BREAKOUT WITH ZOOM: MIXED-METHODS RESEARCH EXAMINING PRESERVICE TEACHERS' PERCEPTIONS OF BREAKOUT ROOM INTERACTIONS

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ABSTRACT

Challenges to teacher education due to COVID-19 are widespread. Preservice teachers, in particular, have faced numerous obstacles as a result. While remote teaching became common in higher education, home-based videoconferencing became a standard means of teaching and learning. Regardless of COVID-19, virtual technologies use increases within post-secondary education, progressively impacting educational experiences. Therefore, educators must consider the benefits and drawbacks of virtual online education. From a constructivist perspective, we studied preservice teachers' interactions and perceptions of Zoom's videoconferencing platform. Specifically, we identified preservice teachers' interactions and responses to Zoom's Breakout Rooms. The findings indicate that students built relationships and valued their online interactions. Additionally, males and females valued different aspects of their online interactions.We conclude with recommendations regarding videoconferences in higher education and suggest future research, including empirical studies.

KEYWORDS

Videoconferencing, Online teaching and learning, Zoom, Teacher education, Gender differences.

1. INTRODUCTION

On March 11, 2020, the World Health Organization reported that the coronavirus disease 2019 (COVID-19) had become a pandemic. Soon after, in Canada, a quarter of all post-secondary students had some or all face-to-face courses postponed or canceled [1]. COVID-19 then triggered an outbreak of online learning.

COVID-19's impact on education took many forms [2, 3]. The Canadian university where this study took place transitioned all courses online. As a result, the teacher education course reported on here used Zoom's videoconferencing platform. Although these changes are interesting, the stimulus for the current examination occurred midway through the winter semester when the professor reorganized the Zoom Breakout Room student groups. After announcing that a change would soon happen, the students immediately protested: "No, don't change our groups!" and "These are our friends." Had these students, who had not physically met, created bonds in a virtual classroom?

Social isolation is often experienced by students who transition online due to COVID-19 [4]. Nevertheless, during our online course, we observed what appeared to be the development of friendships. This study was prompted by the dissonance between our expectations and these

students' experiences. We began to ask ourselves, what are students' perceptions of education via videoconferencing?

Long before COVID-19 was on the horizon, online learning had become the subject of extensive research (for an overview, see [5]). There were, for instance, studies on the impact of perceived support on course satisfaction and learning outcomes [6, 7], emotional reactions to online environments, institutional connections, and technology accessibility on learning outcomes [8]. In addition, studies looked at the online learning culture [9], the influence of physical location, technology, and online evaluation [10], as well as the implications for students from various socioeconomic backgrounds [11, 12]. These studies are only a small sample of a much larger body of work.

Before the COVID-19 pandemic, the number of online higher education courses increased dramatically[13]. Current trends suggest that the shift online will continue after the COVID-19 pandemic. Online courses are often designed to reflect in-person courses, possibly due to online teaching and learning being stigmatized as the weaker option when compared to traditional in-person face-to-face teaching [14, 15, 16]. Furthermore, some education scholars argue that replicating face-to-face courses online is a mistake. While some researchers are concerned about a digital divide [17], Arasaratnam-Smith and Northcote argue: "Rather than beginning with the assumption that face-to-face education is the prototype for quality... [we argue that] the online learning environment is a unique medium which, by its nature, necessitates unique communication, community-building, teaching and learning strategies" [18, p. 188].

With the increasing prevalence of online learning, 33% of post-secondary school administrators report that they will continue to provide remote and online course options [13]; clearly, examining online teaching and learning is vital for the operation of post-secondary schools.

The current study examines the perceptions of preservice students, specifically their perception of online interactions with instructors, classmates, and small groups of peers within an education course. This study is unique for it examines the impact of videoconferencing and the unique feature of Breakout Room, where small groups meet and interact.

Before describing the effects of Zoom's Breakout Rooms on this group of students, this paper addresses the theoretical context, what is meant by online teaching and learning, and the current study's technology-mediated learning environment. With this foundation, we then describe the mixed-method research methodology, analysis process, and investigation results.

2. THEORETICAL CONTEXT

In contrast to the assumptions that have dominated educational philosophy regarding teaching and learning, constructivist learning theory suggests that learners actively assemble meaning and understanding for themselves [19]. "Constructivism is an epistemology, a learning or meaning-making theory that offers an explanation of the nature of knowledge and how human beings learn" [20, p. 195]. In the 18th century, Giambattista Vico suggested that "'to know' means to know how to make" [21, p. 123]. That is, for humans to understand, they must create understanding.

