons. For example, a university implemented online virtual education programs to improve students' learning and interest and to enhance teaching quality (Martin et al., 2013). Students in a virtual classroom find it important to see and hear each other in real-time, generate immediate feedback, and support each other, which boosted their motivation and engagement in the activities (Gedera et al., 2015). Faculty may use virtual learning tools to encourage communication among students and enhance their engagement in the lesson (Gedera et al., 2015).

Overall, the study found that in some cases virtual classrooms could replace traditional learning, but they need to take into account relevant factors. First, learning in virtual classrooms has to be thoughtfully designed, and has to include features that allow everyone to interact freely. Technical glitches, ineffective learning-experience design, and poor classroom management could ruin the educational process. The ability for students to access virtual classrooms from home, communicate with peers and instructors, and participate in group-based assignments could stimulate engagement. Universities that use virtual classrooms should first train faculty to use them and invest in solid technical support to ensure timely accommodation of all faced obstacles.

I recommend analyzing the topic of engagement in virtual classrooms by focusing not only on perceptions of the faculty and students, but also on the instructional design models suitable for this medium and the related learning theories and principles required for its effective utilization.

Traditional and virtual education should be compared to determine whether virtual classrooms are as effective as traditional ones; an experimental design could reveal if virtual classrooms could replace traditional classrooms in the near future and in case of emergencies like the COVID-19 pandemic. Many universities have a rich history of teaching at a distance, and this precedent could be used to detect the advantages or disadvantages of virtual learning over traditional asynchronous online learning. During the current COVID-19 pandemic, comparing these two forms of education is imperative because of the major uncertainty about social interaction and public gatherings.

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