

# Both Sides of the Story: Changing the “Pre-existing Culture of Dread” Surrounding Student Teamwork in Breakout Rooms

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As universities transitioned in-person classrooms to virtual classrooms, instructors faced challenges and changes in how they conduct their classes and teaching style trying to keep virtual classrooms as similar to in-person as much as possible through the use of group work in breakout sessions. Within these breakout sessions, students are expected to work together to complete an assignment. Through 669 surveys and 19 interviews, our paper outlines the successes and challenges of breakout sessions and teamwork in virtual learning environments faced by professors, graduate teaching assistants, and students. Our findings show the importance of pedagogical research for online environments, the student need for persistent instructions and check-ins to facilitate teamwork in breakout sessions, and strong justification for the use of breakout sessions in online courses. Based on our findings, we propose design recommendations to address the challenges highlighted within the classroom and software used by instructors and students. Our work contributes and extends previous CSCW and HCI research in online distributed teamwork and education.

CCS Concepts: • **Applied computing** → **E-learning**; **Collaborative learning**.

Additional Key Words and Phrases: e-learning, teamwork, collaboration, videoconferencing

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## 1 INTRODUCTION

To prepare students for a career, college instructors assign activities, projects, or homework for students to work together in groups. By doing this, instructors are teaching students about the value of teamwork whether the students are aware or not [10, 17, 21]. Previous CSCW and HCI research has noted that teamwork and collaboration play a vital role in the workplace and within education itself, as collaborative assignments and projects have been shown to have a positive outcome on student learning [4, 6, 42, 46, 49, 55, 89]. Unfortunately, due to the effects of the coronavirus disease 2019 (COVID-19) pandemic, universities are utilizing videoconferencing software such as Zoom or Microsoft Teams to conduct their classrooms, including the organization and deployment of

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group work activities [35, 67, 85]. Instead of having students rearrange the classroom furniture and sit in close proximity, they are now being assigned to breakout rooms, which are smaller videoconferencing sessions within the overall main session [56, 74]. As Lougheed and Kirkland define, breakout rooms are an active learning technique that promotes collaborative learning and critical thinking skills by breaking the overall group into small subgroups to discuss a topic outside of the main room [53]. Breakout rooms are becoming more prevalent within classrooms, especially for use with team- or group-based projects or assignments. A long-time topic in CSCW and HCI has been distributed teamwork and learning outcomes, this work aims to add to that body of knowledge through the lens of teamwork in higher education [13, 70, 87].

Online courses and videoconferencing are not a new concept sprouting from the pandemic, CSCW has long researched distributed teams, online education, and videoconferencing software; many universities offered fully online courses in some capacity before the pandemic began [9, 38, 66, 70, 88]. Typically, these courses had higher enrollments of non-traditional students due to being more accessible than traditional courses and allowing for greater flexibility [28, 43]. However, there are limitations to online courses, including limited internet access for students in rural or low populated areas, the availability or access to technology, isolation from classmates and instructors, and weaker classroom engagement due to the online format than in face-to-face classes [28, 71]. A 2013 study from the United States (U.S.) Department of Education (DoE) found that there were over 5.5 million students enrolled in at least one online course, and a subsequent DoE statistics report from 2020 states that this number has increased to 7.3 million students in 2019 [1, 9]. This number has significantly increased with the introduction of the COVID-19 pandemic, with the U.S. DoE estimating that 84% of undergraduate students had some level of exposure to online courses; many governments and institutions closed educational institutions to the majority of the student population due to strict social distancing guidelines meant to reduce the transmission of the disease [2, 7, 16, 18, 62].

In 2014, before the surge in online learning, a study found that 25% of instructors utilize breakout rooms frequently in their online courses [56]. However, instructors quickly had to pivot their face-to-face classes into a format resembling online learning, forcing students to work together within breakout rooms [34]. The switch to virtual often comes with unique sets of problems leaving students to take learning into their own hands and utilize their time effectively until the professor or teaching assistant (TA) arrives into their room [52]. Students have noted that they dread or dislike entering breakout rooms due to the forced interaction with their peers, which can contribute to the under-utilization of the classroom breakout sessions [59]. Instructors have also noted that when students are confused about the instructions given, students will opt to do nothing instead of asking for help from the professor or TA [52]. When students are left to work together on their own, they may not effectively utilize the breakout rooms to their fullest extent, instead group members may opt to work alone or not at all [52, 74].

More universities have decided to offer hybrid or fully online classes for their students to help mitigate the concerns caused by the pandemic [84]. Due to this abrupt shift in learning styles, instructors are having to completely redesign their courses to be compatible with face-to-face, hybrid, and online learning experiences [75, 84]. Transitioning group learning from face-to-face courses into an online format requires instructors to utilize the breakout room function to facilitate discussion and social interaction between students [74]. This paper presents a study exploring breakout room usage in undergraduate classes across the U.S. We aim to expand upon prior CSCW work surrounding online education and distributed teamwork by understanding how students are working together within breakout sessions, their collaboration levels within them, and their preferences for how breakout rooms are utilized within their courses. We also want to understand

how breakout rooms are utilized from the professor and TA perspectives, and we aim to identify if there are any discrepancies between student usage and professor/TA<sup>1</sup> observations.

Through 28 interviews and 669 survey responses, we explore the following research questions:

*RQ<sub>1</sub>*: How do instructors prepare for and execute breakout rooms?

*RQ<sub>2</sub>*: How does instructor preparation and involvement impact student teamwork in breakout rooms?

*RQ<sub>3</sub>*: How do breakout rooms impact student collaboration and attitudes in online learning?

*RQ<sub>1</sub>* explores instructor preparation techniques and research into using breakout rooms in online learning environments. *RQ<sub>2</sub>* investigates how instructor preparation (*RQ<sub>1</sub>*) and involvement in breakout rooms impacts students’ overall collaboration and teamwork in breakout rooms. Finally, *RQ<sub>3</sub>* explores how breakout rooms impact collaboration and attitudes toward online learning from both student and instructor perspectives. This research also presents recommendations for the collegiate academic community based on our survey and interview findings from students and instructors. Since the current reality of education has suddenly shifted into an emergency online format, we need to fully understand how breakout rooms are being utilized for group work and analyze them to better prepare instructors for future virtual course development.

We make several contributions to CSCW. Our focus on online education and teamwork with in virtual learning provides deeper understanding from perspectives of those who may not have chosen online education and highlight where and why distributed teams in academic contexts are successful or unsuccessful. We expand on online education and distributed teamwork through several ways 1) highlighting the importance of instructor involvement in the virtual classroom, 2) exploring the perceptions and reflections of instructors who have taught virtual classes, 3) outlining successes and failures in breakout room usage from instructors and students alike to understand the needs of virtual classrooms, and 4) proposing design recommendations to address software issues within collaboration software.

## 2 BACKGROUND

Within the CSCW and HCI literature, we have focused on three main areas of study – teaching teamwork within colleges, student teamwork effectiveness and attitudes, and breakout room use at the collegiate level. We believe that these focus areas will bring context to investigate teamwork within online classrooms by presenting information from both the instructor and student perspectives.

### 2.1 Teaching Teamwork

Teamwork is a core component of most academic and industry experience and is even more important to consider when working in a distributed environment as COVID-19 has forced. The CSCW and HCI communities have long been interested in teamwork and designing collaborative technologies to improve both collocated and distributed team settings [6, 46, 55, 89]. However, in academia, teamwork cannot be taught like many other subjects, but it can be influenced. Notably, CSCW researchers have utilized many methods, such as gamification, escape rooms, and active learning environments, to improve and study students’ teamwork skills within the classroom [57, 76, 90]. There are many frameworks and methods for teaching teamwork within classrooms, but underlying them all is the Tuckman model. The Tuckman model was presented in 1965, and is the most widely used and accepted model for teambuilding [14, 21]. Hughes and Jones provide a framework for educators to influence positive teamwork; the factors include developing teamwork

<sup>1</sup>For the rest of this paper, we will refer to the professor and TA group as a whole as instructors.

gradually over time, assigning work that elicits the use of teamwork, emphasizing that teamwork is not about the end result but about the process of getting to the end result, and giving meaningful feedback [42]. Teamwork is built by teaching students different skills to help facilitate teamwork including but not limited to communication, risk management, and collaboration skills [51].

In engineering and technology majors, teamwork is taught through experiential learning, such as semester-long team projects [29, 51]. In medical disciplines, instructors utilize case studies or simulated patients as the most popular form of teaching students teamwork [32]. In business classes, instructors assign team-based activities frequently to expose their students to teamwork [77]. However, just assigning team-based activities is not enough to teach students the value of teamwork. In Thi Van Anh and Thi Thu Hien's study, they found that students agree that there is a deficiency in student interest in teamwork-based courses [82]. Learning how to be an effective teammate is critical to learning about teamwork, which is often overlooked in favor of quickly assigning team activities [21].

## 2.2 Student Teamwork: Attitudes & Effectiveness

Student attitudes toward teamwork are mixed, depending on prior experience of working as part of a team. As we stated previously, HCI and CSCW research has had a large focus on teamwork and collaboration, there is a small focus in HCI on student experiences during course projects requiring teamwork [44, 54, 80]. Pfaff and Huddleston found that college-aged student attitudes toward working on a team project can be predicted based on grade weight of the project, workload, amount of time made available in class to work on the project, using peer evaluations, and the absence of a teammate who does not contribute [69]. Pfaff and Huddleston also recommend that for a positive attitude toward teamwork to form for a student, team-based projects and activities should have a reasonable workload, allow time in class to work on the project, and use peer evaluations as a means of giving feedback and monitoring for members who may not be contributing [69].