Martín suggests that technological tools utilize fundamental sociocultural learning theories [22]. Other researchers who inform our work, such as O'Connor [23], advocate learning theories based on knowledge/understandings created by the collective (social constructivism) and knowledge/understanding developed within the individual (individual constructivism). These theoretical understandings highlight the importance of how education is distributed.

Educational research highlights the dilemma many educators face — the online application of the learning theories [24, 25] that bridge the theory-practice gap [27]. The authors of this study also seek to bridge this gap. We are committed to incorporating constructivist-oriented strategies into teaching [28]. In the following section, we examine online teaching and learning. Whether online or face-to-face, we believe a constructivist teaching perspective collides with the traditional teaching culture [29].

2.1. Online Teaching and Learning

To answer the research questions of this article, it is necessary to acknowledge past and present understandings of online teaching and learning. Many education researchers anticipated that a fully online teaching-learning relationship would emerge through technology [30, 31]. From the initial notion that the internet would eliminate traditional face-to-face education, a belief arose that physical and online courses could coexist.

Today, online teaching and learning is a subset of distance education encompassing technology-mediated learning (TML) processes such as computer-based learning, web-based learning, virtual classrooms, and digital collaborations [32]. Alavi and Leidner [33] define TML as "an environment in which the learner's interactions with learning materials (readings, assignments, exercises, etc.), peers, and instructors are mediated through advanced information technologies. "Today, online teaching and learning are integral components of higher education [34]; we want to emphasize that online education is purposeful learning, unlike casual web browsing or online gaming. Online students "need goals, usually ones provided by their teachers. Like their colleagues on campus, the e-moderators have to think through the design of structured learning experiences for their students. To exploit online for teaching, they must understand its potential, which is different from that of any other teaching medium" [35, p. 12].

Joia and Lorenzo [4] contend that online environments differ from face-to-face learning and argue that careful examination of course content and outcomes (teaching hard skills vs. soft skills) is required. For example, TML is widely regarded as a helpful tool for transmitting factual and procedural information[36]. Aligning course content and delivery is essential because "it is easier to move a hard skill course to a TML environment than a soft skill one, although soft skills courses seem to be more enjoyable in a TML setting for the students than hard skill ones" [4, p. 13]. Additionally, although online content delivery is possible, it is not always effective in promoting active learning [37]. Siragusa [38] suggests that courses using TML would benefit from technologies that encourage student communication and participation — such as dialogue, brainstorming, problem-solving, collaboration, and reflection — to improve higher-order reasoning skills and conceptual understanding. Finally, "without social interaction, an online course feels more like an interactive book than a classroom" [39, ¶ 4].

Videoconferencing technology, the TML tool examined in this paper, is not new, having emerged over the last fifty years due to the amount of communication that is visual and nonverbal [40]. Videoconferencing refers to various situations, from live video lectures for large audiences to point-to-point individual-to-individual chats [41].

Videoconferencing is frequently promoted as connecting inaccessible student populations [42]. Trademarked software, including Skype, Zoom, Google Meet, Webex, MS Teams, and even Whatsapp, are videoconferencing platforms popular both outside the field of education and within it. According to a study on blended synchronous course design, students like the flexibility and convenience of attending lessons via videoconferencing [43]. During the COVID-19 pandemic, Zoom was the most popular platform for teaching online classes [44].

Our study examined students' perceptions of their interactions, focusing on Zoom Breakout Rooms. This videoconferencing software supported our pedagogical goal of incorporating constructivist-orientated teaching practices into the course. For example, Zoom facilitates knowledge construction through a dialectic process in which students test and negotiate their constructed views with others.

2.2. Zoom: The virtual tool used in the current study

When creating the educational course examined in this study, we decided to use a videoconferencing service that allows users to communicate with others online in real-time (using a computer, tablet, or mobile device). This choice was essential, for as Rahayu [34] notes, synchronous learning provides a method that improves human interaction during online learning. Zoom's platform is a web-based videoconferencing network that enables users to communicate and interact over the internet. Session recording, screen sharing with annotation capabilities, Breakout Rooms, polling options, and audio and video feeds are just a few of the features and functions available.

Although no videoconferencing program is flawless, educators have rapidly adopted Zoom as a valuable tool in education. It is simple to use, dependable, and allows faculty to concentrate their efforts on building relationships with their students, developing innovative ways to demonstrate the relevance of content, and motivating students to do their best work [39].

Zoom's functions support a constructivist perspective of knowledge creation. For example, within Zoom, instructors can create Breakout Rooms for small group discussions, and participants may share screens and annotate a group whiteboard. Álvarez [45] illustrates the flexibility of Zoom by using Breakout Rooms in his seminary course to encourage collegiality between on-campus and online students, thereby facilitating engagement with one another. Álvarez concluded that using Breakout Rooms allowed the students to initiate "more in-depth conversations than they had before" [45, p. 113].

