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Teachers' Thoughts and Attitudes Regarding the Impact of the Remote Learning Period due to
the COVID-19 Pandemic on Secondary Mathematics Students

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ABSTRACT

The study presented here recounts the thoughts and attitudes of secondary mathematics teachers during and after the remote learning period due to the COVID-19 pandemic. Upon notification of the closure of schools across the world due to the pandemic, teachers everywhere had to quickly transform their curriculum to take place in a remote learning environment. The goal of this study is to identify and share mathematics teachers' observations and reflections on their instructional styles, classroom routines, and school environments after teaching remotely during the COVID-19 pandemic. Teachers that experienced this shift to remote learning and back to an in-person classroom environment were interviewed to learn more about their experiences and attitudes towards these topics before, during, and after the remote learning period. Data from these interviews was then coded and organized to highlight common themes that emerged across the set of all teachers. The findings of this study can be used to inspire other teachers to reflect on their experiences during the remote learning period, acknowledge how their own classrooms and teaching styles may have changed since this period, and possibly incorporate new ideas and activities used during the remote period into their current teaching. This study also sheds light on ways in which teachers, students, and school environments have changed since the remote learning period, and therefore identifies gaps in current research that would be worthwhile to study.

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Chapter 1

Introduction

The COVID-19 pandemic has impacted our society in countless different ways. Virtual schooling became a necessity during this uncertain time to adhere to safety guidelines, but, as we return to a state of normalcy, the impacts of this remote learning period remain prevalent. Educators across the country had to transition to online learning with very little time to prepare a truly effective mode of instruction. When schools resumed in-person instruction, these educators returned with new experiences and attitudes about instructional materials, classroom environments, and other topics related to teaching secondary mathematics. Teachers across the nation had vastly different experiences both during the remote learning period and after retuning to face-to-face instruction, and in this research study I will reveal the thoughts and attitudes of a few of these individuals.

In this study, I will address the following research question: What are secondary mathematics teachers' observations and reflections on their instructional styles, classroom routines, and school environments after teaching remotely during the COVID-19 pandemic? The thoughts and attitudes shared by these participants can educate other secondary mathematics teachers of how to best support students after returning to in-person instruction after the COVID-19 pandemic, as well as prepare teachers for any future events that could cause a transition from in-person instruction to virtual instruction. This information is also meant to provide insight into the experiences and accomplishments of other teachers during this time period. By reading the stories of several secondary mathematics teachers, other teachers can use their thoughts to inspire

introspection, and possible modification, of their own educational strategies and beliefs.

Additionally, these reports of these teachers' experiences will provide a sense of community around the shared struggles and triumphs teachers shared during this difficult time.

The main form of data used in this research study include two interviews with multiple secondary mathematics teachers that taught before, during, and after the remote learning period caused by the COVID-19 pandemic. The first interview with each teacher provided information regarding their strategies, classroom environment, and teaching beliefs before and during the remote learning period. The second interview, which occurred after teachers had at least one full year of instruction back in-person, focused more on their thoughts regarding returning to in-person learning, further reflection on the impacts of the remote learning period, and predictions about instructional strategies for years to come. Through the combination of these interviews, each teacher is able to provide thoughtful insights of how their attitudes and beliefs regarding teaching secondary mathematics has been impacted by the remote learning period caused by the COVID-19 pandemic.

Chapter 2

Literature Review

Remote Learning Environment and Virtual Instruction

An online learning environment utilizes the internet and web-based technologies to instruct students in lieu of a face-to-face, traditional education (Colorado & Eberle, 2010).

Students retain knowledge and experience lessons through manipulation of online technologies as well as interactions with the teacher and classmates. Collaborative academic activities and information sharing platforms have become common among online learning environments to engage students and reinforce key concepts (Colorado & Eberle, 2010). For math in particular, an online education provides additional resources to facilitate learning of skills such as problem-solving and computation. Online tools such as spreadsheets, interactive online whiteboards, graphic calculators, and many other devices enhance lessons and provide additional instruction to reinforce lessons (Barkatsas et al., 2009).

While online learning environments follow similar guidelines and structure as a traditional classroom, there exist some strategies that are crucial to the success of a student that may not seem as important in a traditional classroom. Courses that posted detailed instructions and expectations allowed for a comfortable learning experience due to a decrease in anxiety by students since they were aware of exactly what they should do throughout the course (Herman & Banister, 2007). Timely feedback from the teacher also allowed students to be aware of their successes and improve upon mistakes (Herman & Banister, 2007). Consistent routines in study and due dates influenced student success since they were able to complete assignments in a timely and routine manner (Herman & Banister, 2007). Finally, a group structure provides a place for discussion and community so students can clarify assignments, make connections between concepts, and interact with peers (Herman & Banister, 2007).

The COVID-19 Pandemic was a period of interest because all schools were forced to suspend in-person instruction suddenly. Administrators and teachers were required to quickly create a plan of action to conduct online learning for their students. Modes of education during

this time period included students using “hard copies” of various learning resources, such as textbooks or worksheet packets, to guide their instruction, livestreamed education on video chatting platforms, use of online learning management systems, and private tutoring with mathematics teachers (Mukuka et al., 2021). While schools may have used these and other various strategies to create an online learning environment, there was a unified mission to create an effective form of distance learning that follows one of the following modes of instruction: asynchronous, synchronous, or mixed model (Demir et al., 2021). Asynchronous models are flexible environments that use online learning management systems, such as Google Classroom or Canvas, to post instructional materials and communicate with students (Demir et al., 2021). In this mode, all materials are prepared before learning takes place and students can watch or experience the materials as many times as they want and on their own time (Demir et al., 2021). In synchronous models, learning occurs in real time in an environment, on platforms such as Google Meet and Zoom, where students and teachers can communicate even if not physically together (Demir et al., 2021). Finally, a mixed model combines aspects of both asynchronous and synchronous models to create one cohesive distance learning environment. “Hybrid” is another common name for a mixed model form of instruction.

