

How do K-12 Students Behaviorally Engage in Virtual Learning Environments Post-COVID-19?

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Abstract

The effects of post-COVID learning in classrooms have affected how students are engaged, especially with the implementation of virtual learning. This qualitative study aims to investigate how students display behavioral engagement within virtual learning environments during participation in the iBEARS program. The constant comparison method was used to analyze classroom video observation of K-12 students engaging in scientific inquiry virtually with undergraduate mentors. Behaviors were grouped into three primary themes: behavioral engagement, disengagement, and interruptions and constraints. The findings help illuminate behaviors regarding student engagement within virtual learning. Future research is needed to better understand how behavioral engagement in the classroom has changed because of restraints like COVID-19 and how pedagogy and practice can adapt to student success in virtual learning.

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INTRODUCTION

The COVID-19 pandemic caused a shift from what society knew as “normal” to a world of constant change. The impact of the new accommodations of life affected every part of society, especially education. In accordance with COVID-19 guidelines, teaching was done through virtual settings to minimize the spread of infection (Centers for Disease Control, 2019). Engagement in the physical classroom versus online platforms is significantly different due to pedagogical constraints. Students were placed in virtual learning environments, often requiring students to not be easily distracted in order to retain important material. As our society adjusts to life post-COVID-19, understanding the effects of virtual learning on engagement, especially with K-12 students, can help shape future learning environments that encompass all of a student's needs. To further aid the process, this study aimed to answer the following question: How do K-12 students participating in the iBEARS (Inclusive Biologist Exploring Active Research) program engage in virtual learning environments post-COVID-19? By conducting this study, it was expected that while behavioral engagement in the classrooms would still be prevalent in the observations, a decrease in students' attention spans would also be expected with the mentors teaching from a distance.

PARTICIPANTS

The participants were nine undergraduate mentors who participated in the iBEARS program, and three K-12 student classrooms in elementary school classrooms.

METHODS AND MATERIALS

This qualitative study aimed to investigate how students exhibit behavioral engagement within the iBEARS program, which utilized project-based learning for undergraduate students (St. Louis et al., 2021). Undergraduate mentors were tasked to develop a science experiment with fifth grade students via Zoom. Mentors met with their K-12 students virtually once a week for one semester.

All meetings were recorded on Zoom. All three K-12 classrooms that participated in this study met for an average of 12 weeks, with recorded meetings ranging from 10 to 45 minutes. The behavioral analysis of the students engaging with their peers and mentors was done using the Constant Comparison method (Glasser & Strauss, 1967), which organized excerpts of the raw data into groups based on similar characteristics. Researchers' observations and changes in behavior during virtual classes were recorded on Microsoft Excel. In-vivo coding, a process where codes are derived from the participant's actual actions, was utilized since observations were noted based on raw behaviors, not assumptions (Given, 2008). A range of observations at certain timestamps were recorded from each weekly video. Once coding was complete, themes for each group were developed based on similar behavioral patterns. The overarching themes were then narrowed by certain characteristics into sub-themes.

Afterwards, the researchers met to discuss the validity of each code and work out any discrepancies, which established an inter-rater reliability of >90% and finalized the overall grouping. Once analyzed, descriptive statistics were used to characterize the themes and then graphed to show a visual aid.

RESULTS

The Constant Comparison method (Glasser & Strauss, 1967) was used to group similar observations done by in-vivo coding into categories. Three themes emerged from the data:

1. Disengagement
2. Interruptions/Constraints
3. Behavioral engagement

With some of the themes having characteristics that differentiated them from each other, 8 narrower subthemes were devised to group them even further in a simplistic manner:

1. Positive feedback from students: Students are seen as being excited or giving a more active/excited response than usual.

2. Negative feedback from students: Students are silent when asked something that would usually require a response/shaking their heads.
3. Hands raised for questions asked: Nonverbal action of raising hands to questions asked by mentors/teachers.
4. Verbal communication between mentors and peers: Students work with each other and the undergraduate mentors on experiments.
5. Prior knowledge: Students offer feedback to questions and statements from mentors with the knowledge they had previously learned somewhere else.
6. Disengagement: Disinterest in class activities.
7. Interruption/constraints: A brief hindrance (in-class difficulties & technical difficulties) during class time that causes the students to lose focus.
8. Clarification by mentors/teachers: Follow up by mentors/teachers to redirect students to the task(s) at hand; can also be a brief explanation by mentors/teachers if students are confused over something.