3. RESEARCH QUESTIONS

The present study utilizes many of the concepts addressed above. Against this backdrop, our research examines the efficacy of a videoconferencing tool. We examine student interactions and perceptions during an online teacher education course as we sought to answer the following research questions:

1. What interactions do preservice teachers experience in Zoom's Breakout Rooms?
2. What are preservice teachers' perceptions of their interactions in Zoom's Breakout Rooms?

The rest of this paper is organized as follows. First, we will describe the study design, including methodology, data collection, and analysis. The findings, discussion, and conclusions then follow. Finally, we discuss the implications for educators and future researchers interested in online education.

4. RESEARCH DESIGN AND METHODOLOGY

This research examines a videoconferencing tool's impact on preservice teachers' interactions and perceptions during an online teacher education course. Using a mixed-methods exploratory

sequential design [46, 47, 48], we investigate experiences within Zoom's synchronous Breakout Rooms.

Exploratory sequential mixed-methods design starts with qualitative exploratory data collection and analysis. Next, the data from the qualitative phase is used to develop a quantitative instrument, which is distributed to participants [46]. Often, mixed-methods exploratory sequential design concludes with data analysis and interpretation from the quantitative phase. Fortunately, we conducted three interviews of students that attended the online course yet were housed on campus (see their comments in the discussion section).

As shown in Figure 1, Phase 1 of our research included collecting and analyzing qualitative data (lived experience) from digital recordings. In Phase 2, we developed and administered a questionnaire. This instrument collected quantitative data (student perceptions) to refine and broaden the understandings developed from the qualitative findings.

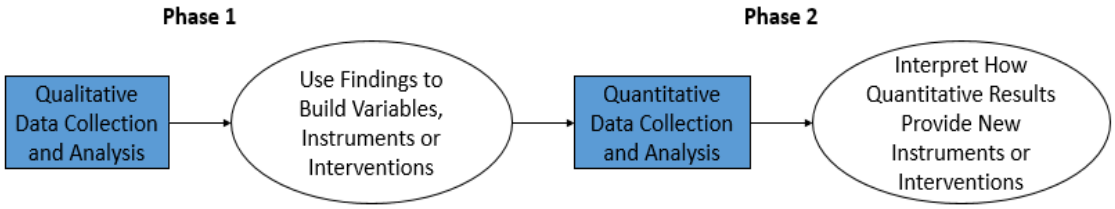

Figure 1. Exploratory Sequential Mixed-Methods Design.

This figure is an amalgamation of Creswell's [46] and Harrison & Creswell's [48] examples. Creswell argues that this mixed-methods design is appropriate when "first gathering qualitative data to explore a phenomenon, and then collecting quantitative data to explain relationships found in the qualitative data" [46, p. 543]; Harrison and Creswell [48] emphasize that rigorous mixed-methods researchers not only collect and analyze qualitative and quantitative data, they also demonstrate the integration of the two data strands, and explain why mixed- methods analysis was chosen.

Because of the complexity of human behavior, education researchers are often required to consider activities in both breadth and depth, a challenge for which mixed-methods study is particularly well suited. One benefit of the exploratory sequential design is that the survey questions are grounded in the data collected from participants. We observed participants then created the survey rather than addressing the subject with a predetermined collection of questions. The integration, or mixing, of qualitative and quantitative data, is the cornerstone of mixed-methods research.

4.1. Setting and Participants

In a small Western Canadian university, twenty-six preservice teachers in a third-year curriculum and instruction mathematics course participated in this study. The consenting students' ages ranged from 19 to 40 years old. All participants accessing the virtual classroom via Zoom resided within Canada.

The education course introduces preservice teachers to the knowledge, skills, and attributes required for teaching elementary mathematics. This course includes examining and applying contemporary pedagogical principles and methods applicable for effective mathematics instruction. Micro-teaching, in-class activities, and field experiences are part of the course.

The study period consisted of one semester, or 26 virtual sessions of 80 minutes each (class recording is standard for online courses at this university). Three classes included no breakout room activities. The questionnaire was distributed to the students after final grade submission at the end of the course.

4.2. Data Collection and Analysis Processes

Data collection began with an examination of all recorded Zoom sessions. Each video recording began 15 minutes before and up to 20 minutes after the 80-minute scheduled class period. Analysis of the qualitative data focused on the identification and categorization of interactions. Representative and significant quotes from students were noted. The categorizations and excerpts were then used to develop a post-course questionnaire consisting of 28 closed-response items using a Likert-like scale and two open-response items. The questionnaire was distributed to the participants via Survey Monkey®. The purpose of the questionnaire was the examination of students' perceptions of their online experience.