Groupwork and Collaboration

Groupwork builds vital life skills such as negotiation, teamwork, and knowledge-sharing abilities (Altinay, 2017). Working with others fosters an ability to hold oneself accountable and provide quality work that will benefit others as well as the self (Altinay, 2017). All these skills are vital in life after school, and therefore it is important to include group problem solving in

lesson plans. For online courses, working in groups also encourages effective professional and personal development, increases intrinsic motivation, and demands involvement in course activities (Altinay, 2017). Problem solving is at the heart of mathematics, requiring critical thinking as well as implementation of previously learned skills (Rustanuarsi & Kayati, 2019). High cognitive processing is necessary for a student to effectively problem solve, and studies have shown that group discussion facilitates these higher-order processing abilities (Rustanuarsi & Kayati, 2019). Finally, groupwork builds students' confidence levels through acknowledgment of valuable contributions and improvement of skills (Promethean, 2020). Working with others during an online course allows students to reconstruct their knowledge through group discussion and problem-solving.

When reviewing the literature, I found that many popular teaching blogs and websites used the terms collaboration and cooperation interchangeably. However, these two learning models have a few differences, and should be implemented appropriately depending on the purpose and type of assignment. Collaboration focuses on working together for a common goal (Promethean, 2020). Students participating in a collaborative learning model join their attention ideas to the same task, and coordinate actions to best achieve a single outcome (Abdu & Schwarz, 2020). Cooperation focuses on individual work and requires students to split up an assignment so that each student completes a certain section on their own (Promethean, 2020). Students do not give any attention to another person's work when participating in the cooperative learning model (Abdu & Schwarz, 2020). Both collaboration and cooperation many benefits to the overall success of group learning. These learning models increase overall performance and quality of the outcome, promote individuality accountability, and promote inclusivity and respect among students (Promethean, 2020). However, collaboration and cooperation both have an

undesirable side to them. Collaboration may cause individuals to conform to the popular opinion of the group and decrease the likelihood for a minority view to be heard (Abdu & Schwarz, 2020). Cooperation, however, puts more focus on individual work, and may result in the avoidance of joint thinking which yield more successful outcomes (Abdu & Schwarz, 2020). In one session of group work, students may flip back and forth between collaboration and cooperation naturally. The literature reveals that if groups can achieve a balance of collaboration and cooperation, group learning will be most beneficial (Abdu & Schwarz, 2020).

Importance of Student Connection

Strong, positive relationships between teachers and students are vital to the students' interpersonal atmosphere at school, which can impact their academic performance (Martin & Collie, 2019). There already exists a large body of research behind the psychological reasoning that supports how these relationships can improve academic success. For example, it has been shown that teachers that foster meaningful connection with students enable students to learn more about themselves and how they can be successful in the classroom (Wentzel & Wigfield, 2009). Similarly, it has been shown that positive relationships between teachers and students can be a source of energizing stimulation that triggers positive emotions towards academics (Furrer et al., 2014). Finally, students experiencing meaningful connections with their teachers can expect to have higher levels of autonomy, more positive and supportive peer relationships, and increased levels of academic engagement (Ruzek et al., 2016).

Supportive and nurturing relationships between teachers and students provide security as students take risks in their learning, try new activities, and establish relationships with other

students (Yu & Singh, 2018). Teachers that are willing to establish relationships with students, learn about their students' strengths and weaknesses, and provide ample support in a variety of ways to their students create a safe space for students to academically and interpersonally thrive (Yu & Singh, 2018). Previous research explains that teachers can connect and support with their students in either an academic or affective manner. Academic support is seen when teachers demonstrate caring about student learning, offers to assist in student learning, and proves they want students to achieve to the best of their academic potential (Yu & Singh, 2018). Affective support is defined as focusing on students' perception on if the teacher cares and likes them as individuals (Yu & Singh, 2018). Both forms of academic and affective support have shown to be influential in students experiencing a positive connection with their teacher, and therefore have benefited their overall academic performance. It has been shown here that student and teacher connections are vital to student academic performance in traditional, face-to-face classroom settings. In this study, we will also address how teachers aimed to create these relationships when placed in an online learning environment, and how those efforts were important to student performance and behaviors in the virtual classroom and after.

Development of Social and Studentship Skills

The term 'studentship' was coined in 1986 to describe the actions and behaviors student perform when observed in a learning environment such as a classroom (Liljedahl & Allan, 2013). These actions include any behavior that a student does with the intent of helping themselves learn, which can include the following: seeking assistance, reviewing previous examples, checking their work, locating sources, and accessing material (Liljedahl & Allan, 2013). In this study,

several teachers discussed the notion of studentship skills, which includes the mentioned studenting behaviors as well as any other skills that a student would need to be successful in a learning environment. For example, previous literature has shown a strong correlation between students who exemplify consistent time management skills and academic performance (Hamzah et al., 2014). Therefore, time management would be considered a studentship skill. Data in this study will identify other skills that can be classified as studentship skills. This study will also discuss that while some studentship skills are the same in a face-to-face instructional environment, there exist skills that are necessary for success in an online learning environment that are not as prevalent in traditional classroom spaces, and vice versa. Current research is beginning to reveal the skills that students learned during the remote learning period. For example, many students learned how to be resilient in while learning mathematics as they searched for supplemental materials, such as tutorial videos and articles online, to aid in their instruction since they could not be physically with their classmates and teachers (Pulungan et al., 2022). Additionally, many students improved their mathematics communication skills as they had more questions about the content while learning in a remote learning environment, and therefore had to be able to express their misunderstandings to seek clarification via an online platform (Pulungan et al., 2022).