Behavioral Engagement

The theme of behavioral engagement is characterized by students being actively involved in their learning. This includes the physical desire observed to continue learning. Subthemes in this category consisted of:

- Positive feedback: Students respond positively to the mentors by displaying genuine interest, and/or students are seen being excited or giving a more active/excited response than usual. An example of this would be: The UNDERGRADUATES ask the students if they know what Newton discovered and they all get excited by jumping out of their seats and shout "Gravity!" (Classroom 5, Week 10). This subtheme appeared at an overall 9% in the study.

- Hands raised for questions asked: Nonverbal action of raising hands to answer questions asked by mentors/teachers. An example of this would be: An undergraduate asks the students if they remembered the discussion about symbiotic relationships last week, and 2 students in the back raise their hands. (Classroom 9, Week 4). This subtheme appeared at an overall 12.8% in the study.
- Prior knowledge: Students apply prior knowledge to the tasks presented to better build on the concept. The knowledge was acquired before the current discussions. An example of this would be: The undergraduates ask where roly-polys are found, and the class collectively answers “under rocks” (Classroom 8, Week 2). This subtheme appeared at an overall 4.4% in the study.
- Verbal communication among peers and mentors: The mentors and students communicated verbally as a way of exhibiting engagement as students are able to voice their thoughts and be actively engaged. An example of this would be: The groups go up to give their sentences, and the UNDERGRADUATES help them write down what was required and how to find information. (Classroom 8, Week 7). This subtheme appeared at an overall 22.9% in the study.

Disengagement

The overarching theme of disengagement is characterized by students exhibiting disinterest in the activities presented. An example of this would be: Two students are seen putting their heads down in the front, focusing on other things as the undergraduates speak. (Classroom 9, Week 1). This theme appeared at an overall 21.8% in the study.

- Negative feedback from students: The subtheme highlights how students are silent when asked something that would usually require a response/shaking their heads. An example of this would be: The undergraduates ask the students if they know who the woman is, the students stay quiet and look at each other. (Classroom 5, Week 8). This subtheme appeared at an overall 4.36% in the study.

Interruptions/constraints

The overarching theme of interruptions/constraints is characterized as a brief hindrance (in-class difficulties & technical difficulties) during class time that causes the students to lose focus. An example of this would be: Another teacher walks in to observe the class, and the students turn their heads to see who it is. (Classroom 5, Week 4). This theme appeared at an overall 11.9% in the study.

- Clarification by mentors/teachers: The subtheme highlights the follow-up given by mentors/teachers to redirect students to the task(s) at hand; can also be a brief explanation by mentors/teachers if students are confused over something. This is usually followed after something interrupts the class and causes a hindrance in the flow of learning. An example of this would be: The undergraduates ask a question about the language used, and the teacher repeats it to the students with more background information. (Classroom 5, Week 8). This theme appeared at an overall 12.8% in the study.

DISCUSSION

The behaviors of the K-12 students expressed in classrooms varied throughout the duration of the iBEARS program. Virtual learning was a necessity for all levels of school to continue education safely after the pandemic. However, with the transition from in-person learning environments to virtual learning environments occurring so quickly, it was expected that the levels of student engagement would vary. A study involving German students who signed up with the learning environment Bettermarks, (Spitzer et al., 2021) found that while registration for the virtual-learning platform increased, self-reported student engagement decreased rapidly with the implementation of asynchronous learning. Wester et al. (2021) found that STEM undergraduates around the United States reported that their emotional engagement with their science courses decreased significantly after the pandemic, and their ability to utilize behavioral engagement in new, online courses staggered. Our findings are similar to that of the literature, where we found disengagement to be the

second-highest observed behavior among students (Figure 2). According to CNLD Testing and Therapy (2022), the feeling of disengagement can be due to a multitude of reasons, as the average fifth grader has an attention span of 20-30 minutes, leaving great room for the mind to roam in an hour-long class. In concurrence, interruptions and constraints in the classroom were followed by brief periods of disengagement from students, which caused mentors/teachers to provide clarification to get the students' attention refocused on the task(s) at hand.

