Bacon, S., & Liu, L. (2021). Participation rate of fifth graders during COVID-19 emergency: Synchronous versus asynchronous learning activities.
International Journal of Technology in Teaching and Learning, 17(1), 47-61.

Participation Rate of Fifth Graders During COVID-19 Emergency: Synchronous Versus Asynchronous Learning Activities

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The COVID-19 pandemic has influenced teaching and learning in dramatic ways. Educators have made significant efforts to facilitate learning in dynamically changing formats, and students have experienced a very difficult time to learn in non-traditional environments and settings. This study focuses on participation rates of 5th grade students on a variety of learning activities or assignments in Language Arts and Social Studies that occurred over a three-month period in which the school pivoted from full remote learning to a hybrid model. Results from a nonparametric analysis on 42 learning activities indicate that students' participation rates on synchronous assignments are higher than that on asynchronous assignments. Implications for increased attention to instructional design as they relate to technology integration and the unique circumstances of remote learning are discussed.

Keywords: synchronous, asynchronous, online learning, hybrid learning

INTRODUCTION

Due to the COVID-19 epidemic, teaching and learning has taken a dramatic turn. It has created the most significant disturbance of educational systems in human history, impacting almost 1.6 billion learners in over 200 countries (Pokhrel & Chhetri, 2021). In the United States, the emergency transition in universities and public K-12 schools started from March of 2020, during which in-person classes transitioned to online teaching and learning in a full-distance model (Lederman, 2020; Supiano, 2020). Online instructions were delivered in two main formats: synchronous and asynchronous. Synchronous online classes aim to simulate the instructional model of an in-person classroom and require students and teachers to be online at the same time via a virtual platform such as Zoom (Hsiao, 2010; Abu Talib et al., 2021). Asynchronous online classes are more flexible,

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providing more options for learner-centered and self-paced learning that does not require real-time interaction or to meet at a specific time (Hsiao, 2010; Abu Talib et al., 2021).

The current study was conducted during this emergency period of American education, in a school district of a western state of the United States. Two learning models were employed during this emergency: hybrid model and full distance model. First, in early spring of 2020, schooling had already been accomplished using traditional instructional methods and teachers shifted to a full distance model as schools were closed and teachers used a variety of means to instruct students at home. Due to the emergency nature and short timeline to prepare for full distance learning, teachers were not uniform in approaching this challenge. Some teachers sent their students paper pencil tasks to complete independently, while others used technology to deliver instruction. Few rules or mandates guided instruction in the early stages of emergency closures, but when the pandemic persisted in the fall, teachers were expected to deliver a portion of instruction synchronously with students learning from home on one-to-one devices. Teaching took place online in meeting forums, and students used Chromebooks daily to participate in learning activities at home, often without any adult participation. While teachers and students were not well prepared for such learning models, in the school where the study took place, the students moved from full remote distance learning, to a hybrid model of instruction, back to full remote distance learning, then back to a hybrid model in a matter of weeks. With the hybrid model, teachers assigned part of the class to come to school for in person learning on certain days while the other part of the class working asynchronously with assignments from home or synchronously through online meeting platform, and on the rest days of the week, the two groups switch the format (Cote et al., 2020; Moore et al., 2021).

Under such unstable circumstance, synchronous learning took place in person in classrooms or with online meetings, and asynchronous learning took place at home or asynchronously online with learning materials. This created new challenges for teachers and course designers. One challenge was that teachers needed to systematically apply instructional design principles to *design* their online/hybrid instructions while they were not well prepared (Gillis & Krull, 2020). For example, learner assessment is a critical part of instructional design (Shelton & Saltsman, 2006; Hattie, 2009), while it is difficult to know the learners skill levels, interests, and personalities in limited online meeting time. Design of learning activities to engage best practices is another important task of instructional design (Cheung, 2016; Marzano, 2017), while most teachers still applied the traditional ways of face-to-face in an online environment, which has not produced expected outcomes yet.