Being a student in a school system does not only teach students content about specific subject areas but also provides adolescents with an atmosphere to gain and refine their social skills. Previous research has stated that the development of social responsibility through interaction with peers and a requirement to adhere to policies is a large purpose of schooling (Wentzel, 1991). When students are physically present in a classroom, they are exercising skills such as appropriate social behaviors and interactions with others (Wentzel, 1991). When schools

were required to transition to online learning environments due to the COVID-19 pandemic, much of the opportunity to practice the skills required to achieve the social competencies usually associated with attending classes was eliminated. The data from this study will reveal teacher concerns about this gap in social skill learning while students participated in the online learning environment.

Technology Use in Mathematics Classrooms

A large body of research exists to justify the benefits of including instructional technology in secondary mathematics education. Furthermore, this body of research has been supplemented and modified since the COVID-19 pandemic as all teachers had to utilize instructional technologies during the period of remote learning. Now, teachers everywhere have been tasked with deciding if and how they will continue to use instructional technologies now that they are able to conduct classes in-person again. Teachers not only can rely on their own previous experiences to aid in this decision, but also the available research on the effectiveness of technology in mathematics classrooms.

Research has shown that an effective mathematics classroom uses technology intentionally to achieve one of the following goals: explore or investigate a new topic, experience different representations of a concept, to generate or organize data, or to serve as a tutee in which students can express what they have learned (Cullen et al., 2020). When used purposefully for one of these intents, technology can improve the learning of mathematics by offering opportunities for higher order thinking (Cullen et al., 2020). Technology can also be used as tools for analysis, assessment of their work, or to assist in the accuracy of solving

mathematical activities (Barkatsas et al., 2009). When students use technology such as graphing calculators, certain computer software, spreadsheets, computer algebra systems, and other platforms, their problem-solving methods and explorations are supported (Barkatsas et al., 2009). In this study, teachers reported their uses of instructional technologies such as these, as well as non-specific technologies such as the use of recording video lectures and additional online platforms to relay information.

An important aspect of technology to note is that the intent of its inclusion in the curriculum should not be to replace basic understanding of skills within mathematical concepts (McGehee & Griffith, 2004). Many of the debates that surround the use of technology in the classroom stem from the idea that technology can replace crucial understanding about key topics, however this is not the intent of technology when used in a purposeful manner designed to enhance student understanding (McGehee & Griffith, 2004). For example, technology such as computer algebra systems and graphing calculators allow students to generate data about a given situation quickly and efficiently so that more time can be spent on high level thinking topics such as generalizing patterns of the data and constructing conclusions about those patterns (McGehee & Griffith, 2004).

Chapter 3

Methods

Setting and Participants

Potential participants for this study included secondary mathematics teachers that were recommended by Penn State Mathematics Education faculty members. Participants that were recommended were known by faculty members through previous research work, field experience observations, professional development opportunities, or curriculum reviews. All recommended participants currently hold a secondary mathematics teaching position in Pennsylvania. These recommended potential participants were invited to participate in the study via an email invitation. The five participants that are included in the study have all taught secondary mathematics in-person prior to the remote learning period, remotely during the remote learning period, and now currently teach in a face-to-face setting after returning from the remote learning period. The setting of this study consisted of email communication and video conferencing via Zoom. For the purpose of this report, pseudonyms have been used.

Data Collection

Participants took part in two interviews that were held virtually via the video conferencing platform Zoom. The first interview took place in the Fall of the 2021-2022 academic year, and the second took place either near the end of the academic year or in the beginning of the summer following that same academic year. The first interview investigated the

teacher's main strategies and routines from prior to the remote learning period, how the teacher transitioned to online teaching, their daily routines when teaching online, what strategies they used to create an engaging online classroom, and what they noticed about these early stages of returning to in-person learning. In this initial interview, I also inquired about what they learned during the remote learning period so far, and how they anticipate that information to be used in the future when they return to in-person instruction.

The second interview investigated whether the teachers maintained use of strategies they created during the remote period, how they have modified their strategies throughout the in-person academic year, and how they feel their students have changed as in-person learners throughout the year. In both of these interviews, I also allowed opportunities for teachers to share general thoughts and attitudes about these and any related topics they choose to include.

The questions for these interviews are included in this report. The questions used in the initial interview can be seen in Appendix A, and the questions used in the second interview can be seen in Appendix B. Most questions were asked to all participants; however, if a teacher already addressed the topic of a question in a prior question, then that question was skipped. The sub-questions were used if further detail was needed regarding the above question. All sub-questions were not asked to every participant, only when the conversation warranted further details or if an answer given by the participant needed clarification.

Data Analysis

After each interview, a transcription of the interview was created in a document. The documented transcription was then coded using the categories seen in Table 1. This coding

method was used to review interview videos and determine strategies used before, during, and after the remote learning period. An excerpt from one interview that demonstrates the coding technique can be seen in Appendix C.

The coded transcriptions were used to fill in a chart for each participant that represented how specific classroom strategies, routines, beliefs, and other topics have changed before, during, and after the remote learning period. An excerpt from one chart from one teacher can be seen in Appendix D. By representing data in this way, I am able to analyze the patterns about these similar topics that emerge across teachers.

Comparative methods of these charts and the coded transcriptions were used to synthesize the data of thoughts and attitudes regarding the impacts of the remote learning period on a variety of topics. The topics that were prevalent in all of the teachers' data can be seen in Table 2. Once these topics were determined, an additional investigation of the charts and coded transcriptions was conducted to ensure that all details of those topics were acknowledged, and that the chronology of the events regarding those topics was accurate.

Table 1: Data Analysis Coding Chart

Color Code	Category
Blue	Teacher experienced this topic or used this strategy prior to the virtual learning period.
Green	Teacher experienced this topic or used this strategy during the virtual learning period.
Gray	Teacher experienced this topic or used this strategy during the virtual learning period, however it was solely a transfer of the strategy used prior to the remote learning period that now exists on a virtual platform.
Yellow	Teacher observations or commentary on their own thoughts, practices, or experiences.
Red	Teacher gives a possible indication of why something was done or why a belief they had was thought.