While Pfaff and Huddleston's work focuses on in-person classes and the ability to work face to face, Tseng, Wang, Ku, and Sun focus on graduate student attitudes and teamwork satisfaction in online classes. Their work investigated the factors of instructor support, getting to know teammates, establishing a means of communication, building trust among the team, and being organized factor into student attitudes and satisfaction of working in a team [86]. Results from their work found that the most substantial contributors to student satisfaction were communication and organization. Notably, they did not find a strong correlation between instructor involvement and positive student attitude or satisfaction. Oakley, Hanna, Kuzmyn, and Felder echo Tseng, Wang, Ku, and Sun's results [86] but with co-located teams that student attitudes stem from student satisfaction with the team experience, instructor presence and input, whether or not there is a non-contributor, and size of the team [65]. The most notable difference between the two works is the disagreement between instructor presence factor; however, future work from Ku and Tseng will align them. A few years later, Ku, Tseng, and Akarasriworn revisited their work on student attitude and satisfaction in online environments and found that team dynamic or the amount of communication and collaboration that is present, team acquaintance or getting to know one another, and instructor support and presence influence student attitude about teamwork [48]. They also noted that most students had a positive and favorable attitude toward working together in a virtual environment.

Also notable in Oakley *et al.* is that student attitudes toward teamwork increased as course level increased, meaning those with more college experience, senior and graduate level courses had better overall attitudes toward teamwork in a class setting, with instructor guidance being strongly related to the increase in class level [65].

While student attitude is one behavioral factor of teamwork, another behavioral aspect of students in teams is effectiveness when it relates to performance. Ahuja, Khan, Symonette, Pan, Stacey, and

Engel identify predictors of the differences between high-performing and low-performing students by analyzing the use of online collaboration tools like Slack or GroupMe [5]. They identified the predictors of performance in a team are words per sentence, total word count of a message, use of dictionary words, honest and authentic communication, clout (expertise and confidence), function, tone, six-letterness (proportion of the words used that are greater than 6 characters), and analytic thinking [5].

Within the classroom, transitional processes like defining goals and guidelines, planning, assessing each other’s skills, and designating roles and responsibilities influence student teamwork and perception of attaining the goals of the team, as well as influencing skill improvement [15].

Previous HCI research looked into student attitudes and measuring teamwork effectiveness with a large focus on in-person courses [36, 41, 83]. However, due to the recent shift to online and hybrid learning, there is little research focusing on online student teamwork within videoconferencing softwares [12, 25, 37]. In an online class designed to teach students to work together effectively, Hazzan found that breakout rooms are an effective tool for student collaboration and teamwork [39]. These findings are similar to other classrooms in many different disciplines [23, 50, 64]. However, Saltz and Heckman warn that for students to actively collaborate together, the classroom environment must be set up to encourage teamwork [74]. Unfortunately, due to the COVID-19 pandemic, instructors that generally teach or encourage teamwork in face-to-face classrooms are having to completely revamp their online or hybrid courses to encourage students to actively collaborate in breakout rooms together. Therefore, our goal is to fill the gap by gaining insight into many different departments from universities, community colleges, and technical colleges on their students’ teamwork within breakout rooms, both from the student and instructor perspectives.

### 2.3 Breakout Rooms

The use of breakout rooms is not a new concept; however, there has been an influx of their use due to the ongoing COVID-19 pandemic. Breakout rooms, such as the ones in Zoom, have several features that enable collaboration similar to face-to-face groups like screen sharing and virtual whiteboards. Much of the most recent research into breakout rooms have been observations from those in the teaching community, giving their perspective about how switching from in-person to online learning has transitioned. However, researchers in CSCW and HCI have been studying breakout rooms in the past few years due to their increased usage in online classrooms for teamwork activities [39, 40, 72].

Many academics from various backgrounds found that the transition to and use of breakout rooms were successful [47, 73, 81]. Takizawa, Honan, Brisette, Wu, and Wilkins highlight some advantages that they said students found breakout room teaming to be better than in-person teaming, which namely were getting to be in different groups and socializing with their teammates, easy transitions between a larger group lecture to small group sessions, as well as a better environment to be able to focus on the group — there is no chatter of other groups to try and listen to a groupmate over or the possible distraction of trying to see what other groups are doing [81]. This research also highlights some downsides to breakout rooms as well: less organic movement about breaking out into groups, having it be jarring to a discussion when an instructor pops into the room, the difficulty of getting the attention of an instructor, and limited capabilities to share something with the entire class while broken out into small groups (in face-to-face settings one could speak up and address the whole class at once) [81].

While not about breakout rooms, Neill and Etheridge provide a framework of having flexible learning spaces in classroom settings that have a positive correlation to student learning, and that flexible learning spaces can enable students to be better engaged, collaborate, and learn [63]. By

extension, we believe that breakout rooms can be considered a type of flexible learning space that enables the same qualities to be elicited in student groups.

As the use of breakout rooms increases within academia and educational research, however within CSCW and HCI research student teamwork within breakout rooms is understudied. There is little prior research in CSCW and HCI relating to student teamwork within videoconferences, such as studying remote students' connections with their peers [79], observing students' teamwork within a coding camp [12], utilizing an online game to teach students teamwork [37], and a remote software engineering classroom experience report [30], and little to no research on student teamwork within breakout rooms, including a blog on studying exponential competence of computer science undergraduate students [40] and a study on teaching soft skills using breakout rooms [39]. Teamwork and collaboration within student teams in breakout rooms is important for the CSCW community to investigate, in particular the outcomes of teamwork within student groups ( $RQ_1$ ), exploring instructor involvement in student attitudes towards teamwork ( $RQ_2$ ), and finally probing into student perceptions of teamwork and collaboration within virtual classrooms ( $RQ_3$ ) to gain a better understanding of how breakout rooms can be utilized for effective teamwork in an educational setting.

Within this study, we surveyed and interviewed undergraduate students and instructors from technical and community colleges as well as universities to gain an understanding into their perspectives on student teamwork in breakout rooms within fully-online learning environments. Studying both student and instructor perspectives allowed us to understand where discrepancies between student understanding and instructor expectations are, allowing for recommendations to be made for both the academic community, such as lecturers, adjuncts, professors, and graduate students, as well as issues with the software utilized providing us the opportunity to make suggestions to the videoconferencing tool designers to better improve future iterations of their software. Due to the current utilization of remote learning, we believe it is imperative to study student teamwork within online breakout rooms from a CSCW perspective.

### 3 METHODOLOGY

In this section, we describe our methodology for how we examined student teamwork within breakout rooms including study design, data collection, and our data analysis. Our study involved surveying and interviewing undergraduate students about their individual perceptions of their team's work as well as surveying and interviewing their instructors about their perspectives on student teamwork within breakout rooms.

#### 3.1 Study Design

Our study was conducted in two parts, a pilot study local to a university campus and then we opened the survey to responses from the internet leading to international participation. In total, we received 729 responses to our surveys where 173 were instructor respondents and 556 were student respondents.

To disseminate our surveys and recruit interviewees, we utilized a variety of distribution methods such as email and social media including Reddit, Twitter, LinkedIn, and Facebook. For the Reddit recruitment, we identified over 1000 local town or city subreddits and collegiate subreddits and reached out to the moderation team to request to post within the communities. We also utilized *r/samplesize* as another distribution method on Reddit. For Twitter, LinkedIn, and Facebook, the research team publicly posted on their own personal accounts as well as within university groups.

The survey itself was comprised of two surveys, either from the instructor perspective or the student perspective. To ensure participants took the correct survey, we asked one question within the demographic section of each survey about the respondent's role at their institution (i.e.,



whether they were an undergraduate student, graduate teaching assistant, or professor/lecturer). The respondent’s choice determined which version of the survey they were provided, either the student or instructor version. For example, if a respondent indicated they were a graduate teaching assistant, they would be provided with the instructor survey. However, if a respondent indicated they were an undergraduate student (or undergraduate TA), they would be provided with the student survey. All survey sessions would terminate if the respondent indicated they had not used a breakout room before. To obtain interviewees, at the end of the survey we included an option to schedule a timeslot with the research team for a semi-structured interview. All interviews were voluntary after completion of the survey. The research team did not offer incentives for interviews.

Both instructor and student surveys included both open- and closed-ended questions. Open-ended questions were follow-up fill-in boxes to closed-ended questions that asked participants to elaborate and provide any additional comments or opinions on questions that were asked. Closed-ended questions were on a five- or seven-point Likert scale from *Never* to *Often*, *Extremely Dissatisfied* to *Extremely Satisfied*, or *Strongly Disagree* to *Strongly Agree*.

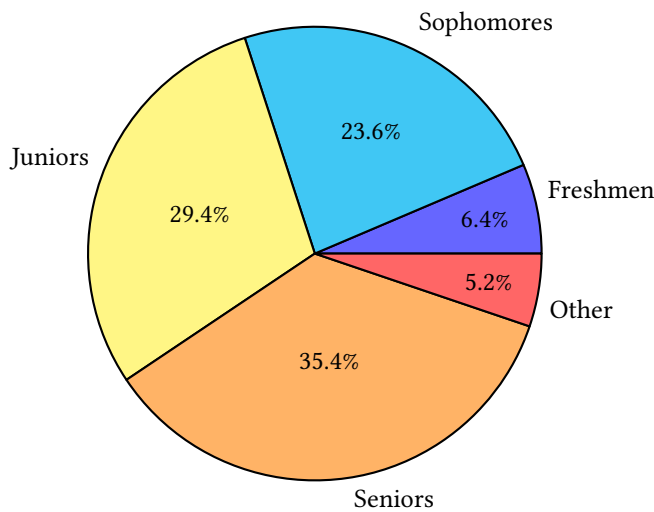


Fig. 1. Demographic breakdown of student survey response by class level.