4.3. Phase 1: Qualitative Data Collection and Analysis (Source - Zoom Recordings)

Phase 1 of data collection and analysis aimed to answer Research Question 1: What interactions do preservice teachers experience in Zoom's Breakout Rooms?

We began with the aspects of student interactions that Northrup [49] identified. Northrup observedforms of interactions that students perceive as significant for online learning, including content interactions, conversation and collaboration, intrapersonal/metacognitive skills, and the need for support. After examining three online class recordings, we identified four types of engagement that we then used to examine all class recordings. These included content interaction (classroom lectures and student contributions), casual conversation (small talk before the lesson and during lessons), collaboration (peer and instructor discussions and feedback), and support requests (between students orbetween students and professor). See Table 1 for an example of this data.

Table 1. Example of Phase 1 data: Observational data from video recordings

Date & time of recording	Code	Example
2-4-2021 0:25-3:50 mins	Casual Conversation	Conversations between the educator and students before class began. This continued into the class period.
2-4-2021 3:55 - 5:30 mins	Collaboration	Students worked together to identify types of resources and the location of resources.
2-4-2021 5:30 – 5:45 mins	Request for Support	Students requested help regarding access to Breakout Rooms (how to join their peers in their assigned groups).
2-4-2021 22:20-34:25 mins	Request for Support &Collaboration	The prof. moved between Breakout Rooms, addressing specific questions regarding Breakout Room tools. Studentsworked collaboratively to manage their group assignments.

Note. Each interaction was recorded and coded. Table 1 displays one example per code. Questions asked and responded to by students were also noted. Nevertheless, only significant interactions — that is, interactions lasting more than 30 seconds — were analyzed.

4.4. Phase 2: Quantitative Data Collection and Analysis (Source - Questionnaire)

Phase 2 of data collection and analysis sought to answer Research Question 2. We sought to uncover the preservice teachers' perceptions of their general online interactions and, specifically, ofthe Breakout Rooms.The questionnaire is structured to identify student perceptions of three types of communication within and outside of Breakout Rooms: 1) general communication between students and professor, 2) general communication among students, and 3) communication within the Breakout Rooms. Also, based on the analysis of the video recordings, we sought student perceptions comparing face-to-face and online communication (see Table 3 for questionnaire results).

5. FINDINGS

Research Question 1: What interactions do preservice teachers experience in Zoom's Breakout Rooms?

Four types of interactions emerged from the video data captured within Breakout Rooms. These interactions included content interaction, casual conversations, and collaborations. Significant requests for technical support were also noted.

Table 2. Total interactions coded from video recordings

	Content interactions	Casual conversations	Collaboration	Requests for support	Total interactions in Breakout Rooms
Total interactions	36	91	56	32	215
Average per class	1.57	3.96	2.43	1.39	9.35

Note. Zoom records the host's video feed, and therefore interactions examined occurred when the host/professor was present in the Breakout Room. Twenty-three classes included Breakout Room recordings (see table 1 for examples of coded incidences).

Casual conversations were by far the most recorded interaction. Based on the data gathered, the majority of these interactions were educator-to-student rather than student-to-student. After noting the high number of student-to-teacher interactions, one preservice teacher (Student 1) clarified the predominance of educator-to-student conversations in Breakout Rooms. He explained that conversational topics changed when the professor entered the Breakout Room. Thus, the recordings show more on-topic Breakout Room interactions than what presumably occurred without the professor.

After causal conversations, the predominant form of interaction noted in the video data was collaborations. We defined collaborations as interactions where peers and/or the educator worked together to improve a product by providing feedback. In the Breakout Rooms, these interactions primarily occurred when the students demonstrated their lesson plans, followed by peer and

professor feedback. There were also occasions when the professor asked for input from the students. This type of interaction occasionally led to a discussion of class content.

Content Interaction is the third frequent Breakout Room interaction. These interactions, led by the professor, involved planned activities directly connected to a learning outcome beyond the collaboration involved in creating a shared product. The vast majority of this type of interaction occurred through discussion. The professor posed a logical or philosophical question to stimulate the examination of opinions or reasoning.

Lastly, Requests for Support were the least frequent. Rarely did the students or professor ask for help on an issue requiring more than a minute to address. Based on the data, around two-thirds of these interactions were students clarifying class content, while the remaining third resolved technical issues.

Research Question 2: What are preservice teachers' perceptions of interactions in Zoom's Breakout Rooms?

Analysis of the data suggests that the students' perceptions varied based on the type of communication. Table 3 contains the aggregated responses regarding perceived communication between students and the professor, between students, and within Breakout Rooms. We also asked students to compare face-to-face and online communication.