Pink	Teacher experiences a topic or uses a strategy now that they are back to in-person instruction after experiencing the remote learning period.
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Table 2: Main Ideas from Teacher Data

Main Ideas from Teacher Data
Teachers see the need for groupwork/collaboration in the classroom
Teachers recognize the need for and want deep connections with students
Teachers were flexible in their organization of instructional content
Teachers noticed struggles with studentship and social skills within their students.
There were changes in teachers' and schools' acceptances and uses of new technologies.

Chapter 4

Findings

Teachers see the need for groupwork and collaboration in the classroom

All teachers in the study stated that, prior to the remote learning period, collaboration and groupwork was an important component to their classroom. The teachers involved in this study explained that, to them, groupwork involved students sitting together and collaborating on a shared assignment to gain further understanding and practice on a topic. However, many of the teachers found that collaboration between students was incredibly difficult to initiate during the remote period. Mrs. Jones and Mrs. Brooks noted that since they could not be digitally present in all breakout rooms at the same time, it was extremely difficult to manage the work that was being done by students. Furthermore, Mrs. Brooks was not allowed to use breakout rooms due to their administration being uncomfortable with students having unsupervised class time. Ms. Walker tried to recreate groupwork online but ultimately abandoned the idea as it was not working as expected. Mrs. Adams stated that, since their school was primarily asynchronous during the whole first year, implementing collaborative activities felt “virtually impossible.” In contrast, Mr. Smith implemented group activities throughout the remote period by constructing groups purposefully. The teacher stated that prior to the remote period, groups in their classroom were always constructed to include a mix of students with high, moderate, and low achievement levels. The teacher continued this strategy during the remote learning period and felt that this greatly helped students to remain on task while the teacher could not always be in their breakout

room. While it is possible that external factors such as grade and ability level could have influenced these findings, none of the teachers in this study noted these or other factors impacting their observations.

Upon returning to in-person instruction, all teachers in the study reinstated groupwork and collaborative activities. Most teachers have brought back collaborative activities that resemble the same activities that occurred in their classrooms before the remote learning period occurred. Mrs. Jones noted that using groupwork regularly in class again is what has made school feel “normal” again after returning to in-person instruction. Mrs. Jones also stated that she was more appreciative of the classroom environment, specifically the ability for the students to easily collaborate, after losing this ability when going to a remote learning environment. While Mr. Smith did use group activities during the remote learning period, the teacher continues to include opportunities for collaboration during in-person lessons due to their philosophy that mathematical understanding occurs in both personal and social endeavors. Ms. Walker has noted that students are working together for approximately 80% of class time. Finally, Mrs. Brooks and Mrs. Adams also noted that students are engaging in collaborative tasks very frequently, if not every day.

Due to the many teachers losing the ability to utilize groupwork in their classrooms, teachers have made informal observations about the impact of regaining this classroom strategy. According to some of the teachers, students seemed more engaged in groupwork now than before the pandemic, which could possibly be contributed to a lack of collaboration and social interaction during the remote learning period. Several teachers noticed that students are more willing to help each other understand mathematical content than prior to the pandemic. Mrs. Jones stated that students are “bending over backwards to help one another out.” The teacher has

witnessed students coming into the classroom during their free time to work with the teacher and each other to build their confidence and mathematical understanding. Mrs. Brooks noticed how students are thriving off assisting each other during class time and hypothesized that this may be due to a lack of social interaction and collaboration during the remote learning period. Similarly, Mrs. Adams noticed the excitement students feel of getting to work with one another again. However, this teacher also noticed a lack of social skills within these interactions, but we will discuss this topic in depth in the “Social and Studentship Skills” section. Finally, Mr. Smith noticed that the year following the remote learning period was the most “collaborative year of students” across all sections of classes that the teacher taught that year. This teacher also thought this was due to a lack of interaction experienced during the remote learning period. Due to the high level of collaboration, the teacher was able to push students to think more deeply about mathematical topics much more than in previous years. Overall, it is evident that the loss of groupwork for many teachers during the remote period has been made up by the success of reinstating those collaborative activities upon returning to in-person instruction.

Teachers recognize the need for and want deep connections with students

Across teachers, it was clear that the remote learning period required more intentional actions for teachers to create meaningful connections with their students. Furthermore, we saw several teachers committing to creating connections with students despite the additional efforts it required and the unique circumstances that surrounded them. Mrs. Jones stated, “Because of what we went through as a society, I think we were able to develop relationships that were more meaningful.” She, along with others, leaned into the harsh realities that accompanied the remote

learning period to connect with students on a more human level. Ms. Walker chose to strengthen her connections with her students by being more intentional in sharing personal experiences and interests with her students. She saw how sharing aspects of her life outside of the classroom interested her students, and she stated that her students craved a connection that transcends the curriculum. Ms. Walker has said that since this experience that she will continue to share details of her life with students in order to create these meaningful connections with students, and her students also then felt comfortable to share pieces of their lives as well. When asked what they were most proud of during their time teaching during the remote learning period, Mrs. Brooks and Mrs. Adams both responded with how they built and maintained relationships with students, even during a virtual learning environment.

After acknowledging the importance of fostering meaningful connections with students, several teachers implemented numerous ways to connect with students, about both academic materials and aspects of their life that were not academic, that were not used frequently prior to the remote learning period. Mr. Smith explained that he sets a goal of bringing as much of what is happening in his students' lives into the course material and finding connections between his students' interests and the lesson, which strengthens his personal connection to his students by exemplifying his knowledge of the students. Mr. Smith further explained that sometimes this works very well, but sometimes a connection is not that strong in the end. He explained that it is still necessary to bring those interests into the conversation after the remote learning period, even if the connection will not be that strong, as students will see this as an invitation to join the conversation and participate in the classroom discussion. Mrs. Brooks saw connection with students as so important that she organized a 'drive-by' to all her students' houses to wave to each of them. Her students after that were more interested in the online lessons as they had a

personal connection to their teacher. Finally, Mrs. Adams ensured that she incorporated fun icebreaker questions and trivia games to connect with her students over something that was not related to the mathematics curriculum.