### 3.2 Participants

We received 729 total survey responses through email and social media solicitation, 173 being instructors<sup>2</sup> and 556 undergraduate students. 132 respondents are students or instructors at Clemson University. The age of instructors (professors and graduate TAs combined) ranged from 20 to 74 years with an average age of 37.13 years and the age of students ranged from 17 to 56 years with an average age of 21.5 years. The majority of instructors identified as female (58.77%), with 33.33% identifying as male, 3.51% identifying as non-binary, 1.75% self-describing as transmasculine, and 2.63% preferring to not disclose their gender. The majority of students identified as male (48.41%), with 45.25% identifying as female, 3.62% identifying as non-binary, 1.36% self-describing as

<sup>2</sup>We have grouped professors and graduate teaching assistants together to create the instructor group. We have combined them because all graduate TAs had similar duties to the professors. All graduate TA responses indicated that they ran an undergraduate class or lab section in their discipline and were in charge of that class/lab’s grading throughout the semester. Additionally, we received only a small number of graduate TA responses within our survey (25) and interviews (3).

transmasculine or agender, and 1.36% preferring to not disclose their gender. Student responses by class are shown in Figure 1 with the majority of student respondents (35.4%) identifying at the senior class (fourth year) level. 5.2% of student respondents identified as fifth year or special circumstances students. Instructors taught or assisted one to 25 classes, with the average number of classes taught or assisted being two (30%) per semester. Additionally, the number of years instructors have been teaching ranged from 1 to 39, with an average amount of teaching experience of 9.32 years. Figure 2 offers an experience breakdown of all instructors surveyed. We received survey responses from students and instructors in many disciplines with the majority of respondents coming from STEM areas.

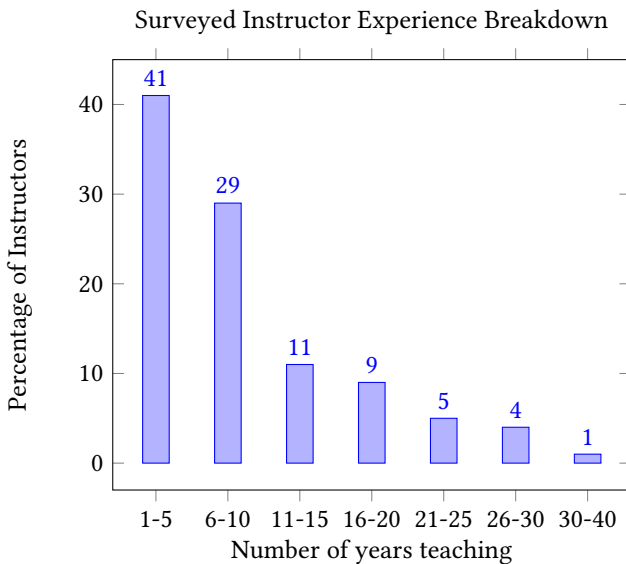


Fig. 2. Experience breakdown of surveyed instructors.

We interviewed a total of 13 instructors, half of whom are from Clemson University. As shown in Table 1, 46% of instructors interviewed identified as female. The average age of the instructor population was between 35 and 44 years of age, while the average amount of teaching experience was 10.5 years. The majority of instructor interviewees are in STEM disciplines, with 31% of interviewees being in the Computer Science discipline. We also interviewed 15 undergraduate students. As shown in Table 2, the majority of their ages ranged from 18 to 24 years. The majority of student interviewees identified at the junior (third year) class level, and the majority of students being in STEM disciplines.

### 3.3 Survey and Interview Design

In this section, we describe our survey and interview designs, and note previous work which we incorporated into or inspired the questions we designed.

**3.3.1 Survey Design.** Questions for the survey were inspired and derived from [20, 27, 65], and focused solely on synchronous online courses due to their use of breakout rooms. Preliminary demographic information was collected first in both instructor and student surveys. Then, we asked questions regarding which videoconferencing application was used as well as breakout room



PID	Age Range	Gender	Experience	Discipline
P1	25-30	Male	7 years	Biology
P2	18-24	Female	2 years	Math
P3	25-30	Male	3 years	Math
P4	35-44	Female	6 years	Computer Science
P5	25-30	Male	5 years	Computer Science
P6	45-54	Female	25 years	Healthcare
P7	25-30	Male	3 years	Math
P8	35-44	Female	1 year	Biology
P9	55-60	Female	30 years	Biology
P10	35-44	Male	13 years	Computer Science
P11	35-44	Male	2 years	Physics
P12	55-60	Male	30 years	Communication
P13	35-44	Female	10 years	Computer Science

Table 1. Instructor Interview Participant Demographics.

PID	Age Range	Gender	Class Level	Discipline
S1	18-24	Male	Senior	Math
S2	18-24	Male	Junior	Chemistry
S3	18-24	Non-binary	Junior	Engineering
S4	18-24	Undisclosed	Junior	Music
S5	18-24	Female	Sophomore	Social Work
S6	25-30	Male	Junior	Computer Science
S7	18-24	Male	Sophomore	Computer Science & Engineering
S8	25-30	Male	Junior	History
S9	18-24	Male	Junior	Computer Science
S10	18-24	Male	Freshman	Computer Science
S11	18-24	Male	Freshman	Computer Science
S12	18-24	Male	Freshman	Computer Science
S13	18-24	Male	Junior	Computer Science
S14	18-24	Female	Sophomore	Early Childhood Education
S15	18-24	Male	Sophomore	Computer Science

Table 2. Student Interview Participant Demographics.

usage statistics such as how often breakout rooms are used, how many students are typically in a session, and how long sessions lasted to establish an understanding of the classroom atmosphere and culture. In the third and final section of the survey, questions regarding perceived effectiveness of breakout room usage for teamwork and collaboration such as how often instructors check in with groups ( $RQ_1$ ), perceptions of students working in groups ( $RQ_2$  and  $RQ_3$ ), utilization of videoconferencing features like whiteboards or screen sharing ( $RQ_2$  and  $RQ_3$ ), and microphone usage as motivated by our research questions ( $RQ_3$ ). The questions in this section were derived from Oakley *et al.*'s teamwork survey questions and were updated (as shown in Appendix A) for our survey to incorporate teamwork within breakout sessions [65].

**3.3.2 Interview Design.** Our interview questions were inspired by our survey questions, expanding upon our survey to delve deeper into how instructors and students viewed breakout rooms. We

began by gathering demographic information such as name, age, gender, university/college name, department/major, and whether or not breakout rooms were utilized in the class the participant taught/attended. For the instructor group, we then asked how their class was setup and how breakout rooms were integrated, including check-ins, activities, and assigning students to breakout rooms. For students, we asked about the class activities where breakout rooms were required and how often an instructor checked-in on their breakout room sessions. Our last section of questions for instructors included having them elaborate on how they perceived student teamwork within breakout sessions, how they prepared/updated their class to incorporate breakout rooms, and what features they wish videoconferencing software had to improve breakout rooms. The last section of questions for the students involved asking about their teamwork within breakout sessions, aspects of breakout rooms that could be improved, and how the course could better use breakout rooms, if applicable. A subset of student and instructor interview questions is provided in Appendix B.

### 3.4 Data Collection and Analysis

In this section, we discuss our data collection process and our analysis of our survey and interview data.

**3.4.1 Data Collection.** The survey creation software Qualtrics<sup>3</sup> was utilized to create and distribute the surveys during both parts of our research study. The surveys consisted of a mix of quantitative and qualitative questions about how breakout rooms are utilized and perceived by the respondent in their classroom(s).

To recruit both survey and interview participants, the research team sent over 200 targeted emails to instructors, advertised to 202 out of 1000 identified collegiate or location-based subreddits due to moderation restrictions, and additionally the team utilized Facebook, LinkedIn, and Twitter for recruitment. The surveys were left to accrue responses for two months, and interviews concluded shortly afterwards. To recruit interview participants, at the end of the survey, respondents were instructed to schedule a timeslot using Calendly<sup>4</sup> to opt-in to a semi-structured interview. All interviews were held over Zoom, recorded, and lasted between 30 minutes and one hour with an average of 45 minutes. No incentives were given to participants to complete either the interview or survey. Interviews started with basic demographic information before moving into classroom design and finally perceived student teamwork within breakout sessions. At the end of each interview, we immediately began transcribing the audio into textual data for analysis.

**3.4.2 Survey Analysis.** All surveys included a mix of quantitative and qualitative questions. The quantitative questions were analyzed using standard statistical methods outlined in [8]. For qualitative open-ended survey responses, the research team used open-coding methods [26]. First, we identified and isolated the open-ended qualitative responses from the surveys for both instructors and students. Next, we read and re-read answers to understand the data holistically and then team-coded a subset of the responses to generate the codes to be used for the rest of the survey data. After team-coding, the first and second authors independently coded and categorized the remaining survey data and came together to dissolve any disagreements.

**3.4.3 Interview Analysis.** Instructor and student interviews were treated as solely qualitative data analyzed by the research team using thematic analysis and qualitative data analysis guidelines outlined in McDonald *et al.* [58]. We began by team-coding two interview transcripts from the localized study to generate a list of general codes. The first and second authors then team-coded the remaining localized transcripts, and reconciled any disagreements together during the coding

<sup>3</sup>qualtrics.com

<sup>4</sup><https://calendly.com>

#, $RQ$	Theme	Definition
1, $RQ_1$	Levels of Pedagogy	Relates the amount of pedagogy research done when instructors prepped for their online courses
2, $RQ_2$	Student Success VS. Instructor Involvement	Relates the success of students within a particular course to the involvement of the instructor
3, $RQ_3$	Instructor Perceptions of Breakout Rooms	Relates instructor perceptions of breakout rooms to the class content and types of students within their course
4, $RQ_3$	Student Perceptions of Breakout Rooms	Relates student perceptions of breakout rooms are dependent on instructors and their involvement in the course

Table 3. Breakdown of our four themes drawn from our results.

session. After both the survey and interview data coding was finalized, the first and second authors began their grounded-theory analysis [24].

## 4 RESULTS

In this section we present the results from instructor and student surveys and interviews. Survey results are subdivided by instructors and students and further broken down by identified themes in each section. Interview results are presented in the same way – divided into instructor and student responses and further subdivided by emerging themes, as defined in Table 3, for each type of respondent. Our first emerging theme, levels of pedagogy, investigates how instructors prepared to teach their online courses ( $RQ_1$ ). The second emerging theme, student success versus instructor involvement, explores how instructor involvement within breakout rooms relates to student success in the course ( $RQ_2$ ). Our last two emerging themes, student perceptions and instructor perceptions of breakout rooms, investigate the differences in how instructors and students perceive breakout rooms ( $RQ_3$ ). Table 4 presents a count of comments from both instructors and students related to each theme from both our survey and interview data.