Although the primary findings gave virtual learning a bad connotation for its effects on K-12 learning, it is important to note that these studies were only considering students in higher education in the time period right after the pandemic, during which restrictions were slightly relaxed and engagement levels for online environments varied for all students. In another qualitative study observing university students' engagement during an online workshop, preprogrammed learning content was found to have lower learning effectiveness, and online-mediated teaching had no discernible effects on the students' level of engagement. (Hu & Hui, 2012). Upon completion of our study, it was found that there may be strengths and weaknesses in a student's engagement level that allows them to be proficient in certain areas, and their approach to learning makes the greatest difference.

According to Hu and Li (2017), the biggest determining factor for a student's overall engagement was their willingness to learn because positive emotions in the student would stimulate their use of knowledge and effective means to accomplish the academic tasks. This would, in turn, create interest in the next learning task. Due to virtual learning requiring a stronger approach to keep students engaged, the quality and quantity of how often the students collaborated with each other, understood the expectations, and respected boundaries was as important in influencing their levels of engagement as was the utilization of technology. As shown in Figure 2, communication between the students and their mentors was the highest observed behavior. This grounded the assumption that students were eager to participate in class by inputting previous knowledge they knew

into figuring out new tasks and gave positive feedback to the learning styles set up by the iBEARS mentors. A YouTruth survey from 2012-2017 gathered from over 230,000 students from different grade levels on how they perceived their level of engagement was analyzed, and 78% of elementary schoolers felt engaged in their learning, whereas 60% of high schoolers felt engaged in theirs (YouTruth, 2022). It is possible that since elementary students are learning new concepts that are more foundational to further their learning, their interests are peaked, but older students may not feel the same way.

Limitations of the study were that many of the publications on post-COVID effects on student learning are not centralized around lower education levels, and it is important to note that school-age children learn primarily through active engagement, which can hone their cognitive abilities and self-regulation (Parker et al., 2022). Other limitations of our study were the study's scope and number of participants. Students will actively participate if the content piques their interest, whether it be through virtual settings or in-person classrooms.

CONCLUSION

The implementation of technology with online learning enacts an overall positive response from K-12 students, but discrepancies in paying attention is also expected. Students exhibit behavioral engagement in several ways, and the study signifies if the current approach to teaching kids is ideal. The pedagogy used for the new normal of online environments is continuously changing to fit the needs of students, and how the material is taught is now understood as a defining factor for the retention of material. Further research should include how different levels of elementary school students feel about online learning environments to detect trends, as well as more observational analysis of classroom behavior during online classes. The new research would further expand our understanding of how the pandemic affected school-aged students, especially during their prime learning years. Adjustments to online pedagogy could be made, and a new framework of how the material is presented could be established.

Table 1: Developed Themes and Examples

Themes	Subthemes	Definition	Examples
Behavioral engagement	Positive feedback from students	Students are seen being excited or giving a more active/excited response than usual	<p>1. The undergraduates ask the students if they know what Newton discovered and they all get excited by jumping out of their seats and shout “Gravity!” (Classroom 5, Week 10)</p> <p>2. Students express excitement for working on the science project. (Classroom 8, Week 2)</p>
Disengagement	Negative feedback from students	Students are silent when asked something that would usually require a response/shaking their heads	<p>1. The undergraduates ask the students if they know who the woman is, the students stay quiet and look at each other. (Classroom 5, Week 8)</p> <p>2. The undergraduate asks if anyone wants to make edits to the research poster. No one says anything. (Classroom 9, Week 10)</p>
Behavioral engagement	Hands raised for questions asked	Nonverbal action of raising hands to answer questions asked by mentors/teachers	<p>1. An undergraduate asks the students if they remembered the discussion about symbiotic relationships last week, 2 students in the back raise their hands. (Classroom 9, Week 4)</p> <p>2. Students are asked to raise their hands to call out their answers, and many hands go up, some stand out of their seats so they can be seen and picked. (Classroom 8, Week 3)</p>
Behavioral engagement	Verbal communication between mentors and peers	Students work with each other and the undergraduate mentors on experiments	<p>1. The groups go up to give their sentences, and the undergraduates help them write down what was required and how to find information. (Classroom 8, Week 7)</p> <p>2. As the experiment continues, the students are actively watching and asking questions as to why the reaction didn't proceed. (Classroom 5, Week 5)</p>
Behavioral engagement	Prior knowledge	Students take notes of what is being discussed in class and do what they can to better build upon the concept. They offer insightful comments, pulling information from prior knowledge they have acquired.	<p>1. A student has her hand raised to answer the question, but only remembers one of the variables. 3 hands go up to answer the other. (Classroom 5, Week 4)</p> <p>2. The undergraduates ask where roly-polys are found, and the class collectively answers “under rocks” (Classroom 8, Week 2)</p>
Disengagement	Disengagement	Disinterest in class activities	<p>1. 2 students are seen putting their heads down in the front, focusing on other things as the undergraduates speak. (Classroom 9, Week 1)</p> <p>2. Students in the front are talking to students in the back while the undergraduates explain Excel. (Classroom 8, Week 12)</p>