Now that teachers have resumed in-person instruction, most teachers recognize the importance of making deep relationships with students and continue to engage with students as people as well as learners. The remote learning period emphasized the value of connecting with students to Ms. Walker and several other teachers. Ms. Walker stated, “Content is still key, but I realized that it's the connection with students that allows learning to happen. I realized there's nothing worth taking that out of my teaching philosophy, it only deserves a higher spot.” She said that if she were to rewrite her educational philosophy after the remote learning period, she would bring relationships to the forefront. Mrs. Jones felt that she did a good job connecting with students through the remote learning period, but she has now made a more conscious effort to connect even more deeply with students once back in-person. Additionally, she noted that during the remote learning period, she was restrained to only teaching from a teacher’s desk. Now, she is able to engage with students in the physical space with more flexibility and freedom, she has a deeper appreciation and desire to connect with students over the material. Mrs. Adams has also stated this appreciation for a return to in-person instruction, as she explained that real relationships with students do not happen through just emailed and submitted electronic assignments. Mrs. Adams went into this profession to connect with students and learn about her students as people. She explained that not being able to connect easily with students was the hardest part of the remote learning period for her, and that losing the ability to easily create connections has made her immensely grateful for the classroom environment.

For Mr. Smith, his time spent teaching during the remote-learning period encouraged him to value each individual student's thought processes more than the logistics of their mathematics performance in the class. He refined his philosophy towards learning and made an intentional switch to a student-first approach in learning, meaning students will take the 'driver seat' in deciding how they learn mathematics. This has allowed him to honor each student's thought processes as they take control and leadership in how they grow in their mathematical endeavors. This switch in philosophy has been very important to Mr. Smith, but he believes that his students would not have felt confident in their role in the student-first approach if Mr. Smith had not created those foundational connections first. Finally, since returning to in-person instruction, Mr. Smith has made intentional efforts to provide opportunities for socialization, as he strongly believes that mathematics requires social learning, which was withheld from students during the remote-learning period. For example, the teacher provided several opportunities for students to complete math projects and examples together, as well as opportunities for students to talk about what they have been doing outside of school.

Mrs. Brooks found that while she does take more time to enjoy her students and interact with them now that everyone is in-person again, she has to be stricter in her classroom procedures and regulations as students are still regaining their behavior skills. She stated that she was proud that she provided her students with a safe place during a tumultuous time for students to connect with others and be engaged in something. However, she is now finding a balance of creating and keeping those meaningful connections, and ensuring students follow direction and classroom policies. Mrs. Brooks was the only teacher to note behavioral considerations that may accompany the increase of connection opportunities between teacher and students.

Teachers were flexible in their organization of instructional content.

The remote learning period required teachers to present material virtually, which often resulted in lessons taking longer for students to understand in comparison to lessons taught in-person. Subsequently, teachers had to make decisions about what content to eliminate or decrease to make up for this increased time spent on other topics, and teachers became flexible in their sequencing of content in order to combine topics and save time. This experience has allowed teachers to feel comfortable modifying their sequencing of curriculum for any reason. Mrs. Jones explained that she had to “cut down” the content of each unit, and now she feels more prepared to adjust her lesson plans when class periods that are shortened due to inclement weather, early dismissals, or any unexpected event. Ms. Walker prioritized students staying engaged in mathematical thinking of any type compared to covering every topic in the course. Therefore, Ms. Walker also had to choose which topics to eliminate, and now she states that she is more flexible regarding the extent to which every topic is covered. Mrs. Adams shared a similar value and stated that her main concern was to “keep students thinking about and engaged in mathematics.” She also revealed that she now feels more comfortable being flexible with the order and depth to which she presents content for each topic.

Another strategy teachers took to increase efficiency in covering material was to search for topics that have similar skill sets, and to “overlap” those topics to decrease the days spent on those topics. Mr. Smith stated that he searched for these scenarios in his units instead of following the textbook suggested sequence of topics. After returning to in-person instruction, Mr. Smith still uses his revised order of topics as he noticed that overlapping certain concepts increased student understanding. This experience has allowed Mr. Smith to be more open to

leaving the textbook and the order in which it presents the content, and he now organizes material to best support understanding of his specific students and searches for resources and activities that increases engagement in these topics. For example, Mr. Smith modified the order of multiple calculus topics in order to more efficiently ensure student understanding. He now introduces the idea of continuity before the details and properties of limits as this has allowed him to be more efficient with his time.

Prior to the remote learning period, Mrs. Brooks always had the goal of “getting as much math as possible out of each topic.” She also always tried to have each new concept and lesson be as hands-on as possible. During the remote learning period, she had to modify this goal to match the environment she was constricted to. Mrs. Brooks tried to make her lessons lighter, and more relatable to the real world so that students found them more interesting and worthwhile. This was also in part to get students to choose to participate in these online classes and to be active members of the virtual classroom. Once Mrs. Brooks returned to in-person instruction, she still desired to create a classroom atmosphere that was centered in math that is explicitly applicable to life after high school. She explained that, in comparison to her classroom before the remote learning period, her classroom is much lighter and not as strict about getting through all the material that is included in the textbook. For example, the teacher would modify many of the units to include more real-world and engaging topics and exercises.