#	$RQ$	Theme	Instructor Count	Student Count
1	$RQ_1$	Levels of Pedagogy	160	124
2	$RQ_2$	Student Success VS. Instructor Involvement	160	172
3	$RQ_3$	Instructor Perceptions of Breakout Rooms	153	–
4	$RQ_3$	Student Perceptions of Breakout Rooms	–	293

Table 4. Our four themes and number of survey and interview comments for both instructors and students related to each theme.

### 4.1 Survey Results

The collection of surveys for this study was completed in two parts, and for each part of data collection surveys were left open for one month. We received a total of 729 responses from all students and instructors during this study.

**4.1.1 Instructor Surveys.** Instructor surveys were open for one month alongside the student surveys and received a total of 173 responses. After data cleaning, including removal of incomplete responses and those that did not meet our inclusion criteria, there were 146 responses left for analysis. Overall, instructor’s number of years teaching ranged from 1 to 40, with the average number of years teaching being 10.

Overall, the majority (25.2%) of instructors utilize breakout rooms in most of their class sessions, 18.9% utilize them in every class, 22.5% only use them in half, and 33.3% use breakout rooms in

Questions	SD	D	N	A	SA
<b>P_Q1</b> Do you notice, on average, that most students turn on their cameras within breakout session?	14.29%	9.52%	23.81%	30.48%	21.9%
<b>P_Q2</b> Do you notice, on average that most students unmute their microphones within breakout sessions?	4.76%	13.33%	13.33%	41.9%	26.67%
<b>P_Q3</b> Are students utilizing the screen share or whiteboard option within breakout sessions?	19.19%	17.17%	25.25%	23.23%	15.15%
<b>P_Q4</b> Within breakout session, do you notice students working together to complete the assigned work?	1.9%	8.57%	12.38%	53.33%	23.81%
<b>P_Q5</b> If students are not working together, are students working independently within the breakout sessions	9.1%	36.36%	36.36%	9.1%	9.1%
<b>P_Q6</b> Do you notice that nearly all members of the breakout session contribute equally to the assigned work?	8.74%	33.98%	23.01%	33.01%	0.97%

Table 5. Breakdown of Instructor Responses to P\_Q1 - P\_Q6.

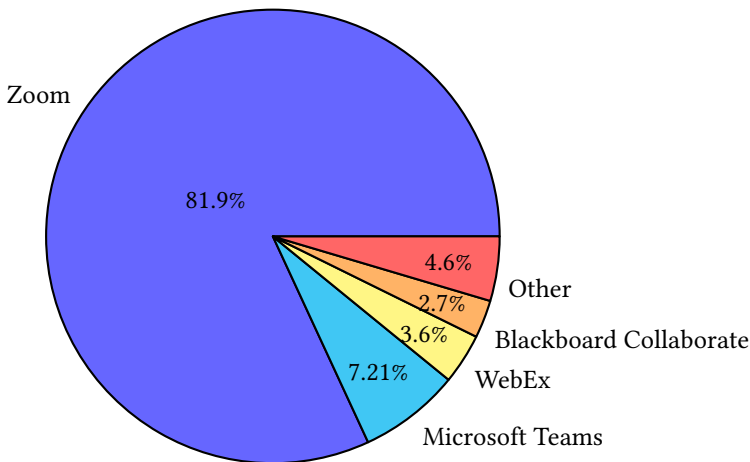


Fig. 3. Breakdown of videoconferencing tools used by instructors.

some of their class sessions. Figure 3 shows the breakdown of videoconferencing tools utilized by instructors with Zoom being used most-often. The average length of breakout sessions is about 25 minutes and the average number of students assigned to each breakout room is 5. Instructors often (30.84%) check-in on students in breakout rooms and have mixed views on their perceptions of student teamwork within breakout rooms, half responding that students work together all of the time and half responding that they only work together some of the time. Table 5 shows the Likert scale questions we asked to understand instructor perceptions of student teamwork, camera and microphone usage, and collaboration within the breakout rooms.

**Student Success versus Instructor Involvement: Instructor Perceptions** – This theme relates the success of students within a particular course to the involvement of the instructor. Instructor survey responses also indicate they saw an increase in participation once they provided materials that were detailed and provided in a persistent format and checked in with students.

Questions	SD	D	N	A	SA
<b>S_Q1</b> Did the instructor/TA check-ins increase your team productivity?	10.51%	12.1%	29.94%	32.17%	15.29%
<b>S_Q2</b> Did the instructor/TA check-ins increase your team efficiency?	9.27%	15.97%	36.74%	26.84%	11.18%
<b>S_Q3</b> Are breakout rooms in this course helpful?	26.3%	21.43%	6.49%	29.87%	15.91%

Table 6. Breakdown of Student Responses to S\_Q1 - S\_Q3.

*“Students seem to be productive when I give them appropriate guidance, and or when they are working on a group project where they are self-directed.” - Instructor Survey Respondent 56*

*“I think the technology is hard for them—they have trouble opening links to worksheets. Without me being there to just state the instructions over and over sometimes people miss them, even if I visit the breakout rooms. Visiting breakout rooms also takes more time than it would in-person. Breakout rooms on the whole are more time-consuming than in-person class activities, with less success.” - Instructor Survey Respondent 56*

**4.1.2 Student Surveys.** The surveys were left open for one month and received a total of 556 student responses. After data cleaning, which involved removing incomplete responses and those that did not meet the following criteria: appropriate course number or valid college/university, instructor taking student survey, and those that did not answer if they used breakout rooms, left 496 responses for analysis. Of the 60 excluded responses (11% of our initial sample), 22 participants (4% total) reported that breakout rooms were not used in their online courses. Student respondent ages ranged from 18 to 56 years of age with an average age of 21.5 years. The majority of classes utilized Zoom (84.8%) as their videoconferencing method, with 4% utilizing WebEx, 3% Microsoft Teams, and 7% specifying they utilized Blackboard Collaborate. The majority of respondents identified their course being remote synchronous (77.3%), 13.6% hybrid, and 6.8% remote asynchronous.

Overall, the majority of students responded that their instructors utilize breakout rooms in every class (40%), 33% utilize them often, 17.7% sometimes, and 8% use them rarely. Students perceived instructors checking into their breakout sessions 73% with TA check-ins happening 25% of the time when a TA was present for the course. Our survey also asked students several Likert scale questions seeking to understand student perceptions relating to team productivity and efficiency, and how helpful breakout rooms are in their course, the questions and breakdown of responses can be found in Table 6. As shown, the majority of students agree that breakout room check-ins increase productivity, with the majority feeling neutral when asked if check-ins increased team efficiency. The majority of students also agreed that breakout rooms were helpful in their course.

**Student Success versus Instructor Involvement: Student Perceptions** – One of the most common things students commented on in our surveys and interviews (as shown in the subsequent sections) was expressing the need for instructors to set clear expectations for the breakout rooms and routinely checking in on students when the breakouts were in session. Having more general expectations leads students to mute themselves and work independently or not at all instead of working together with their group. Instructors who provided materials in an easily accessible and persistent format aided students when they needed more guidance.

*“Provide students with materials ahead of time. The instructor for this course would have discussion questions on a screen share within zoom, which wouldn’t be accessible within*

*the breakout rooms. Students didn't know what the discussion questions were.*" - Student Survey Respondent 72

Overall, there are many factors that influence student success in breakout rooms relating to instructor involvement. Involvement activities that students dictate they need from instructors revolve around setting classroom expectations, enforcing participation, and checking in with the student groups. These activities and resources from the instructor make students feel breakout rooms are more organized and provide means to combat social loafing from their peers.

**Student Perceptions of Breakout Rooms** – The final theme we identified is that student perceptions of breakout rooms are dependent on instructor involvement in the course, instructor knowledge of the online technology, and attitudes of other students. For student survey responses, much like the interview responses within subsequent sections, students felt classes needed to be reorganized to fit into the virtual space and not be a direct mirror of in-person classes.

*"Instructors don't know how to play to the strengths of breakout rooms. There is benefit to everyone having their own workstation and being able to communicate without moving their attention away from their work, but instructors are wholly inexperienced with this type of work and instead try (and usually fail) to mirror in-person instruction as closely as possible, leading to an experience that feels shallow and even fraudulent."* - Student Survey Respondent 181

Instructor experience is a factor in how students perceive breakout rooms and online courses in general. Instructors with more experience who are comfortable with lecturing and transferred that into online courses may have received less involvement from students than instructors who restructured their in-person courses to incorporate the online format and breakout rooms. Directly mirroring the structure of in-person lecture classes in an online format can lead to negative student perceptions of online courses.

## 4.2 Interview Results

We conducted interviews for this study over a period of one month alongside the surveys. From a total of 28, 13 interviews were conducted with instructors and graduate TAs from universities within the United States and 15 interviews were conducted with undergraduate students from universities within North America.

**4.2.1 Instructor Interviews.** Instructor interviews took place alongside the survey collection and all interviews lasted between 30 minutes and 1 hour. No interviews were removed from our analysis. Of the 13 interviews conducted, 2 interviewees were graduate teaching assistants while all others were teachers of record for the class(es) they taught. Instructor interview demographic data can be found in Table 5.

Questions asked during the interview sought to extrapolate more details about how instructors approach the use of breakout rooms - understanding if they did any research prior to choosing to use them in their class, how they use them within the class, and their perceptions of student involvement and engagement in their class' breakout rooms. The most common coded themes from the interview data surrounded instructor expectations of students, course preparation, and challenges and negative feelings of breakout rooms and virtual learning. Though a lot of negative feelings were coded, most instructors had no real issues with breakout rooms but they posed new challenges for their own preparation needs and for student adjustment.