Table 1 Continued: Developed Themes and Examples

Themes	Subthemes	Definition	Examples
Interruptions/ constraints	Interruption/constraints	<u>A brief hindrance (in-class difficulties & technical difficulties) during class time causes the students to lose focus</u>	<p>1. <u>Another teacher walks in to observe the class, and the students turn their heads to see who it is. (Classroom 5, Week 4)</u></p> <p>2. As the undergraduates ask another question, the lesson is paused due to another announcement. 2 students leave to take their pictures. The question is asked again to bring the attention back to the lesson. (Classroom 5, Week 2)</p>
Interruptions/ constraints	Clarification by mentors/teachers	Follow-up by mentors/teachers to redirect students to the task(s) at hand; can also be a brief explanation by mentors/teachers if students are confused over something	<p>1. The undergraduates ask a question about the language used, and the teacher repeats it to the students with more background information. (Classroom 5, Week 8)</p> <p>2. The undergraduates ask who wants to do food, 2 hands go up, the teacher repeats the question and more hands go up. (Classroom 9, Week 3)</p>

Figure 1: Overall Themes Observed in K-12 Online Mentorship Program

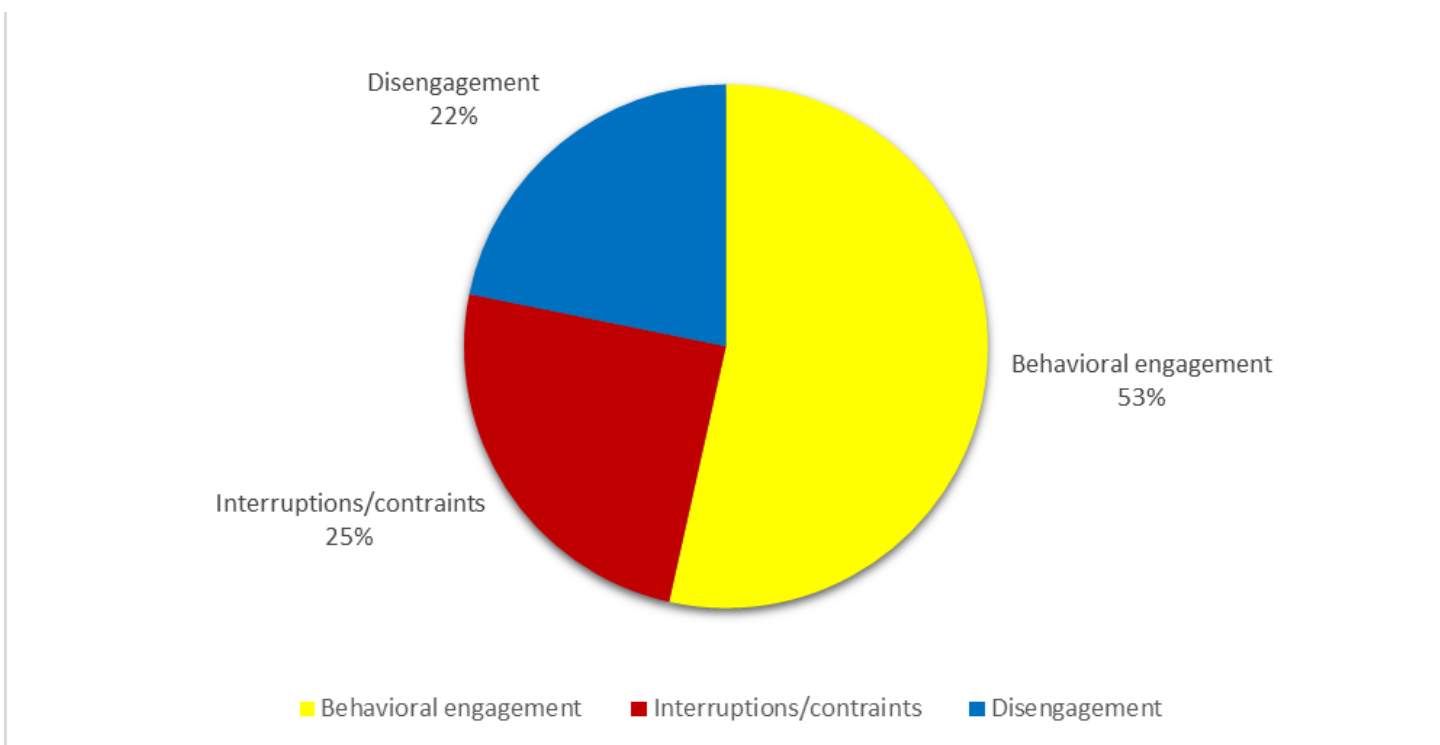
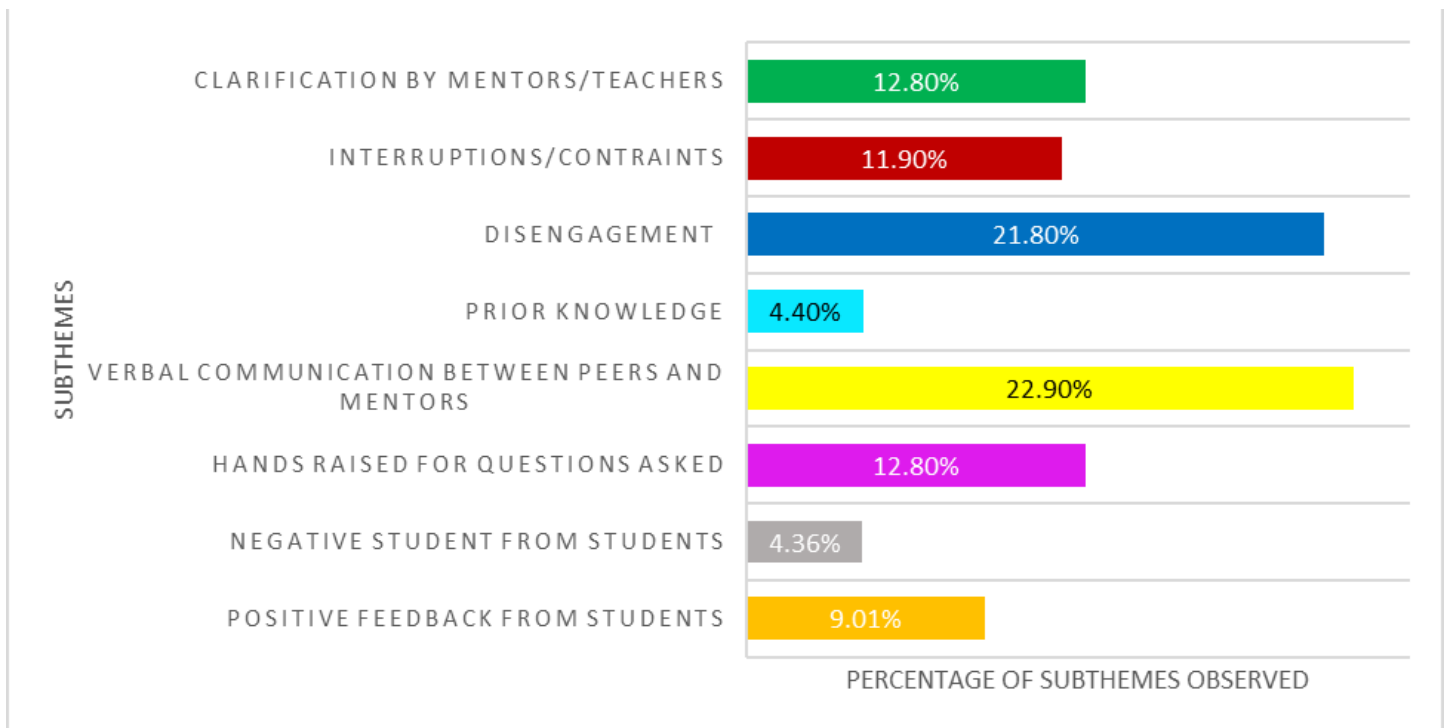


Figure 2: Subthemes From Themes Observed in K-12 Online Mentorship Program



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