Table 3. Responses from the questionnaire (Aggregated percentages)

Statements	**SD**	**D**	**N**	**A**	**SA**
Participants' perception of overall communication between themselves and the professor					
Q1. In Zoom, I had an opportunity to ask and respond to questions from my professor.	0.00	0.00	0.00	57.9	42.1
Q2. In Zoom, I could easily communicate with my professor in spoken conversation.	0.00	21.1	5.26	42.1	31.6
Q3. In Zoom, my professor provided me with comments on my learning progress.	0.00	15.8	5.26	52.6	26.3
Q4. In Zoom, I was able to comprehend the lessons.	0.00	5.26	15.8	63.2	15.8
Q5. In Zoom, I communicated with my professor the same way I would in a face-to-face meeting.	10.5	36.8	15.8	21.1	15.8
Q6. Compared to Zoom, access to lessons and materials is more manageable and better in face-to-face learning.	0.00	15.8	31.6	10.5	42.1
Q7. In Zoom, I could readily communicate with my professor via written correspondence.	0.00	5.26	5.26	42.1	47.4
Q8. Face-to-face meetings allow me to converse and discuss lessons with my instructor more efficiently and effectively than online meetings.	0.00	5.26	31.6	42.1	21.1
Q9. I felt like my contributions in my Zoom class(es) mattered.	0.00	5.26	31.6	47.4	15.8

Q10. There were few technological difficulties, and if there were, the problems did not interfere with my understanding of material or professor.	0.00	10.5	21.1	57.9	10.5
Participants' perception of overall communication between classmates					
Q11. Before the lessons began, I had a quick chat with my classmates.	5.3	42.1	10.5	42.1	0.00
Q12. Zoom interactions allowed me to develop my teaching skills.	0.00	15.9	26.3	31.6	26.3
Q13. In this online course, I communicated with my classmates in the same way I would in a face-to-face meeting.	26.3	47.4	21.1	5.26	0.00
Q14. Face-to-face meetings allow me to converse and discuss lessons with my peers more efficiently and effectively than online meetings.	0.00	5.26	15.8	47.4	31.6
Q15. I was able to build friendships with classmates during this online course.	5.26	26.3	21.1	36.8	10.5
Q16. I felt a connection to my peers despite the interaction occurring online.	0.00	15.8	26.3	47.4	10.5
Q17. I am more comfortable in face-to-face meetings than I am with Zoom interactions.	0.00	15.8	47.4	21.1	15.8
Q18. I find using text chat to be more comfortable than using video and voice chat.	5.26	47.4	10.5	31.6	5.26
Participants' perception of communication between peers within Breakout Rooms					
Q19. In Zoom Breakout Rooms, I could easily converse with my classmates.	0.00	5.3	10.5	52.6	31.6
Q20. I was comfortable meeting with my peers in Breakout Rooms.	0.00	15.8	0.00	57.9	26.3
Q21. I regularly engaged with my peers in our Breakout Rooms.	0.00	5.3	5.26	52.6	36.8
Q22. I believe the time spent with my peers using Breakout Rooms was valuable.	0.00	0.00	0.00	73.7	26.3
Q23. I find using video and voice chat is more effective than just using text chat.	0.00	10.5	42.1	10.5	36.8
Q24. I believe Zoom is an excellent alternative to face-to-face meetings	0.00	10.5	47.4	31.6	10.5
Q25. I collaborated with my classmates by doing group work in Breakout Rooms.	0.00	15.9	0.00	52.6	31.6

Q26. I participated in lessons that used Zoom's whiteboard/shared screen.	0.00	5.3	15.8	42.1	36.8
Q27. During the Breakout Room conversations, my classmates and I discussed aspects of teaching practices.	0.00	0.00	0.00	68.4	31.6
Q28. I became effective using Zoom's Breakout Rooms.	0.00	10.5	5.3	57.9	26.3

Note. The data presented in Table 3 is rounded to the nearest tenth (SA=Strongly disagree, A=Agree, N=Neutral, D=Disagree, and SD=Strongly disagree).

Table 3 shows that these preservice teachers felt they could "easily" communicate verbally and via written correspondence with the professor. Nevertheless, most respondents indicated that face-to-face meetings facilitate more efficient and effective communication. Preservice teachers' overall impression of communication with classmates was less definitive—less than half interacted before the beginning of lessons. Also, 32% of respondents indicated that they could not build friendships during this online course. When comparing face-to-face classes and online classes, nearly 80% of respondents indicated that they communicate more efficiently and effectively in face-to-face situations. Nevertheless, almost 50% of respondents felt connected to their peers despite interacting only online.