Instructor expectations of students mirrors what they expect as though they were in-person. Instructors wanted to be able to see students but found that many chose not to have their camera on for many reasons. They also found that requiring cameras and microphones on did not work



for the class. Instructors feel that their students had a hard time finding a rhythm with their class, multi-tasked during class, and were overall fatigued, leading to unmet expectations for breakout rooms and online instruction.

**Levels of Pedagogy: Instructor Research** – The first theme we identified from our interview and survey data relates to the levels of pedagogy research instructors sought when planning their online courses. Three levels of pedagogy were identified from the data – no research or prep work was done, a high-level understanding of teaching online or understanding the technical aspects, and a more-involved level where instructors conducted formal research into conducting virtual classes.

No research into the pedagogy behind online teaching or breakout rooms was the most common level of involvement from instructors. Instructors were varied in their reasoning behind their decision to not research online teaching, stating that their time was restricted or that the COVID-19 pandemic was ephemeral so converting their course into an online format was not necessary due to the expected return to in-person classes.

*“So yes, I would love to do that (online classroom research). No, I don’t have the time.” - P10*

*“And something that I have explained to my students is that [this] University is not an online university. This is not an online class. And so it is not set up in the best way to be an online class. If this was an online class, I would absolutely be doing everything differently.” - P4*

The second level of involvement in pedagogical research was to gain a high-level understanding of the breakout rooms and how to use them within the course. Instructors utilized university-provided training and materials, social media, and learning from others in their department to help inform their decisions within their online classrooms.

*“I didn’t dive a lot into the literature. I read articles that friends posted on social media. But I also took advantage of the university material where they were doing virtual hands on training. And I just gone through an active learning workshop summer program about two years ago, and a lot of that helped inform what I was doing in the breakout rooms.” - P12*

*“Other than trial and error, not really. I’ve talked to I was one of three TAs in that class over the main part of the year, and we talked quite a bit about what worked and what didn’t work for that week. But every week was different a different type of thing that they were doing. So really, everything was just completely new to everybody.” - P11*

Lastly, the most involved level is researching virtual classrooms or beta-testing strategies before students enter the classroom. March 2020 was when COVID-19 hit full-force in the U.S., causing many universities to extend Spring Break in the hopes of gaining more time to make informed decisions [61].

One instructor interviewee chose to utilize this additional time to ensure that their course was ready to be taught in a remote fashion. In addition, another instructor interviewee had been teaching online and using breakout rooms in their courses at least 4 years before the COVID-19 pandemic disrupted classrooms across the world and was well prepared to teach their courses online.

*“And so when this all went down, I literally pulled together a group of my graduate TAs in all my classes and said we got to test this we have to test Zoom, we have to test WebEx, we have to test all these different things - avenues for online delivery we have and then the*

*whole grading thing, right? These assignments have to be graded remotely. So we did beta testing on that all within a two week period during spring break. And we really worked hard. And we found out some really cool options that work really well.” - P9*

*“I have done plenty of research and training into group activities in general. And so that’s why I am not doing anything that I wouldn’t normally be doing in an in-person class in terms of group settings.” - P1*

We conclude from our findings that these observed levels of pedagogy factor into student success and perceptions about the use of breakout rooms within online classrooms, as well as impacts how well students participate within the class as a whole. For example, instructors who better understand the online format and breakout rooms might better structure their online course which makes the class more enjoyable for students. We also looked at instructor expectations within the classroom and note that more-informed instructors may set clearer expectations for students within breakout sessions. We also note that instructors within the most involved level of pedagogy research may set their classes up in such a way that better encourages students to participate and work together within breakout sessions.

***Student Success versus Instructor Involvement: Instructor Experience*** – Within our interviews, we found that all instructors were involved with their breakout room sessions. Most interviewed instructors set clear expectations for their breakout rooms, allowing their students to know exactly what is expected of them and what they are to accomplish working together.

*“Because they’re in a zoom breakout room, you’ve got to visit those rooms much like you would if you had the breakout groups in a lecture hall, you’ve got to bounce in the hall and talk to everybody.” - P9*

*“So they always go in with a very specific set of instructions, that’s why I’m not spontaneous about it. They go in with a specific set of instructions, what they’re supposed to be doing in their breakout session and what they are supposed to have achieved.” - P4*

Many instructors pop through the breakout sessions to check-in on the students and see if there are any issues, where other instructors will utilize collaboration tools such as those within the Google Drive suite (e.g., Docs, Slides, Sheets, etc.) to monitor their students’ progress on the assignment by assigning one breakout room group to one slide or page within the document to complete their given assignment.

*“I’ll have some kind of small lecture about whatever we’re talking about. And then I’ll give them the activity. ... So I’ll give them a prompt, I’ll usually attach whatever the prompt is in the chat. So everyone can download it and have it on their own screens. I mean, for ones where we do our tracking them in Google Docs, kind of simultaneously, we’ll share that link and kind of tell them what we expect.” - P1*

Within classrooms where instructors defined clear expectations for their students, instructors find that the majority of their breakout rooms have their cameras turned on and microphones are unmuted.

*“So what I know, when they’re in the main room with me, they’re half on half off. ... The smaller group, all the cameras are on, but when they’re in the larger group with 50 plus students in the main room, half the cameras are off.” - P6*

*“But yes, when I jumped through breakout rooms, the majority of them have cameras on are unmuted and are on task, which is kind of like the trifecta that I look for.” - P2*

However, there are some instructors who set expectations for breakout rooms where they find that most students work independently or without their cameras on and microphones muted.

*“So collaboration is the expectation. While there’s no way for at least my type of assignments to positively enforce collaboration, it is the underlying expectation that they work together during these Breakout Room sessions.” - P3*

**Instructor Perceptions of Breakout Rooms** – The next theme we identified is that instructor perceptions of breakout rooms. Data was mixed and we found that perceptions are dependent on the class content and types of students within their course. A common theme within instructor interviews is that the course content either lends itself to breakout rooms or not as well as student type affecting the utilization of the breakout sessions. Instructors also mentioned within our interviews that the class level of students tended to be a factor in their success when using breakout rooms.

The quotes from P4, P6, P13, and P10 below show that instructors notice that student maturity and personality levels influence their classrooms to an extent. P4 is talking about a senior-level course where students are required to collaborate on a semester-long project together to pass. This quote implies that senior-level students are mature enough to understand the severity of non-collaboration within collaborative courses. However, the quote from P13 recognizes that there are differences in student personalities within their classroom and this particular class does not interact with each other within breakout sessions. P10 also notes differences in student types within their courses so they utilize peer evaluations for their course assignments to keep all students accountable.

*“...at the 4000 level, if they don’t collaborate, they won’t pass. And if they don’t pass, they don’t graduate. And so that the course is designed that it so much of their grade is dependent on collaboration. And particularly in the capstone version, when we do have teams that we struggle with in the communication area, those are the teams that struggle in the course overall, that we consistently find are not engaging with each other during that time.” - P4*

*“...but with the freshmen, it has to be very highly structured, they don’t really know each other that well, they’re, they’re in gen ed classes, they haven’t really started to cohort enough where they’re with the same people all the time, and they get to know each other. So it depends on the level of students, juniors and seniors. By the time our nursing students are seniors, they get it.” - P6*

*“I would prefer more student interaction. But I don’t think that that’s really due to the breakout room that’s due to a lot of student personalities, in many cases.” - P13*

*“Yes, because otherwise, you’re gonna get a lazy student who’ll ride on coattails. And you also get some students who think that they’re working hard, and they have no idea that they’re not.” - P10*

The quote from P6 below notes that the instructions students receive need to be very structured, which is also corroborated in our student interviews within the next section.

*“I don’t know if student maturity, but they certainly need direction, they need very highly structured directions regarding what is to occur in the breakout, very structured, I think it just needs to be, I don’t necessarily know if it takes maturity or not.” - P6*

These data show that not all courses are suited to be taught in an online modality or even be suited for breakout room usage. Lower level courses that are more content-heavy might not lend

themselves to the use of breakout rooms due to time limitations. P1, who teaches both lower- and upper-level courses, notes that in one of their lower-level courses, there is no time to have group activities. They also note in their interview that there is a difference between what is taught in upper-level courses and lower-level courses, leading to a shift in course structure in general since lower-level courses are more ‘content heavy’ and upper-level courses are more ‘practical application.’

*“So like, I have a one credit hour freshmen level Biology class, that’s very much like content heavy. And because there’s only one credit hour, 50 minutes a week, and I got to get through a lot of stuff. So I just don’t do group activities in that. So I wouldn’t even probably consider using breakout rooms in there.” - P1*

Other factors limiting use of breakout rooms in undergraduate classes include the up-front time investment for instructors to research the best ways to utilize breakout rooms for their course as well as the need for instructors to be more hands-on in the classroom when incorporating breakout rooms. When we asked students how often their instructors check-in on them within breakout sessions, the majority (36.9%) stated that instructors only checked in sometimes while 17.8% stated that they checked in always, and 13.7% said they checked in rarely. Instructors felt the same, with the majority (30.8%) stating that they check-in often within breakout sessions, 29% always check-in, and 12.2% rarely check-in. In addition, many survey respondents and interviewees mentioned classes utilizing shared documents such as Google Docs with student groups to monitor their progress and assess teamwork.

*“I can drop in on the groups, which I do, but I can also pull up the Google Docs, and have those on with the Google Docs, I set them up so that anybody who’s got the link can edit. And so I’ve got them, I’ve already got four or five of them set up on Canvas at the beginning of semester and say, okay, if you’re in group one, go to Google Doc one, room two, Google Doc two, etc. But that’s a really easy way to monitor – and they know I’m monitoring, which means they can use it also, as its kind of as a chat environment. And I can drop in, and if I see something that’s off, I can go and correct it in within Google Docs. But I do also drop into the rooms, because... because students... try to keep them on track.” - P12*

Overall, there are many factors that influence how breakout rooms are used and perceived within online courses by instructors. Student type is a large factor in the success of breakout rooms, with less mature, motivated, or sociable students leading to less successful collaborative breakout sessions. Students may also categorize specific classes as ‘unnecessary but required,’ meaning that they must complete the course to get their degree, but may not put their full effort into learning the material. Another factor found within this analysis was different types of course content utilize different teaching strategies that may or may not be able to utilize breakout rooms effectively. Many of our interviewees noted that there is a difference in course content for upperclassmen versus intro level courses and that the content either allows for use of breakout rooms or not.