Since several teachers acknowledged that they were not going to cover all the material they would during in-person instruction while in a virtual classroom, they had to make choices about what topics to eliminate without hurting their students’ overall understanding of the course. Mrs. Brooks stated one of the most difficult parts of starting to teach remotely was knowing what to teach since it would be more difficult to display materials and facilitate group

discussions. When asked how she prioritized content, she stated that if she never used it in her adult life, then she did not worry about teaching it during the remote learning period. For example, problem solving remained a priority, but the intricate rules of negative exponents were not as big of a concern. Mr. Smith admitted that he eliminated topics during the remote learning period that he felt students could not learn and still walk away from the class with a fine understanding of the entire course.

Now that students have returned to in-person instruction, teachers are noticing the effects of these modified, and sometimes condensed, courses. Teachers have had to find ways to combat gaps in their knowledge that were widened due to the remote learning period. Mrs. Jones stated that, overall, she has found that she needs to slow down instruction more often than prior to the pandemic and needs more time to teach mathematical concepts and skills. A benefit of the virtual learning environment, however, is that she can now draw on videos and digital resources that she created or found during the remote learning period to support students that need extra support after the in-person lesson on that topic.

Mr. Smith became more comfortable in asking students for visual representations of evidence of understanding from students. During the remote learning period, he asked students to use concept maps, create videos, and other forms of alternative assessment since it was difficult to evaluate student understanding when not in the same physical space as the students. The teacher kept these forms of assessment, and they have afforded him another form of assessment and opportunity to make adjustments in his lessons based on student performance.

Mr. Smith and Ms. Walker both found that, after their experience with the remote learning period, they prioritize mathematical thinking and effort more than adhering to policies, deadlines, or the traditional chronological order of topics. Mr. Smith stated that he became more

lenient with deadlines and emphasizes to students that he wants them to do the work and think deeply about the topics. Ms. Walker stated that, after reflecting on her time teaching virtually, “mathematical thinking is just as important as their procedures, because if they have an understanding of the mathematical structures, and then they can pick up procedures easier, for the most part.” Ms. Walker therefore keeps a goal of maintaining student engagement in rich tasks that increase mathematical understanding, and values less students submitting assignments at a specific time.

Teachers noticed students’ struggles with studentship and social skills.

When students attend and engage in in-person learning and the school environment, they learn skills and lessons that are not specific to a content area. When attending school virtually, students did not use many of the skills needed for traditional school such as organizational, social, and studentship skills. Studentship skills are skills that enable students to be successful in their academic careers such as time management, study skills, professionalism, and more. Therefore, when students returned again to in-person instruction, several teachers noticed gaps in these skills. Mrs. Jones noticed that since students did not practice time management skills and frequently multitasked during virtual classes, students struggled to get homework done when they came back to in-person instruction. Ms. Walker noticed this same struggle with time management and learned that students forgot that homework was a common aspect of their schoolwork since, during the remote learning period, everything was done at home. She struggled to explain the difference between homework and classwork to her students since, at this time, all work was technically being done at home regardless of the time of day. Ms. Walker

and Mrs. Adams both stated they saw many students struggle with organizational skills. They both explained that their students could not keep papers and books neat, and they had great difficulty meeting deadlines. Ms. Walker also added that students struggled to communicate misunderstandings and to ask questions when they needed further information or clarification. Finally, Mr. Smith recounted a decline of “traditional” studentship skills due to the skillset required of a student in a virtual learning environment is so different from that of an in-person setting. Before online learning, the skills needed to be successful were reported to focus a lot on organization, being attentive in class, and attending to school policies. While many of these skills transferred over when moving to a remote learning environment, there was a larger struggle with attentiveness during class, however, since students were not physically in the same room as the teacher. Since students were able to easily be on their phones at home or multitask with other activities, he says that he struggles to have their full attention and to eliminate distractions. Students for this same reason have been having difficulty structuring their day to get all of their responsibilities and activities accomplished since they got comfortable doing multiple activities or tasks at the same time.

Additionally, learning remotely sometimes required completely different skills and crutches were available to take a more passive role in their education. Mrs. Jones stated that she watched two very different outcomes result from students attending virtual classes. Students realized that they either needed to pay even more attention than they would in-person and be more engaged in order to learn, or they realized they had a video to rely on and therefore did not pay as much attention. Mrs. Jones further explained that some students relied on various crutches, such as communication with classmates or consistently using notes or the internet, for assessments and projects during the remote learning period and it was more difficult to regulate

students' behaviors. Mrs. Jones has noticed that the students that used these resources are now struggling even more with the transition back to in-person instruction. Ms. Walker explained that students did not learn how to study or take timed tests since assessing students during the remote learning period looked drastically different than the assessments we use during in-person instruction.

Mrs. Brooks realized that students lost the ability to be patient in learning, and to grapple with the content and try on your own before immediately looking for the answer. While at home, students could search and find any answer they wanted instantaneously. Therefore, Mrs. Brooks has had to teach her students to pause and think on their own first in order to instill this patience and work ethic again. Similarly, Mrs. Adams noticed that students could easily take a back seat in learning while in the remote learning period. For example, she explained that students had to take a large initiative to ask questions or volunteer to solve a problem during the online classes. Therefore, she has noticed students struggling to stay motivated and engaged since it was quite difficult to do so during the remote learning period.

Now that students have returned to in-person instruction, teachers have identified skills that are missing. Mrs. Jones stated that her students' confidence levels are much lower after returning to in-person instruction. She explained that students will ask for extra tutoring even when they have clearly demonstrated understanding of the content in order to boost their confidence. Additionally, several teachers noted that students are lacking the skill to assume responsibility for their own work and belongings. Ms. Walker explained that she wished she emphasized more strongly the importance of the student being responsible for their own learning as a student, and that the responsibility is not solely on the teacher. She said that she could have explained to students the value of asking questions and investigating related topics on their own,

and in the future, she will know the value of discussing these ideas with students. Mrs. Adams noticed an overall lack of motivation while students were virtually learning. However, she explained that once students were back to participating in in-person instruction, these motivational levels began to rise again.