Another challenge was that teachers need to *teach* or *deliver instructions* either online or in a hybrid format to engage student participation while they themselves were not well prepared yet. Participation in online meetings and learning activities varied dramatically and became an issue of extreme concern to teachers and a source of major frustration to parents (Carrillo & Flores, 2020). Many teachers made efforts to engage students by seeking the use of the multiple online learning platforms, such as Jungroo Leasrning, ClassPlus, and GlbalGyan introduced by Dhawan (2020), and some currently often used ones such as Zoom, Blackboard, Collaborate, Elluminate, and Adobe Connect (Martin et al., 2021). Although these programs have added many engagement features and tools to allow students to interact with each other and receive feedback all within the program(s), and many efforts to incentivize or encourage participation by teachers, students still participated at a low rate on the digital assignments (Gillis & Krull, 2020). For this reason, teachers were in a position of shifting to synchronous format when possible.

Some literature has already found a statistically significant effect in favor of synchronous online learning versus asynchronous online learning (Martin et al., 2021). The present study aims to explore the differences specifically between participation rates of

fifth grade students' learning activities and assignments in Language Arts and Social Studies conducted synchronously such as lecture, note taking, and guided practice, online games, and that of asynchronous assignments such as independent reading and writing with online learning platforms (i.e., Lexia, NewsELA, Edpuzzle, and Quill.org assignments, see Appendix).

LITERATURE REVIEW AND BACKGROUND OF THE STUDY

Relevant research includes attention to best practices that are linked to high achievement, social learning theories as they relate to the role of synchronicity in learning, instructional decision making, and developments in online learning. In addition, this research is relevant because it attends to a population that has had limited attention from researchers in terms of online learning. According to Doucet et al. (2020), "Different subjects and age groups require different approaches to distance learning" (p.15). Thus it is critical that we look closely at what strategies engage students at the primary level, upper elementary level, and secondary levels separately as students mature and change as learners, and demonstrate unique characteristics in online learning forums.

BEST PRECTICES FOR STUDENT ACHIEVEMENT

As a result of accountability measures ignited by the No Child Left Behind Act (2002) and its successor, the Every Student Succeeds Act (2015), generations of teachers and their students have worked feverishly to demonstrate proficiency on tests of academic performance. Thus, two decades of research has accrued focusing on the factors that influence student achievement. John Hattie's (2009) work synthesizing over 800 studies relating to student achievement identified a significant number of actions within the teacher's control that yield high effects toward achievement. One of the highest effects that Hattie reports is that of teacher efficacy, meaning that the belief of a teacher in their ability to affect learning, has a significant impact on student achievement (Waack, 2018). The pandemic induced teachers to work in emergency instructional models with little time or resources to develop a strong sense of efficacy. Work by the Marzano group (2017) is built off of Hattie's analysis and follow up studies in learning labs. This work revealed the critical implementation details involved in best practice strategies to promote academic achievement: communicating clear goals, using assessments, direct instruction, deepening lessons, applying knowledge, cognitive and engagement strategies, rules and procedures, building relationships, and communicating high expectations. Clearly, these strategies can be implemented in multiple learning environments, including remote instruction, but Robert Marzano cautions,

> "No single strategy can guarantee student learning for a number of reasons. One is that many factors other than the use of instructional strategies affect student learning. Another is that instructional strategies work in concert or sets and should not be thought of as independent interventions. Still another is that educators have to use the strategies in specific ways to produce positive outcomes" (Marzano, 2017, p.1).

The nature of teaching and learning is complex, and involves both teacher and student affect, efficacy, engagement, and environmental factors. Each of these components was rocked by the pandemic, and the tenuous nature of the emergency educational situation that ensued can't be understated. Strategies that were effective before the pandemic may not have been effective during the pandemic due to multiple factors including teacher and student self efficacy. The best practices for online schooling when children are at home have yet to be researched thoroughly (Petrie, 2020). While there may be some similarities to best practices in traditional settings, there is clearly a lot that needs to be learned from the emergency implementation of online learning during the pandemic.