**4.2.2 Student Interviews.** Student interviews took place during the same time frames as instructor interviews and alongside the survey collection. We interviewed 15 undergraduate students from North American universities. We provide their demographic data in Table 6.

Questions asked during our interviews, similar to those of the instructor interviews, sought to extrapolate more details about student perspectives of the use of breakout rooms by instructors - understanding the structure of breakout rooms, instructor involvement, and room inter-personal dynamics. The most common themes to arise from the student interview data surrounded the type of activity the breakout room was used for, interpersonal challenges faced in breakouts, as well

as positive and negative perceptions of the rooms as a whole. Though many negative feelings are expressed throughout the themes, students felt that, with improvements to their online learning environment, they could see breakout rooms and virtual learning more positively if changes occurred.

Students commented they participate in breakout rooms for discussion, group assignment, labs, and general socialization purposes. For three of our participants they acknowledged their instructor would open breakout rooms at the end of class as a means of socialization and this was well received as a general benefit to make the class more like in-person sessions where you could talk with classmates after lecture. These gave students the opportunity to see and socialize with others to have a “real connection” and commiserate about class with someone virtually.

Even when given an opportunity for socialization, student participants felt they still faced interpersonal challenges with groups when tasked with discussion, assignments, and labs. Social loafing and lack of participation are the most common challenges, especially for those whose breakout co-participants would leave when rooms open or never showed up to class. Students felt there was no accountability for non-participation. For our participants, many expressed that they took on a leadership role in the breakouts to try and facilitate engagement or to encourage equal participation. Others expressed that they wanted more input or justifications from instructors for the breakout rooms.

*“If the instructor comes into the breakout room, and everyone’s just sitting there, everyone’s on mute, the cameras are off, it makes you as students look bad. So I think that [checking in] does help provide some accountability.” - S14*

*“I think the biggest thing is the lack of direction in a room, it’s not feasible, obviously, to have a TA in every single breakout room, but [instructors] need some sort of way to ensure that there’s a driving force.” - S11*

Students gave feedback on the aspects of breakout rooms they disliked and liked within our interviews and surveys. Many students found the format of virtual learning to be easy to get distracted from, more so when student participation and engagement is low or non-existent. They found engagement difficult when instructors give no instructions or “unstructured” and directionless assignments for the breakout sessions.

Things our student participants like about breakout rooms often revolved around check-ins from the instructor, a less intimidating environment, and practice working with people they may not typically work with. Check-ins often were helpful to continue the discussion and way the students felt kept them on track with the assigned task in the breakout room. Many found the rooms were less intimidating compared to the main room and were more informal allowing for natural discussion. One participant also noted that they felt more comfortable asking a question to a small group and that they felt that it was less of an interruption than if they asked in the main session. These small groups also enabled some participants to better formulate and discuss ideas with others that are different from them. Finally, though it was an overall negative for the participants, several thought that working with a group in a random assignment or with loafing teammates helped them to “create a strategy” for working with people they may not like or know well.

***Student Success versus Instructor Involvement: Student Experience*** – One of the most common things students commented on in our surveys and interviews was students expressing the need for instructors to set clear expectations for the breakout rooms and routinely check in on students when the breakouts are in session.

Having unknown or generalized expectations leads students to mute themselves and work independently or not work at all with their group. Instructors who provided materials in an easily accessible and persistent format aided students when they needed more guidance.

Much like our interview data show, student survey responses also indicated that students wanted instructors to set clear expectations for the breakout rooms and would routinely check-in with the student groups.

*“I would say sometimes it was a little difficult. I have ADHD, and like, didn’t you know, sometimes it’s just too much when the teacher says something. And like, even when they write it down, it sometimes isn’t really clear, even though they say it clear, rather than on what they write. So I’d say some, I think a lot of times, I’d be like, what’s going on like our to ask, you know, my classmates because I genuinely, like, I’d zone out or something. So I found like, that definitely was like debilitating in a sense of like, feeling really stupid. ... And other times, like, it was good that the teacher did put the questions in the chat, but again, it was sometimes very hit or miss on that.” - S5*

**Student Perceptions of Breakout Rooms** – A common theme of instructor involvement is discussed above, and factors heavily into the student experience in a class and therefore their perceptions of the use of breakout rooms in a class. Students who are loafing, fatigued, or have negative attitudes in breakout rooms make the overall experience for their peers lesser. Instructors who do not foster or enforce engagement as well as provide feedback about breakout rooms encourage social loafing from their students within breakout sessions.

*“Instructors can’t really force students to be engaged, they can do something structurally to try to encourage it. But like, at the end of the day, like it’s all dependent on the students.” - S1*

*“I think the most engaged I ever was in a breakout room... It’s when you’re the leader, so you have to participate.” - S10*

*“Whenever a teacher mentions the word breakout rooms, everyone goes into a panic, like, no, no, we don’t want to. They’re not fun, and they’re not inherently fun. I get why they’re used. And it’s always that worry of, are people going to start talking? I didn’t like the waiting game of who’s going to talk versus someone gonna turn on the camera, who’s going to unmute, it’s a waiting game. And a lot of people don’t want to play it and they just don’t do anything.” - S15*

Additionally, students were introspective and admitted that online formats make it easier for them to get distracted or multitask during class.

Students expressed feelings that negative outlooks by instructors also led them to have negative feelings about online learning and breakout rooms. S4 explains how he enjoys the concept of online learning and breakout rooms, but feels like his instructors do not share the same sentiment.

*“Online courses are good. They’re not inherently bad. Yeah, so I just really wish professors would stop treating them as inherently bad. Yeah, it’s a they come in with this defeatist mindset, and it becomes a self fulfilling prophecy. And then they use it to justify it themselves. And it makes me sad.” - S4*

They also felt like instructors attempted to use online learning tools to precisely mirror in-person class, which they felt leads to an optimized and disorganized experience. Again, S4 explains how his experiences were shallow and felt like they could have been better.



*“The professor gives you time in class where they expect you to work with other people on something is very much emblematic of, of a professor who is just trying move their in person class to an online format as opposed to designing an online course, you know, the, the better and more effective online experiences I’ve had have either not used to breakout rooms whatsoever, or have used them in a considerably different format.” - S4*

Other students also commented that technical limitations of video conferencing software made it difficult to be seen by an instructor or find ways to ask for assistance. Hand raise features would go unnoticed or students would be unsure if the instructor was helping another group. S11 comments on how lack of features or awareness of where their instructor was often left their group at a standstill when help was necessary.

*“In breakout rooms, you have to message the professor or put your hand up or do some sort of indication and then wait several minutes, which I think can be really detrimental [to participation].” - S11*

Overall, students were receptive to the use of breakout rooms but their perceptions skewed negative due to influences of distractions, instructor negativity, and other students behaviors. We feel these perceptions might be influenced by student maturity and the type of class in which they are attending. Class type may not be suited to online modalities and breakout rooms might be used inefficiently. Additionally, instructor experience, years teaching, and technology comfort levels are also a factor in how successful breakout rooms can be, if instructors have little experience teaching or are uncomfortable with the technology, then breakout sessions may be unsuccessful leading to negative student perceptions. To combat this, instructors might need to be more involved in researching pedagogy and planning for online instruction methods, be more proactive in encouraging participation, and fostering classroom repertoire to gain feedback from students about the instruction methods and the participation of their peers in breakout sessions.

## 5 DISCUSSION

In this paper, using thematic analysis we identified four themes (Table 3) surrounding breakout room usage — levels of pedagogy ( $RQ_1$ ), student success appearing to be dependent on instructor involvement ( $RQ_2$ ), instructor and student perceptions of breakout rooms ( $RQ_3$ ). In the following sections we breakdown observed phenomena within these themes and provide evidence to support the phenomena within the themes. We discuss the implications of our findings for extending current CSCW and HCI studies on distributed teamwork, remote learning, and collaboration software. Due to 40% of instructors stating they use breakout rooms on a daily basis, we have incorporated our recommendations to better implement breakout rooms to maintain student engagement based on our findings. Implementing some of these recommendations will have a positive impact on perceptions of and engagement within breakout rooms. Throughout each section we also outline potential design recommendations (Table 7) for addressing technological challenges and limitations of current collaboration software.

### 5.1 Instructors’ Research Efforts in Online Pedagogy

As noted, there has long been established interests in methods and frameworks for teaching and influencing teamwork in student teams [14, 21, 29, 42, 51, 57, 76, 90], as well as established interest in collaboration technologies to facilitate teamwork [6, 46, 55, 89]. However, with the increase in distance learning and the need for distance collaboration, this study endeavors to understand the necessary levels of pedagogy and understanding to convert a face-to-face or in-person collaboration-oriented class into distance collaboration, as it relates to our  $RQ_1$ .

Improvement	Description
Justify Breakout Sessions	We recommend ensuring that breakout rooms are necessary for the task, providing students with clear instructions before opening the rooms, and ensuring the time needed in the breakout room is justified for the assignment.
Monitor Participation	Implementing collaborative software gives the students persistent access to the material as well as a common place to work with the ability for monitoring.
Provide Persistent Instructions	Providing students with breakout room instructions in multiple formats gives students confidence in what is expected from them during and after the breakout rooms.
Research Online Teaching Strategies & Tips	We recommend learning the technology that will be used for classes and test that technology with peers or a small student group to understand all features.

Table 7. Recommendations for improving online learning experiences.

Our findings highlight that students were able to see where instructors who did not put effort into understanding the collaboration software or attempting to directly mimic face-to-face classes in collaboration software, and felt that this was detrimental to their own success. Instructors also were able to notice when their methods and teaching practices caused student motivation and attitudes to drop, and some of our population, as well as identified in recent research, altered their course formats to better serve their students and make distance learning and teamwork more feasible [3, 60, 78]. Those that made changes and took student feedback about class formats resulted in a more positive outlooks of breakout rooms and online collaboration.