Once back to in-person instruction, several teachers observed the impact of the remote learning period on the social skills of the students. Ms. Walker noticed immediately that students struggled to appropriately interact with their classmates, and sometimes struggled to maintain professional behavior in the classroom. She explained that she felt that she needed to reteach her students the appropriate ways to collaborate, and that their skills have improved as they continue to see each other in the classroom. Mr. Smith also noticed the lack of social skills and was specifically concerned since he values mathematics as best learned through collaboration. Mr. Smith acknowledged that they have not been able to socialize for a long time due to this remote learning period and has been working to get students back to where they should be socially.

There were changes in teachers' and schools' acceptances and uses of new technologies.

Teachers used different materials and methods to present information and keep students engaged during their remote classes. Many of these methods included new technologies, software, and websites. Mrs. Jones, along with others, utilized pre-recorded video lessons, online homework submissions, and other online platforms that made learning interactive (e.g. Desmos) during the remote learning period. Mr. Smith used technology during the remote learning period, such as Pear Deck (an interactive way to deliver lesson presentations to students), for the purpose of gauging student understanding and ensuring all students kept at the

same pace. Mrs. Brooks explained that she incorporated technology into her lessons for organizational purposes of lesson content, such as structuring information in slideshow formats. She also frequently used platforms that transformed PDF worksheets that already existed into an interactive activity. Mrs. Adams revealed that she rarely used technology prior to the remote learning period at her school's request. She began using Google Classroom as an organization and communication tool to ensure students all could access all lesson materials.

Once teachers were able to return to in-person instruction, teachers had to make decisions on which of these new methods would be kept when they return to in-person instruction, and which would be let go. While Mrs. Jones thought the technology used during the remote learning period was helpful for that scenario, she values the hands-on approach and wants to get back to students working with others in the classroom. Mrs. Jones, as well as other teachers, viewed what we call the hands-on approach as using tools such as worksheets, whiteboards, computers, and more within the classroom in the presence of other students and the teacher. While this approach may sometimes include the use of technology, the teacher is not relying on technology to ensure the lesson is successful, and still ensure the opportunity for students to grapple with mathematical topics. She is thankful, however, for the bank of pre-recorded lessons she has now from the remote learning period as students who are absent can easily get caught up by reviewing that lesson's video. Mrs. Jones also explained that homework submissions via Google Classroom has been a huge affordance for her classroom as she no longer uses class time to check whether students completed homework, and her students have reported that they are more diligent with their homework efforts since their responses are being submitted and kept on file. Mr. Smith chose to keep much of the same technology used in the remote learning period in the classroom

and noted that the technology is much easier to facilitate the use of in the classroom since he is there to troubleshoot and monitor student activity.

Ms. Walker explained that since she used Desmos so much during the remote period, she has learned to use Desmos more effectively and can include it in her lessons more purposefully. However, she also explained that her students have started to become tired of Desmos since they were relied on so heavily during the remote learning period, so she will have to find a balance and incorporate them carefully. Ms. Walker also uses technology for organizational purposes, and she gives online quizzes to quickly evaluate students' progress while providing them with an opportunity for immediate feedback. Overall, Ms. Walker explained that while she will still use technology, she also has had to intentionally incorporate note-taking opportunities into the lessons as she saw students lacking that skill after the remote learning period. Mrs. Brooks had a very similar attitude towards technology use in the classroom. While she saw the use in using technology to create interactive activities and keep records more easily organized, she also saw immense value of students completing hands-on work within collaboration with other students. For Mrs. Adams, there was a large affordance in that her school leaders and administrators became more comfortable with their teachers using technology in the classroom, as prior to the remote learning period, they were very uncertain. While Mrs. Adams has said that she does not use all of the technology that she implemented during the remote learning period, it is beneficial to be able to use organizational tools such as Google Classroom to create more structure in the class and ensure absent students have access to the class materials. Across teachers, we can conclude that although new uses of technology have been implemented in the in-person classrooms, there is still benefit to hands-on working with mathematics, and technology is not the “answer” to learning mathematics.

Chapter 5

Discussion

The following section will aim to further discuss the findings of this study and provide implications for future research. The results of the study will be discussed in terms of relevant literature when applicable or may highlight gaps in literature that could be filled by future studies. The goal is to explore teachers' thoughts and attitudes regarding the remote learning period due to the COVID-19 pandemic, and to use their experiences to increase knowledge and improve secondary education classrooms for the future.

Use of Recorded Lessons and Technology in In-Person Classroom Environments

In this study we have seen the evolution of five teachers' classroom routines and commonly used activities before, during, and after the remote learning period. All teachers in this study had to use at least one type of technology during the remote learning period in order to hold their classes via an online learning environment. When given the opportunity to return to in-person instruction, these teachers had to make decisions about which, if any, forms of technology they would continue to use. As discussed previously, a large body of literature (Cullen et al., 2020; Barkatsas et al., 2009; McGehee & Griffith, 2004) supports the use of technology in the classroom when use effectively. Similarly, many teachers noticed scenarios when the forms of technology used in the remote learning period could be beneficial to their instruction in the traditional, in-person classroom.