The current study focuses on the impact of Zoom's Breakout Rooms on the participants' perception of interactions. The Breakout Rooms were viewed positively. 84% of respondents indicated that they were comfortable meeting with peers in Breakout Rooms, 90% regularly engaged with their peers in Breakout Rooms, 84% collaborated with classmates by doing group work in Breakout Rooms, and 100% believed that time spent with their peers in Breakout Rooms was valuable.

5.1. Breakout Room experiences: A closer look

The results shown in Table 3 provide interesting generalizations. We used cross-tabulation analysis via IBM's Statistical Package for the Social Sciences (SPSS) to analyze the data further. First, we examined the correlation of 8 Breakout Room questions with the remaining 20 questions. The Breakout Room aggregation (BRA) combines scores from all questions concerning Breakout Room interactions, giving us one score (Q19, Q20, Q21, Q22, Q25, Q26, Q27, and Q28). This aggregation allows us a comprehensive way to look at student perceptions.

Table 4. Correlations between the Breakout Room aggregate and all other questions

		Q1	Q2	Q4	Q5	Q6	Q7	Q10	Q12	Q15	Q18	Q23
BRA correlated with Zoom interaction questions	Pearson Correlation	.488	.570	.576	.563	-.496	.595	.636	.641	.491	-.612	.541
	Sig. (2-tailed)	.034	.011	.010	.012	.031	.007	.003	.003	.033	.005	.017

Note. Only strong ($p<.05$) associations are listed in this table.

The students' perceptions of Breakout Rooms (BRA) were positively and significantly correlated with communication with the professor (Q1, Q2, Q5, and Q7), comprehension of lessons and development of teaching skills (Q4 and Q12), the technical management and distribution of

course material by the professor (Q10), the fostering of friendships (Q15), as well as the students' affinity to video and voice chat over text chat (Q23). These results shown in Table 4 suggest that students' experience in Breakout Rooms was heavily impacted by the professor's communication, the academic objectives, and the social connections facilitated by Breakout Rooms.

Student perceptions of Breakout Rooms (BRA) were negatively impacted if the student found that access to lessons and materials was more manageable in face-to-face learning (Q6) or if the student considered text chat more comfortable than video chat (Q18).

Given that multiple questionnaire statements correlate with the aggregated Breakout Rooms statements, we examined the responses of students who expressed an affinity for Breakout Rooms and those who expressed resistance to Breakout Rooms. Operationally we divided the class in half based on their BRAscores and, using cross-tabulation, searched for correlations. Table 5 compares students' answers with high and low BRA scores.

Table 5. Students with high BRA compared with low BRA scores

	BRA Score		Q1	Q4	Q5	Q7	Q8	Q12
BRA correlated with all interaction questions	High	Pearson Correlation	.683	-	.833	.683	-	.782
		Sig. (2-tailed)	.029	-	.003	.029	-	.007
	Low	Pearson Correlation	-	.827	-	.861	-.725	-
		Sig. (2-tailed)	-	.006	-	.003	.027	-

Note. Only strong ($p<.05$) associations are listed in this. A dash indicates that the question was not strongly correlated with the BRA

Table 5 shows that students with above-average BRA scores show significantly positive correlations for four questions. These students scored higher on Q1 (in Zoom, I had the opportunity to ask and respond to questions from my professor), Q7 (in Zoom, I could readily communicate with my professor via written correspondence), and Q12 (Zoom interactions allowed me to develop my teaching skills). These questions relate to their comfort with communicating with their professor. This comfort is particularly evident in the results for Q5 (I communicate with my professor the same in Zoom as face-to-face).

Cross-tabulation results shown in table 5 show three questions significant among the low-scoring BRA students. Q4 (I could comprehend the lessons), Q7 (I could readily communicate with my professor via written correspondence in Zoom), and Q8 (Face-to-face meetings allow me to communicate… more effectively than online meetings) correlated highly with the BRA. Although the low-scoring BRA students scored high on comprehension of lessons within Zoom and high on professor communication, they indicated communication was more effective in face-to-face meetings.

Delving further into the students' perception of their Breakout Room experiences, we examined the female and male responses using cross-tabulation for the BRA and the rest of the interaction questions in the questionnaire. Table 6 contains the notable positive and negative correlations for males and females.

Table 6. Comparison of male and female perceptions of Breakout Room interactions

	Gender		Q2	Q4	Q7	Q8	Q9	Q10	Q11	Q12	Q18
BRA correlated with all interaction questions	Female	Pearson Correlation	.624	-	.585	-	-	.877	-	.673	-.609
		Sig. (2-tailed)	.017	-	.028	-	-	<.001	-	.008	.021
	Male	Pearson Correlation	-	.971	-	-.907	.903	-	.893	-	-
		Sig. (2-tailed)	-	.006	-	.006	.036	-	.042	-	-

Note. Only strong (p<.05) associations are listed in this. A dash indicates that the question was not strongly correlated with the BRA. Also, note the lack of overlapping significant correlations for males and females.