SOCIAL INTERACTION AND SYNCHRONICITY AS MOTIVATORS

The intricacy of human's social nature is what sets us apart from all other species. Bandura's social learning theory (1977) highlights the importance of reinforcement in guiding human behavior. In this theory, the idea of reinforcement is a critical component in impacting behavioral choices and people are always learning from either the reinforcement they receive, or the reinforcement they witness others receiving. Online learning platforms often provide immediate feedback or reinforcement based on responses, but this feedback may not be as important to the learner when it occurs in isolation or in an independent environment. Social media platforms, however, do provide an audience for the feedback and a shared experience for the learner and leverage the social nature of humanity (Deaton, 2015). Of the online activities used in this research, only one included real time social interaction due to the need to keep learning performance and progress anonymous. Thus, the distinction between online or technology based activities that include social reinforcement, and those that don't must be made as the social aspects of learning have an influence on the learner. In a recent study of doctoral students, teacher experience in teaching online and opportunities for structured social interaction had positive effects on learning during the pandemic (Orlov et al., 2020). Orlov et al. (2020) noted the critical importance of synchronous peer interaction in supporting online learning. Malik et al. (2017) also found that university students preferred synchronous learning activities when it involved learning that would contribute toward a grade. Initially, it may appear that the impact of an activity or assignment on a grade would be a significant motivator, but clearly the social nature of activity is an important factor as well. It's not that asynchronous learning doesn't appeal to many students. Educators have known for some time that many students prefer to work alone, at their own pace. However, asynchronous learning must be enhanced by synchronous experiences that lend themselves to collaboration and social interaction (Koutsabasis et al., 2011; Rovai, 2002).

INSTRUCTIONAL DECISION MAKING

The instructional decisions made by teachers have significant impacts on learning. However, many factors influence how and what a teacher decides to do with students. Commonly, there is a gap between research based best practices and implementation. A study of Australian preservice teachers found that the number one consideration in decision making was their practicum experience (Carter et al., 2015). However, in the US, pressure to increase standardized test scores has resulted in efforts to increase data driven decision making. Professional learning activities have increasingly focused on helping teachers use data to inform instruction (Mandinach & Gummer, 2013). One of the earliest pushes toward data driven decision making focused on student engagement. On a basic level, a student who is participating in the lesson is engaged. However, research on engagement and achievement is mixed. Other factors outside of engagement impact learning (Guo et al., 2015). Due to the semi-chaotic nature of teaching in flexible models of remote learning and hybrid learning which make it difficult to measure achievement, the focus of the present study however is simply on participation as one level of engagement with some benefit to the student.

TECHNOLOGY BASED INSTRUCTIONAL DESIGN

Computer assisted learning has been a tool for educators for the past thirty years. However, recent advances in technology have led to thoughtful and dynamic learning platforms. The ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model for creating online courses and training programs has been a successful framework for developing online learning experiences successfully. The approach takes careful

consideration of the learner in the first stage, analysis, thus objectives, methods, and assessments are then attended to with meeting the learners needs in mind (Peterson, 2003). The ADDIE approach has been used effectively in the medical field to teach radiography interpretation, but the researchers were quick to recognize that other factors would contribute to enhanced learning including the size of the group in the instructional setting, with opportunities for peer interaction and immediate feedback from the instructor (Cheung, 2016). The ADDIE model has been used internationally, and in a study done in Tanzania, was updated to include an instructional design component that allowed for greater agility to provide learners with a dynamic experience. The ADDIE- FDDP integrated model adds a Feature Driven Development process to support teaching and learning. This design was able to overcome some of the obstacles faced by the learning environment in Tanzania including lack of professional teachers, few school materials and large class sizes (Budoya et al., 2019).

While it is clear that there are effective online learning platforms, the implementation of the platform or program is critical for its success. Liu and Velasquezbryant (2003) noted that technology integration often fails as a result of misguided educators who are attracted to the promise of new technologies, their desire to appear as if they are "on the cutting edge" of integration without full understanding of it, and the challenge of knowing how effective the technology is in meeting the learning goal. They outline a critical interaction between information or content to be learned, the technology being used to achieve the learning, and the design of the learning experience.