Existing human factors research on teamwork in academia reveals that research on teaching teamwork to undergraduate students is inundated with papers from engineering disciplines [22, 31, 33, 36]. In our paper we focus on how teamwork is facilitated within most disciplines offered by universities and with these recommendations and subsequent evaluation of teaching methods this may significantly improve academics abilities to foster teamwork and collaboration in a distributed setting on a larger and more diverse class scale.

**5.1.1 Recommendations for Mitigating Negative Reactions of Online Learning.** Instructors are mixed in their feelings toward online learning, as well as students. However, students point out that they felt that they were getting less of an education and developing their own negative perceptions of online learning from instructor unpreparedness, negativity surrounding online learning, and not enforcing student participation within breakouts, as 47% of students felt that breakout rooms in their courses were not helpful. Overall instructor experience, course subject, and willingness to adapt are all factors contributing to students' negative perceptions and attitudes towards online learning.

To better migrate to online education and potentially provide students with a better experience, we recommend for instructors to learn the technology that will be used for classes and test with peers or a small student group to understand all features. We also note that students and instructors might be experiencing "zoom fatigue," and recommend, as Peper *et al.*, does to encourage camera use and incorporate creativity as a means to deter multitasking [68].

We recommend that instructors research online teaching strategies and tips if continuing distance learning, having a better understanding of virtual classrooms and online collaboration methods, as well as taking feedback from students about methods used in class. Additionally, we recommend that instructors be flexible in an online environment for students who might be struggling to include flexibility in class as well as with office hours and outside of class assistance.

## 5.2 Involved Instructors Encourage Student Success

There is a small focus on student experiences during teamwork-based course projects in HCI [44, 54, 80]. Although there is focus on students' team project experiences, there is little research on instructor involvement within students' team projects [45]. Our study strives to investigate how

instructor involvement within breakout sessions affects the success of their students, relating to  $RQ_2$ .

From our results, we found that students expressed a need for instructors to set clear expectations within the breakout sessions and to routinely check on students when breakouts are in session. About 22% of student survey respondents noted that their favorite part of breakout rooms was socializing with their groupmates or taking a break from lecture. Many student respondents found the format of virtual learning to easily allow distractions, more so when participation and engagement is low or non-existent. They found engagement difficult when instructors give no instructions or directionless assignments for the breakout sessions, such as “discuss the chapter.” When clear expectations are given, students are more confident in their abilities, turn on their cameras and microphones, and work together within the breakout rooms which is similar to the findings of [48] and [65]. Within our findings, instructors noted increased participation from students when they were provided with detailed, persistent instructions before entering breakout rooms. From this, we recommend providing persistent instructions to students before they enter breakout rooms as described in the section below.

*5.2.1 Persistent Instructions are Key.* We found that accessibility of instructions ties into students perceptions of instructor expectations and communication which overall affect their ability to collaborate and work as a team with other students in their breakout session. Providing students with persistent instructions was brought up by both instructors and students. Students noted that having the instructions within the breakout sessions was ideal, allowing them to refer back to the provided instructions when confused. Students who were not provided persistent instructions, when asked what instructors could do to improve the breakout room experience, requested that instructions were provided in multiple formats that are viewable within the breakout sessions such as through chat or a collaborative file. Possibly due to lack of understanding the software in use, instructors would leave up discussion questions on screen in the main room when sending students to breakouts, potentially unaware that students did not have a copy of the instructions. Instructors provided persistent instructions through multiple mediums, such as on their learning management system, in the chat, or through a collaborative software such as Google Docs or GroupMe which allowed students to access the instructions within breakout sessions.

Providing students with breakout room instructions in multiple formats gives students confidence in what is expected from them during and after the breakout rooms. Instructors who utilize collaborative softwares such as Google Docs or Google Slides also have an additional benefit of being able to monitor how well their students are working on the assignment without entering the breakout rooms. Other tools instructors utilized included Discord and GroupMe to provide a way for students to communicate with each other and the instructor, interact with the course, as well as a way for the instructor to distribute assignment instructions.

*“With Discord, I can form \*persistent\* “rooms,” consisting of 1 or 2 voice channels, and 1 to many text channels. Groups typically join an appropriate voice channel and text channel, and communicate there. Text chat is incredibly rich, allowing text, images, sound, computer code, editing, polls, tagging others, replying to comments, and so on. Anything text is preserved the entire semester. Voice chat allows for quick and easy mic communication. Window/screen/camera sharing is also native and free.” - Instructor Survey Respondent*

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In addition to students wanting clear expectations within breakout rooms, students expressed concerns about their peers who did not pull their weight within breakout sessions, or those who were loafing. Student loafing and overall maturity, although not new to online courses, can emerge from lack of interest in or requirement to complete a course and can affect how others perceive

specific courses – especially in courses where groupwork is a requirement. Instructors expressed concerns about how different monitoring the breakout sessions are compared to monitoring in-person student groups. However, some recommendations from instructor interviews gives insight into utilizing collaborative documents, such as Google Drive, as a way to actively monitor all groups during a breakout session. In addition to actively seeing who is currently typing, instructors can also utilize the version history to see who participated in creating the document. Our recommendations for instructors on how to monitor participation within their breakout rooms are discussed below.

### 5.3 Notable Insights into Online Learning Through the Lens of an Instructor

Connecting to  $RQ_3$ , emphasis on instructor perceptions provides greater context and understanding of the phenomena in breakout rooms and virtual classrooms. The most notable perceptions of instructors were course content and class level being translated into virtual learning situations, monitoring participation, and perceptions about the behaviors and attitudes of students.

*5.3.1 Class Content and Student Maturity.* Instructors indicated differences in their varying class-levels of courses, as well as the course content not being appropriate for breakout room usage and even some believe that it is not appropriate for online learning at all. Notably, instructors who taught lab sections of class that required hands-on experiments required the most drastic changes and noted that, due to the circumstances, students may not be getting everything they need out of the hands-on portion of the course.

Oakley *et al.* noted in their study that student satisfaction increased when less mature or motivated students left the course [65]. This was corroborated through our instructor interviews, with some instructors mentioning students' overall class and maturity levels being a factor in their success using breakout rooms. Instructors notice that student maturity and personality levels influence their classrooms to an extent. P4 talks about a senior-level course where students are required to collaborate on a semester-long project together to pass and implies that senior-level students are mature enough to understand the severity of non-collaboration within collaborative courses. However, P13 recognizes that there are differences in student personalities within their classroom and their particular class does not interact with each other within breakout sessions. P10 also notes differences in student types within their courses so they utilize peer evaluations for their course assignments to keep all students accountable.

*5.3.2 Mitigating Student Loafing in Online Courses.* Instructors expressed concerns about monitoring students the same as they would in an in-person session. With the current videoconferencing software that most instructors were using, they were unable to get a high-level overview of the progress and status of their groups. Instructors also expressed how difficult it was to address all groups in a meaningful and apparent way without bringing them back into the main room and then sending them back into the breakouts.

P12 encountered this same issue and implemented a work around, by utilizing Google Docs, that he felt enabled him to monitor the groups, have the groups know they were being monitored, and felt like it encouraged teamwork and collaboration, while also leaving the option open for checking in with the group by joining the breakout session.

Instructors implementing collaborative software gives the students persistent access to the material, a common place to work without having to have a student take initiative to make a shared document, and gives an additional means of monitoring, check-in, and communication venue to help students stay on track. We recommend that for instructors who feel like they are unable to monitor groups when given a worksheet or activity to create a shared and persistent document for students to collaborate on. We also recommend to inform students that they will be monitored

through these sheets and to encourage cameras on and microphones to facilitate working together on the document.

#### 5.4 Student Observed Difficulties in Online Learning

Overall, student perceptions of breakout rooms provides greater insight into how breakout rooms are being utilized within the classroom, relating to  $RQ_3$ . From our findings, students wanted better monitoring to weed out their peers who were loafing, breakout sessions that were justifiable to the activity they were completing, and, during fully-online classes, an amount of time allotted to socialization.

*5.4.1 Accountability within Breakout Sessions.* Videoconferencing software, such as Zoom, only allows for an instructor or TA to be in one breakout room at a time, leaving all other breakout rooms unattended. This allows for students to get off-topic, not participate, or forces a collaborative assignment to become an individual one instead. A large problem noted by students is that within breakout sessions, many of their peers expect the others to complete the collaborative assignment, leading to an overall issue of social loafing within the breakout sessions. About 25% of student survey respondents wanted instructors to check-in with their groups and to enforce participation from all group members. Students’ behaviors and attitudes impact the perceptions of their classmates [11, 19]. Additionally, students are aware that they are responsible for their own learning and that they benefit from also supporting their peers’ learning [11]. Many students brought up within their survey and interviews that they wanted instructors to hold the loafing students accountable for their inaction on the assignments. Peer social loafing forced many students to overwork themselves on collaborative assignments, leading to a loss in motivation for those doing the work.

From our surveys, 47% of students indicated that instructor check-ins helped increase team productivity within their breakout rooms. About half of our instructor survey respondents conducted regular check-ins, based on these numbers our recommendations for instructors to mitigate social loafing within breakout rooms include utilizing collaborative documents to monitor all breakout groups at once, conducting check-ins for each group during each sessions of the breakouts, and enforcing all students to participate on the assignment.

*5.4.2 Justify Breakout Sessions.* We found that students appreciated the use of breakout rooms to foster socialization and teamwork within their classes. The majority of student responses stated that the breakout rooms in their course were utilized for open-ended discussions or group-work to solve course-related problems. However, at times students feel breakout rooms are unnecessary or forced to fit into lectures, are too long or too short, or that the assignments within breakout rooms are too vague or unclear. Previous research shows that providing students with specific tasks to complete allows them to stay on track [91]. Instructors also noted struggling with breakout room length and assigning unclear instructions or tasks. When asked how instructors can better utilize breakout rooms, students wanted clearer instructions for their assignment or task, group or team-based assignments instead of individual ones to encourage teamwork, and for instructors to set the breakout room length on the amount of time students need to finish the task or assignment. Others noted that attention spans are limited, so providing multiple breakout room sessions to break up lecture material are ideal to keep students engaged in the content.