For Breakout Room interactions, males and females differ in their perceptions. For female preservice teachers, positivity towards technology, communication with the instructor, and social organization correlate highly with BRA. A preference for text over video chat is negatively associated with the BRA. For male preservice teachers, performance in the course matters. That is to say, comprehending and contributing to the course content matters to males. Those males who indicate face-to-face is more effective than online communication (with the instructor) negatively correlate with the BRA. This result demonstrates internal validity. We expected a negative correlation as we previously noted the importance of effective instructor communication in Zoom interactions.

5.2. Face-to-Face Delivery vs. Zoom Deliveredlessons

The qualitative and raw questionnaire data suggest that students appreciate face-to-face delivery over Zoom-delivered lessons. Five questions investigate this perception (Questions #6, #8, #14, #17, and #24). We aggregated the results from these questions. This aggregation (FvZ) provided an avenue to investigate the factors influencing student perceptions of course delivery. Next, we used cross-tabulation to examine FvZ and the rest of the questionnaire.

Table 7. Male and Female perceptions of course delivery (f-to-f vs. Zoom)

			Q2	Q4	Q7	Q9	Q10	Q11	Q12	Q19	Q20	Q21	Q22	Q25	Q28
FvZ correlations	Female	Pearson Correlation	.624	-	.585	-	.887	-	.673	.777	.777	.777	.653	.644	.767
		Sig. (2-tailed)	.017	-	.028	-	<.001	-	.008	.001	.001	.001	.011	.013	.001
	Male	Pearson Correlation	-	.971	-	.903	-	.893	-	.971	.885	-	-	-	-
		Sig. (2-tailed)	-	.006	-	.036	-	.042	-	.006	.046	-	-	-	-

Note. Only strong (p<.05) associations are listed in this table. A dash indicates that the question was not strongly correlated with the FvZ aggregate. Note the difference between genders.

Multiple questions correlate positively with FvZ for females in this course (Table 7). These include communication with the professor, understanding course content, developing teaching skills, and comfortable peer interactions within Breakout Rooms. For males, the FvZ aggregation correlated positively with five interaction questions. These include comprehension of the lessons, feeling that their contributions mattered, brief interactions before class, and comfortable interactions with peers within Breakout Rooms.

As noted above, few questions are significant to both males and females. Only Q19 (In Zoom Breakout Rooms, I could easily converse with my classmates) and Q20 (I was comfortable meeting with my peers in Breakout Rooms) was significant for both genders. These findings, discussed in the next section, suggest a clear difference in perception between the genders.

6. DISCUSSION

The current study transpired during a period of global educational disruption caused by COVID-19, during which many educators delivered courses via web-based videoconferencing. In this mixed-methods study, using data from one teacher education course, we examined preservice teachers' interactions within Zoom's Breakout Rooms, explicitly looking for participants' perceptions of their experiences. The findings indicate that the participants felt comfortable in Zoom's Breakout Rooms, believing that time spent with peers in the Breakout Rooms was valuable. Nevertheless, the preservice teachers expressed a preference for face-to-face course delivery.

We sought a deeper understanding by aggregating the questionnaire scores from the eight Breakout Room questions (questions that examine student perception of Breakout Rooms) and searching for correlations between this aggregate (BRA) and the remaining questions. BRA allowed for a novel way to interrogate the data as we searched for aspects that impacted student perceptions.

Significant positive correlations between BRA scores and the questionnaire responses suggest that student experiences in Breakout Rooms are heavily impacted by communication with the professor, academic objectives, and social connections facilitated by Breakout Rooms. At the same time, weak technical skills significantly and negatively affected Breakout Room experiences.

Students with above-average BRA scores (positive perception of Breakout Rooms) show significant correlations for several questions, summarized by the statement, "I communicate with my professor the same in Zoom as face-to-face. "These students also indicate that Breakout Rooms provide an environment for effective communication where they grew as teachers (the curricular goal).

Lesson comprehension and communication with the professor were significant factors among the low-scoring BRA students. Although this group felt comfortable communicating with their professor, our findings suggest that their concerns regarding developing teaching skills reduced their comfort in the online environment.

Regardless of the students' perception of Breakout Rooms, all students valued effective communication with the professor. Therefore, comfortable communication with an instructor may transcend the students' comfort regarding general Breakout Room interactions.