Ever present in the discussion around online learning platforms and instructional technologies is the idea of very careful analysis and research that goes into the development and design of the successful learning experiences. Unfortunately, the classroom teachers who are at the heart of instructional delivery rarely have the time nor the training to successfully design learning experiences; this deficit was amplified by the current pandemic. Many teachers fell into the trap outlined by Liu and Velasquez-Bryant (2003) in a rushed effort to keep students engaged in learning from online devices far from school sites (Greenhow & Lewin, 2021). Currently, even though we are still under the influence of pandemic situation, educators and researchers are making efforts to explore more effective and operational methods of such technology integration in online teaching and learning (Kaisara & Bwalya, 2021), and especially the best practices in synchronous and asynchronous online learning (Martin et al., 2021). The latter is the focus of the present study as well.

SYNCHRONOUS VERSUS ASYNCHRONOUS ONLINE LEARNING

Studies on online learning have been increasing over the past decade. Martin et al. (2020) conducted a systematic review and examined 619 research articles published in twelve journals from 2009 to 2018. They categorized the studies into twelve themes and a framework across learner, course and instructor. Online learner characteristics and online engagement were examined, in which asynchronous computer-mediated communication was one of the critical features in online learning (Martin et al., 2020).

Literature has also revealed research findings on learning related variables or outcomes such as cognitive outcomes, motivational variables, cooperative and performance outcomes. According to a meta-analysis on 19 publications with 27 tests about the effects of synchronous online learning outcomes, a statistically significant effect in favor of synchronous online learning versus asynchronous online learning for cognitive outcomes was found (Martin et al., 2021). Siler and VanLehn (2009) found a difference in motivational variables (i.e., students' ability goals – wanting to demonstrate one's ability to others, and tutoring duration) between students who had face-to-face interaction with the tutor and those with asynchronous comuputer mediated communication tools, but no

differences in some important pedagogical characteristics, such as learning gains, tutorial interaction, the activity measures associated with learning gains, and student motivation (Siler & VanLehn, 2009).

Furthermore, Peterson et al. (2018) examined the effects of synchronous versus asynchronous interaction on students' sense of cooperation and found that asynchronous communication interfered with the relationship between cooperative goals and the outcomes of cooperation, and therefore asynchronous cooperative learning may not work as designed because the presence of cooperative goals do not predict cooperative outcomes (Peterson et al., 2018). A study examining student performance outcomes found that synchronous course delivered using VIRI (virtual interactive, real-time, instructor-led) online learning technology had the same level of student performance outcomes as face-to-face learning (Francescucci & Rohani, 2019). The literatue addressed a variety of ways to examine online learning outcomes. As the formats of learning changed unstably during the pandemic time, learning achievement was difficult to measure consistantly. In present study, we focused on the paricipation rates of online learning activities conducted synchronously and asynchronously.

BACKGROUND OF THE STUDY AND RESEARCH QUESTION

Besides the theoretical framework and research findings revealed from the literature, the research question and design of the study evolved as the result of informal observation. As reflective practitioners, effective teachers are constantly thinking about what they can do as a teacher to increase participation in learning activities. One of the biggest concerns of teachers and parents of school age children is how kids were spending time at home if they weren't engaging in the learning activities. Prior to the pandemic, it was common to leave technological devices at school, so that students would not have easy access to the internet without parent support. However, due to the need to connect with students during remote learning, devices were sent home to all students, and families became responsible for monitoring internet use.

Initially, many teachers believed that students would prefer to participate in online learning platforms that are created by computer learning design professionals such as those provided by Lexia, NewsELA, and Edpuzzle (see Appendix). All of these platforms include modern graphics and videos as well as immediate feedback. Both of which are linked to engagement. The Lexia program is even gamified, meaning the format and feedback are like video games. However, teachers noticed right away that many students were not participating in these activities when assigned. The researcher and colleagues then shifted toward paper-pencil activities, thinking that this more traditional form of practice would be more accessible and easy to monitor for parents. Once again, teachers were surprised by the lack of participation and completion of the paper pencil activities. One issue that was discovered during the study is that when students were not participating, they were choosing to use their school provided device to watch YouTube, engage in online chat, or play video games during much of the day. This information was gathered by examining the search histories of students on their devices. It was remarkable how many students were spending several hours each day on non-school related searches and entertainment.