Overall our recommendations for use of breakout rooms in an online course include ensuring that breakout rooms are necessary for the assignment or task, providing students with clear, detailed instructions before opening the rooms, provide collaborative assignments, and ensuring the time needed in the breakout room is justified for the assignment.

## 5.5 Design Implications for Online Learning Tools

In addition to asking for recommendations to improve the overall online learning environment, we asked instructors and students what features they wanted within their videoconferencing tools. There were two main requests from instructors, breakout room participant entry auditory cues and additional breakout room monitoring features, defined in Table 8. Students also felt that entry auditory cues would be helpful to know when an instructor has entered their session.

Improvement	Description
Auditory Cues	Recommend incorporating an auditory cue for breakout room participants to ensure they are aware when someone enters their breakout room.
Additional Monitoring Features	Recommend incorporating a feature that enables a host to message all breakout rooms more apparently, be able to direct message outside of the breakout rooms, and a way to cancel closing breakout rooms.

Table 8. Recommendations for improving online learning tools.

*5.5.1 Auditory Cues.* A concern for both instructors and students involved lack of awareness of instructor check-ins. P3 mentioned that during their breakout room check-ins, their students were noticeably unprepared to have a discussion with the them during the breakout rooms. S4 noted that their instructor did not make their presence known within the breakout rooms and they would often miss when the instructor entered their breakout session. When missing the cues of an incomer to the session, students could feel a violation of privacy or feel like they may not want to be as vocal knowing there might be an intrusion to the conversation at any given time.

Another situation that was brought up within instructor interviews included students expressing negative views about the instructor or the course while the instructor entered their breakout session and the student did not that the instructor had entered their breakout and continued talking. Both P12 and P6 entered breakout rooms where their students were expressing negative views about either the instructor or the course without the speaking student realizing.

To mitigate both of these issues, we recommend that videoconferencing tool designers incorporate an auditory cue for breakout room participants to ensure they are aware when someone enters their breakout room. As an example, during Discord voice chats, when another user enters or leaves a chat channel, a short noise is heard by all participants to inform other participants that another user has arrived or left.

*5.5.2 Additional Monitoring Features.* Instructors and students both highlighted several deficiencies in the videoconferencing software that were limitations of the software itself that caused frustrations and miscommunications. Instructors noted several road blocks of communication with their students - the ability to direct message (DM) the instructor(s), more apparent announcement notifications, and ease of moving between breakout rooms. In addition to these features, being able to cancel closing or opening breakouts was found to be a pain point in setting up breakout sessions, as well as a lack of ability for large picture monitoring of all open breakouts.

We recommend that videoconferencing software incorporates a feature that enables a host to message all breakout rooms more apparently, be able to direct message outside of the breakout rooms, and a way to cancel closing breakout rooms. Additionally, we encourage the adoption of breakout room monitoring capabilities in videoconferencing software for those who do not use third party solutions like providing a shared document where one can see all the activity.



## 5.6 Limitations

There are limitations with this study design, similar to most other research involving surveys and interviews. First, our survey was only distributed online, reaching only people in social media communities, though we argue that the demographics of these platforms align closely with the demographics that we intended to survey and interview. Additionally, the demographics of our student interviewees may not generalize well due to the majority identifying as male and being within STEM disciplines. Next, similar to all survey and interview research, respondents may leave out important information resulting in non-response bias. Survey responses were collected over a period of time to include during semester classes and during summer break, details about the class as a whole could be forgotten or otherwise left out. However, we ask for the general overview of the use of breakout rooms and not ask for intimate details of each breakout room a respondent took-part in. Other variables to consider are volunteer bias and unintentional bias which may also skew the results of our data due to the self-selection nature of our surveys and previous experiences with online education and breakout room use. Finally, since our data was collected only over a short period of time and as a relatively new practice for many of our participants, we cannot guarantee that these same perceptions would hold true over an extended period of online education and learning. A long-term study of breakout room usage would enable us to see if these perceptions of teamwork and breakout room usage extend unto long-term trends.

## 6 CONCLUSION

Online learning has become more prominent due to the COVID-19 pandemic, bringing breakout rooms and their challenges into virtual classrooms. This paper presented a study of teamwork in virtual classrooms across North America. The research team collected both survey and interview data from instructors and students to determine how breakout room teamwork was perceived. From our data, we identified four broad themes including levels of pedagogy, instructor involvement influencing student success, instructor perceptions of breakout rooms depending on class content and student type, and student perceptions of breakout rooms dependent on instructors. We presented three research questions, which were all answered positively by the research team. Overall, breakout rooms were found to encourage teamwork within virtual classrooms and we extend CSCW research on distributed teamwork and online education.

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**A SURVEY QUESTIONS**

	Student Survey Questions		Choices	
How much guidance did you receive from your instructor or TA before entering the breakout rooms?	A lot	Some	None	
Did your instructor check-in with your group in the breakout sessions?	Yes	No	N/A (No TA for course)	
Did your TA check-in with your group in the breakout sessions?	Yes	No		
How often did your instructor or TA check in with your group?	Always	Often	Sometimes	Rarely
Did the instructor/TA check-ins increase your team's productivity?	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Strongly Disagree
Did the instructor/TA check-ins increase your team's efficiency?	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Strongly Disagree
Did the instructor/TA check-ins keep your team on track or focused?	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Strongly Disagree
Overall, how satisfied were you with your instructor/TA check-ins within breakout sessions during this course?	Extremely Satisfied	Somewhat Satisfied	Neither Satisfied nor Dissatisfied	Strongly Dissatisfied
Are breakout rooms in this course helpful?	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Strongly Disagree
My group _____ works together within the breakout rooms for this course.	Always	Often	Sometimes	Never
How well did your team collaborate within breakout rooms?	Extremely Well	Very Well	Moderately Well	Not Well At All
Were there people on your team who did not pull their weight?	No	Yes, 1 person	Yes, 2 people	Yes, 3 or more people
Do you think your team would have worked better together in person?	Definitely Yes	Probably Yes	Might or Might Not	Probably Not

Table 9. A subset of the student survey questions and answers.

	Instructor Survey Questions		Choices	
Have you noticed students leaving class entirely once breakout rooms open?	Yes	No	Sometimes	Never
How frequently do you check-in on students in the breakout rooms?	Always	Often	Rarely	
During these check-ins, do you perceive that students are working together?	Yes	Sometimes		
Do you notice, on average, that most students turn their cameras on within breakout sessions?	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Strongly Disagree
On average, do you notice that most students unmute their microphones within breakout sessions?	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Strongly Disagree
On average, do you notice that breakout rooms being silent when you enter them?	Definitely Both	Only Share Screen	Only Whiteboard	Unknown
Are the share screen and whiteboard options available to students within breakout rooms?	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Strongly Disagree
If so, are students utilizing these tools within the breakout sessions?	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Strongly Disagree
Within breakout sessions, do you notice students working together to complete the assigned work?	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
If they're not working together, are students working independently within the breakout session?	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
Do you notice that nearly all members of the breakout session contribute equally to the assigned work?	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
Do you think that breakout rooms are contributing to the overall learning and success of your students?	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Strongly Disagree
Are students effectively working together as teams in the breakout rooms?	Yes	Maybe	Somewhat Disagree	Strongly Disagree
Please elaborate on why student teams are/aren't utilizing breakout rooms effectively in your class(es).	Fill-in			

Table 10. A subset of the instructor survey questions and answers.



## B INTERVIEW QUESTIONS

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### Instructor Interview Questions

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Demographic Information - name, age, gender, years teaching, college name, state/country, discipline  
 How do you teach in the online classroom? (e.g., flipped, lecture, group work)  
 What is the main type of content that you teach in your class?  
 Do you use breakout rooms in your classes? How often? For what activities?  
 Please explain how you set up your lecture to incorporate breakout rooms.  
 Please explain the process of initiating breakout rooms through closing the breakout rooms.  
 Are breakout rooms suitable for the way you like to teach in the online environment?  
 How do you assign breakout rooms? Are they pre-assigned for each class?  
 Have you found any challenges with using breakout rooms?  
 Do you think students are using the breakout rooms as you intended?  
 Do you check-in on students in breakout rooms? How often? What do you typically find?  
 Are there any examples of teamwork or effective collaboration you have seen in your breakout rooms?  
 Do you notice any role assignments between group members in a breakout room?  
 Have you done any research into pedagogical methods for using breakout rooms?  
 Are there any features of breakout rooms that you wish you had?  
 Are breakout rooms suitable for the way you like to teach in the online environment?

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Table 11. A subset of the interview questions asked to instructors.

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### Student Interview Questions

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Demographic Information - name, age, gender, years in college, college name, intended major  
 What classes would you like to talk about breakout rooms for? Are these classes in your major?  
 How often were breakout rooms used?  
 Can you give a high level overview of how your class was structured?  
 Please explain the process of entering through exiting the breakout rooms.  
 Did you receive instructions for the breakout rooms? How were they provided?  
 Did the instructor or TA ever check in with you in the breakout rooms?  
 Do you feel like your group worked together well during this course in the breakout rooms?  
 What do you like or find helpful about breakout rooms?  
 What do you dislike or find unhelpful about the breakout rooms?  
 Do you feel like the course content is appropriate for the online format and use of breakout rooms?  
 Are there any suggestions you have for how instructors can better incorporate breakout rooms into their classrooms?  
 What was/is your favorite part of the breakout rooms that you feel is beneficial to your learning style?  
 Do you have any previous experience with breakout rooms? (e.g., using Discord calls when gaming, FaceTime calls, etc.)

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Table 12. A subset of the interview questions asked to students.