Our findings also reflect the current literature that suggests women and men are impacted differently by Zoom experiences [50]. For females, instructor communication and social

experiences are essential. For males, performance in the course is crucial. That is, males focus on comprehending course content and contributing to the lessons during a class.

Analyzing male and female perceptions toward course delivery (face-to-face vs. Zoom) suggests similarities and differences. Although both groups preferred face-to-face lessons, they expressed comfort interacting with their professor and peers in Breakout Rooms. Also, both genders valued their developing skills (becoming teachers), which occurred in Breakout Rooms. What differed was that males wanted to feel that their contributions to the class mattered, while females focused on communication with the professor. These results illustrate that there are differences in each gender's experience. Both genders valued contact with the professor; males appreciated course content communication, whereas females valued individualized, more personal communication.

Regardless of the divisions and groupings of students discussed above, we suggest that, as a whole, preservice teachers desire to contribute to the class and connect socially beyond the pragmatic goal of becoming teachers. This suggestion may be significant for traditional teachers using lecture-style teaching practices, for our findings suggest that these factors are critical for high-quality studenteducational experiences. We propose that Zoom Breakout Rooms provide these elements and, therefore, should be considered when planning a course using a videoconferencing platform.

The extreme reaction of preservice teachers' to new Breakout Room groups stimulated this inquiry. Frankly, we were surprised by the students' response, for their feedback was similar to one in a face-to-face classroom. COVID-19's impact on the educational context should not be overlooked. The pandemic likely influenced the Breakout Room interactions, as many students were socially isolated outside of the virtual classroom. While the isolation lessened as some public health measures were lifted, many students met only via Zoom throughout the semester. This context must be acknowledged as our findings are reviewed and future post-pandemic online courses are formulated.

7. CONCLUSIONS

Amid the burgeoning use of online teaching and learning, we sought to examine how technology-mediated learning platforms providing videoconferencing impact students. As post-secondary institutions continue to increase the number of online courses, we contend that simply bringing together disparate groups or individuals in different locations will create ineffective learning environments. We encourage online instructors to reflect on facilitating communication with their students. Also, a significant portion of participants in this study wanted to feel that their contributions to the class mattered. Online instructors should reflect on how they might provide opportunities for student contributions within lessons.

Although we found that the virtual space of Zoom's Breakout Rooms facilitated student interactions and learning, our findings matched suggest that participants prefer face-to-face courses. Also, although our findings suggest that preservice teachers were comfortable communicating via Zoom, these students indicated that they communicate more efficiently and effectively in face-to-face situations.

Additionally, although previous research [51] suggests that online courses inhibit social connections with peers, nearly half of our respondents felt a strong connection to their peers despite being online. Social connections are essential for online courses. Nevertheless, we suggest that explicitly facilitating student connections between peers reduces stress and promotes academic motivation. Therefore, when planning courses that employ videoconferencing, course

structures and learning exercises must be provided to assist the development of relationships that may not naturally occur.

Finally, we found that the affordances provided by Zoom's Breakout Rooms also met our constructivist goals. The virtual space allowed students to interact positively and collaboratively within a constructivist learning environment where preservice teachers negotiated learning by discussing what they were learning.

While COVID-19 changed the landscape of post-secondary course delivery, the current study identifies significant implications as online delivery of university courses increases post-pandemic. Although we argue for the use of Zoom Breakout Rooms, the preservice teachers exhibited "Zoom Fatigue," a weariness with online modes of communication [44].

There is much to learn regarding online teaching practices using videoconferencing in a post-pandemic world. Future research, large-scale and case studies, must inform our choices. As more education is delivered online, post-secondary education will need to cultivate online counterparts to the investments universities have made in physical infrastructure to provide quality education to students from diverse backgrounds.

8. RESEARCH LIMITATIONS AND FURTHER STEPS

This research, like all research, has its limitations. First is the limited number of students in this study; a larger group would have provided a more robust statistical analysis. Also, during the qualitative research, the Zoom platform itself reduced our ability to examine student interactions. Specifically, Zoom records the host's video; therefore, we could only analyze interactions when the host/professor was present in the Breakout Rooms.

While this paper focused on a single online course, an in-depth investigation of student perceptions of Zoom's Breakout Rooms would benefit educators. For example, empirical studies would offer helpful information for developing online courses. Such studies may clarify claims that online learning experiences provide equivalent benefits to face-to-face learning experiences.

Furthermore, this study investigated Zoom, one specific platform among many. As a result, it is essential to look at other platforms on the market, such as Google Meet, Skype, Microsoft Teams, GoToMeeting, Cisco WebEx, etc. In this way, the validity of the findings reported here may be assured with greater certainty. We hope that this work will act as a catalyst for further research.

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