It is not surprising then that the researcher noticed that participation was most reliable when the activity was assigned and completed during a synchronous Google meeting. During the meeting, if student cameras were on, it was obvious if a student was off task, and those students could be redirected by the teacher. One stumbling block in this strategy occurred, however. Students would login to meetings, turn off their cameras, and proceed to watch YouTube or play games while simply running the meeting in the background but not participating. This behavior was obvious because if a student was summoned during

the meeting, they would often have no idea what the class had been talking or learning about. Students would justify turning off their cameras by saying that they had "bad internet". The district policy allowed students to retain privacy by turning their cameras off, so teachers were at a loss until artificial backgrounds were introduced. After a "cameras on" policy was enforceable, traditional best practices could be maintained in the Google meeting, and students were more attentive and participatory. This assumed that synchronous learning activities may yield higher participation rates. Therefore, the following research question was formulated to guide through this study:

Do participation rates of fifth grade students on synchronous assignments differ significantly from asynchronous assignments?

The research hypothesis for this study was that participation rates on the two assignment categories would be different. Based on informal observation in 2020, it was presumed that participation rate would be higher on synchronous activities.

METHODOLOGY

PARTICIPANTS AND SAMPLING

This is a non-experiential exploratory study. The participants were from two existing fifth grade classes in a medium sized elementary school in California. The population of the school is majority white, with most diversity in economic status. Many students come from families in the 1% highest income bracket, and in stark contrast, twenty percent are designated as low income and SED (socially economically disadvantaged). The majority of students fall somewhere in between the two groups (California School Dashboard, 2020). The students in the school are generally very successful on standardized tests, with 70% or better proficiency on English Language Arts and Math performance on the CASPP (California Assessment of Student Progress and Performance) test (School Accountability Report Card, 2020). In total, 40 students were in these two classes.

However, in this study, individual students did not serve as the cases to be examined. Rather, assignments or learning activities in *Language Arts and Social Studies* for the classes served as the cases under analysis. In total, 42 such assignments were used, including 22 synchronous assignments and 20 asynchronous assignments. For each assignment, student participation rate was calculated, that is, the percentage of students who completed the assignment to the extent that they could demonstrate their learning. This is a nonrandom sample (or convenience sample), which is often used in educational research when random sampling is not applicable (Fowler, 2002; Rovai et al., 2013). In the case of this study, the sample was a convenience sample as part of the learning evaluation from the two existing classes.

PROCEDURES

This study was approved by the Institutional Review Board (IRB) of the university before we conducted the activities and collected the data. Student learning and participation during school closures in early spring of 2020 was at the forefront of this research. The study took place in three phases.

Phase I. Designing Learning Activities. The first author of this article, who was the instructor of the classes, designed the synchronous and asynchronous online learning activities for their Language Arts and Social Studies classes. The activities met the requirements that were engaging and attentive to social and emotional needs, and that developed knowledge and skills on the fifth grade priority standards.

Phase II. Completing the Learning Activities. Then over a period of twelve weeks, the fifth grade students worked on and completed (or partially completed) the learning

activities in the 42 assignments, 22 synchronously and 20 synchronously. The records of student participation were kept for every activity that required the student to complete a task. The settings and procedures of completing the asynchronous and synchronous activities are described in the next section.

Phase III. Coding the Participation Rates. After the classes ended, student participation rates for each learning activity were coded. The learning activities served as the cases to be analyzed.

FULL REMOTE MODEL AND HYBRID MODEL

All activities took place in either a full remote learning context or hybrid learning context. *Remote learning* was characterized by all students being at home or at a care center. Each student had access to a district provided Chromebook, but they had to rely on their home or daycare internet to login to meetings through Google. For a few students, internet connectivity was an issue, and the students would lose connection with the meeting if the application or activity required more than a basic connection. The 5th grade students whose work was the focus of the study are at a unique point in their maturation as young people. While the prevalence of ten and eleven year olds being left at home alone is low (Doi, Fujiwara, Isumi, Ochi, & Kato, 2018), parental involvement in schooling tends to be minimal because by late childhood, students demonstrate significant independence and competence. In addition, upper elementary students are extremely savvy at using technology, as they have all grown up in an era of personal smart devices. For this reason, they will often find creative ways to use technology and avoid the sometimes cumbersome aspects of remote learning. During both remote and hybrid learning models, parents had to be contacted to help support student engagement. Savvy students would login to Google meetings, but then turn off their cameras and do other self selected activities such as watching YouTube or playing video games during class. Much effort was put into engaging students in the meetings, so that they would stay in the meeting and participate regularly.

The *hybrid learning* model posed new challenges to teachers. Two days per week, half of the students would come to school and learn in a traditional classroom format, while the other half would be responsible for doing learning at home. On Wednesdays, all students would stay home and do remote learning. Then, at the end of the week, the second set of students would learn in person and the other cohort would learn from home. Teachers handled the hybrid model in different ways, so consistency within a school or the district as a whole was rare. Some teachers had the at home students login to a meeting each day, and they would teach the children in the room and the children at home at the same time, covering the same content (this is where synchronous learning occurred). Other teachers would assign asynchronous work to students at home, so that they could focus all energy and attention on the students who were in the classroom. Synchronous and asynchronous activities were assigned and performed in both models.

SETTINGS OF SYNCHRONOUS AND ASYNCHRONOUS ACTIVITIES

Synchronous activities during remote learning days included lecture and note taking, shared reading and discussion, guided writing, online games and challenges, moderated activity on online platforms like Padlet or Quill, and guided worksheet completion that was done while students were logged into a Google Meet. Asynchronous activities included any activity that students had to complete independently, outside of a Google Meet or classroom setting, without real time teacher instruction. Students were asked to independently and asynchronously do online reading programs like Lexia and NewsELA, online writing applications such as Quill (see Appendix) or Google docs, and to complete paper based reading and writing assignments that were given out in packets. The settings and operations of synchronous and asynchronous activities were as shown in Table 1.

Table 1. Settings of Synchronous and Asynchronous Activities

	Synchronously		Asynchronously	
	Off-line	**Online**	**Off-line**	**Online**
School	In Person			
Home or Care center		Google Meet	Self-learning	Log in online without meeting
Example of Activities	• Guided note taking • Guided worksheet completion • Synchronous quiz or Q and A • Guided text annotation • Guided reading and quiz		• Quill, Edpuzzle, Lexia independent time • Paper/ pencil worksheets • NewsELA annotation • Independent reading and Quiz	

Activities were uniformly difficult. Some asynchronous activities were very simple, like answer one question after watching a video that states the answer directly, where the video can be paused while answering the question. Others were more challenging, like write a summary of what you read in your good fit book. The same was true for synchronous activities. The simplest synchronous activity was taking notes (students were allowed to copy exactly the notes that I was modeling). Other activities were challenging, such as answering a question about complex text on a digital bulletin board (Padlet).

MEASUREMENTS

Participation. According to the purpose of the study, a participation rate was calculated for each assignment. Participation was defined as completing enough of the task to demonstrate learning. For example, a coding of *participation* was given to a student for a given task if the student answered the question, provided some feedback or support to a communication task, performed the required operation to an activity, completed the worksheets or writings that demonstrated learning. Otherwise, it would be considered as non-participation. For example, sometimes students would turn in an essay assignment with only one sentence on it, or hit the turn in button in Google Classroom even if the assignment was not completed because they could avoid having their parents get an alert of a missed assignment. When students did not complete enough of the task to show attention to the learning objectives, a coding of *non- participation* was given.

Participation Rate (PR). Participation rate for a given assignment or learning activity was calculated by first counting the *number* of students who had a coding of *participation (NP),* and then dividing the *NP* by the *total number (TN)* of students who were assigned with the activity (see Equation 1):

$$(PR) = [(NP / TN) * 100] \% \qquad \text{(Equation 1)}$$

For example, if an assignment activity was assigned to 40 students, and 26 students received a coding of *participation,* the calculation of the participation rate for that assignment would be: 26 is divided by 40 and times 100; the participation rate turned out to be 65 percentage (65%).

Level of Participation. Participation records were also coded as *high* participation or low participation for each assignment; a rate of 70% or higher participation was considered high, and less than 70% were considered *low*.

DATA ANALYSIS AND RESULTS

DATA ANALYSIS

In this study, individual students did not serve as the cases to be examined, instead, we treated each individual activity as single cases. Other researchers also used individual

assignment, online post, discussion thread, or a single study as individual cases to be measured and analyzed (Chiu, 2017; Hanselman & Liu, 2021). In this study, individual learning activity was measured with participation rate, which was considered independent data as well (Hanselman & Liu, 2021).

According to the purpose of the study, a comparison analysis needs to be conducted. However, the data did not meet statistics assumptions of parametric statistics test such as independent *t*-test. First, the data was nonrandom data, we used the available learning activities from existing classes. Second, the normality was not assumed for synchronous group (Shapiro-Wilk test = .855, p = .004); although it was assumed for asynchronous group (Shapiro-Wilk test = .983, p = .963), the two groups had unequal variances, and the group sizes were unequal. Furthermore, power analysis by *G*Power* showed that with the desired effect size (Cohen's d = 0.5), α err prob (=.05), and Power (*1–β* err prob = .95), we would need 88 participants in each group for the independent *t*-test. That is, a total of 176 participants. The sample size for this study was 42, which is not enough (Chen & Liu, 2019). Therefore, a nonparametric analysis method was considered an appropriate method for the data analysis; a Mann-Whitney *U* test was used to compare the difference in participation rates between synchronous assignments and asynchronous assignments (Liu & Chen, 2018; Siegel & Castellan, 1988), which is to actually compare the medians of the participation rates between the two types of assignments.

RESULTS

In the Mann-Whitney *U* test, the dependent variable was the participation rate, and the independent variable was the formats to complete the assignments with two levels, synchronously and asynchronously. Results showed that the median difference of the participation rates between assignments completed in the two different formats was significant (Mann-Whitney U = 26.00, p < .001), with an effect size η^2=*0.59.* The participation rates for assignments completed synchronously (Mean Rank = 30.32) were higher than that completed asynchronously (Mean Rank = 11.80). Figure 1 demonstrates the difference.

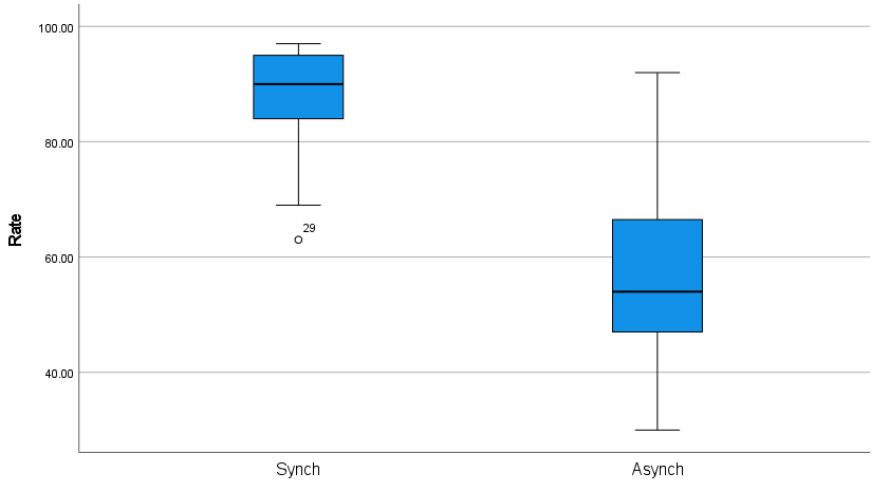

Figure 1. Participation Rates of Synchronous and Asynchronous Assignments

Results were also calculated with simple completion rates compared to a 70% cut rate. 16 of 22 synchronous assignments were completed at a rate of 70% or higher, while only 4 out of 20 asynchronous assignments were completed at the rate above 70%.

DISCUSSION AND CONCLUSION

Clarity around which kind of activities generate greater participation is significant as educators move forward in being prepared for school closures to last through the end of the school year and to be better prepared for future school closures. The results of this study indicate that upper elementary students are more likely to participate in learning activities that are synchronous and offer opportunities for real time interaction. The importance of the age and developmental stage of the students can not be ignored, as 5th grade students are at a unique station of independence, but also need more concrete motivation and support. Younger learners naturally get more attention from their parents, and older students can be motivated by grades. Upper elementary and middle school students should be studied separately from primary and high school students.

In addition, traditional best practices intended for the regular classroom were impactful and made possible to a significant extent in synchronous Google meetings. Within those meetings, relationships between students and teachers were fostered, positive and corrective feedback was given, connections were highlighted, and social interactions between students were achieved. The students also benefited from the structure and routines that could be embedded in the meetings, but not necessarily present independently in the home setting. The results of this study and research by others indicate that even though computer based learning programs are thoughtfully designed and can have strong impacts on learning, they do rely on some degree of human interaction in person or in an online environment to yield the best results (Koutsabasis, et. al., 2011).

Looking ahead, effort and research is needed in three areas to attend to the findings of this study. First, given the importance of synchronous learning experiences that can only take place if students are at school or have the ability to login to a meeting remotely, much effort and funding needs to be allocated to providing devices to each student and ensuring internet access that is reliable. Second, the unique characteristics of upper elementary and middle school students needs to be studied in the context of the home. For example, what kind of supervision and support do these students receive? What kind of supervision and support do they need? From that information, educators can make better decisions about how to engage their students in learning practices when schools are closed and students are at home. Finally, parent education around supporting students during school closures is essential. Parents need support in understanding how devices can be used and abused at home, as well as how to provide structure and boundaries to support remote learning.

While conducting this study we were aware of the limitations. Responding to emergency teaching and learning conditions limited the scope and the duration of this study. Due to the very critical nature of student and teacher interactions, instructional approaches were always shifting to gain more participation and learning from students. The primary goal of the researcher was to support students in learning during an unprecedented situation. The secondary goal was to study the impact of instructional decisions around the synchronicity of learning activity and participation. Thus, uniformity for the purpose of research was not achieved. Interruptions in data collection occurred due to sudden shifts from full distance to hybrid learning as well as from the researcher's Covid 19 infection and subsequent illness and quarantine. Without those interruptions, more assignments could have been coded and analyzed. In addition, conditions that surrounded the study were not static. Continuous shifts were made in instructional design in order to garner more participation and learning. Growing concerns over participation or lack thereof inspired significant parent contact and meetings which would sometimes change participation rates. These limitations capture the very dynamic nature of

teaching, and are made more dramatic by the unusual circumstances of teaching in remote and hybrid formats.

The pandemic induced school closures of the 2020-2021 school year are certainly not going to be the last school closures in our history. It is critical that we extract as much research and analysis out of this crisis as possible, so that we can be better prepared to serve students in the future.

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APPENDIX
Online Programs Used in the Study

Ed Puzzle
https://edpuzzle.com/
Allows teachers to embed questions and activities into video content. Teachers can choose videos from YouTube or the Ed Puzzle library and add questions for students to answer with automatic feedback.

Flipgrid
https://flipgrid.com/
A simple video collection tool wherein students can make and comment on videos that are organized by topic and moderated by the teacher.

Lexia
https://www.lexiacore5.com/r
An interactive and gamified reading and vocabulary program with video game style graphics, immediate feedback, and a reward system.

Newsela
https://newsela.com/
Provides leveled reading passages in all content areas with annotation tools and comprehension questions within the interface. Feedback is immediate.

Padlet
https://padlet.com/
Acts as a digital whiteboard where students can post ideas and responses in a brainstorm like fashion.

Quill.org
https://www.quill.org/
Provides free grammar and writing activities with embedded instruction and immediate feedback for elementary students.

Quizizz
https://quizizz.com/
A platform for teachers to make games out of quizzes or access lessons and quizzes made by other teachers. Allows students to track progress in a competitive fashion.