For example, Mrs. Jones did not use Google Classroom as a way to collect homework assignments prior to the remote learning period. However, since she could not physically walk

through the aisles of the classroom and see who completed the work during the remote learning period, she was required to use a form of online submission. Once she made this change to her classroom routine, she noticed that students' work looked more organized and thoughtful since there was a physical copy of their work that the teacher could review multiple times. Upon returning to in-person instruction, Mrs. Jones has chosen to keep this form of technology in her classroom to motivate students to take more time and care with their homework assignments. This example exemplifies how technology can be used to enhance students' academic performance and increase efficiency in the classroom (McGehee & Griffith, 2004). Mr. Smith required students to create videos that allowed students to explain their understanding of the topics orally and visually, since communicating with all students in one class period during the remote learning period became difficult. However, after seeing the success and quality of the students' work, he has chosen to continue to use video creation assignments as a form of assessment in the classroom. Mr. Smith has demonstrated how technology can offer an opportunity for students to engage in tasks that require higher order thinking skills (Cullen et al., 2020). Finally, all of the teachers, in some capacity, utilized recorded video lessons during the remote learning period. Several of these teachers mentioned that having videos of most topics readily available is greatly valuable for students that are absent or need to further review the topic. This once again showcases the use of technology as a resource to provide organization and efficient routines in the classroom (McGehee & Griffith, 2004).

Although these examples and more show the great benefits to the continued use of technology in the classroom, the data from this study and the literature remind us that technology should be used only where it will be effective in enhancing student learning (McGehee & Griffith, 2004). For example, Ms. Walker chose to decrease her use of Desmos and other online

platforms that allowed for interactive student exploration when students returned to in-person instruction. While she acknowledged that these tools had great benefits to student understanding and were especially useful in the online learning environment, she noticed that her specific students were lacking in skills such as notetaking and communication that would be best exercised without technology. Through the combination of the data in this study, and the vast amount of literature that has shown the affordances and drawbacks of technology in the classroom, we can see that teachers must carefully make decisions on how technology should be used based on their students and course material.

Student-Teacher Connection in an Online Learning Environment

There exists a large body of research that proves that a healthy and positive connection between students and teachers has a positive correlation to academic performance (Martin & Collie, 2019; Ruzek et al., 2016; Wentzel & Wigfield, 2009). However, this data has only been shown to prove true in classrooms with traditional, face-to-face instruction. The data from this study has exemplified that teachers see the need for and value the importance of connections with their students, despite the instructional mode. Therefore, we saw that teachers engaged in multiple strategies to foster similar connections with their students during the remote learning period. For example, we previously mentioned that Mr. Smith made conscious efforts to learn about his students' interest outside of the classroom as a way of creating connections. Since he took acknowledged the importance of learning about his students' lives in order to foster meaningful relationships, he was then able to incorporate these interests into the lesson material. He noted that students were more willing to engage in the class and participate in the lesson

activities. Mr. Smith exemplified how teachers that purposefully foster connections with their students also create a space that enables students to academically thrive, as proven in previous literature (Wentzel & Wigfield, 2009). For this specific example, we do not have evidence to say that the students that connected to lesson, and therefore participated more actively than in previous lessons, saw an improvement in their academic performance. However, we do have evidence, in the form of this narrative by Mr. Smith, that these students did participate in the positive behaviors of engaging and participating in the classroom environment.

It may seem to be a logical assumption that if student-teacher connections will impact the academic success of students in a face-to-face classroom, then connections created within an online learning environment should also result in increased academic success. However, there is currently insufficient data to support this claim. In this study, we focused on the connections made between teachers and students from the teachers' perspectives only to conclude that teachers recognized the need for these connections and worked to create them. We did not conclude in this study that these connections had a direct impact on students' academic achievement. Furthermore, there is lack in the literature available that focuses on interpersonal connections made via an online learning environment. Currently, the vast amount of research surrounding the topic of student-teacher connections in educational environments surrounds exclusively in-person instruction (such as Martin & Collie, 2019; Ruzek et al., 2016; Wentzel & Wigfield, 2009). Therefore, further research is needed that studies classes taught in a remote learning environment. Not only would this research be relevant for teachers if an unexpected event that requires the sudden shift of all classes to be held remotely occurs again but would assist in classes that are normally held online. Research in this area would provide teachers conducting remote lessons with data that can support their journey to foster nurturing

relationships with their students that are not physically with them. Hopefully then, not only would students experience a meaningful connection with a teacher despite not being in the same room as them but could also possibly see academic improvement due to these increased levels of connection.

Impact of Curriculum Planning and Sequencing on Conceptual Understanding in Mathematics

A role of the secondary mathematics teacher is to follow a mathematics curriculum as provided by the school administration and ensure that all topics within that curriculum are taught to the students. Often times, the teacher will follow this curriculum by using a textbook or other instructional resource that provides a sequential order and plan for these topics to be presented. However, during the period of remote learning due to COVID-19, many teachers needed to adjust this sequence of educational topics to best fit the time left in the academic year and the mode of online learning their school has chosen to use. Of the limited body of literature that discusses related topics such as planning and sequencing of curriculum, the emphasis is placed on the following topics: the sequencing between different mathematics courses (Chinofunga et al., 2022), how mathematics courses can impact other subject areas (Stohlmann, 2020), and the comparison of instructional materials proposed by official curriculum and those of the enacted curriculum (Choppin et al., 2022).

There is a gap in literature that focuses on this specific notion of secondary mathematics teachers adjusting the curriculum within one course to best support student learning. In this study, the participants that reported adjusting the sequence of their course material did so due to

the limited time, and sometimes resources, available during the remote learning period. These teachers were then able to report if they chose to keep those changes for their first year back in-person after the remote period. However, they were unable at that time to disclose if they saw a benefit of these changes on the students' academic performance, and therefore mathematics understanding. Further research is needed on the impact of curriculum sequencing on student mathematical understanding in secondary mathematics courses. This topic would be worthwhile to research as teachers frequently must make decisions about how to adjust their curriculum based on unexpected events such as weather closures, school calendar modifications, student illness, and more. Additionally, this could lead to a more defined framework for teachers to follow if there were to be a future event that requires school closures once again.

Chapter 6

Conclusion

The goal of this study was to showcase the experiences and thoughts of secondary mathematics teachers after the teaching remotely due to the COVID-19 pandemic in hopes that others can learn from this period of virtual learning. By comparing what teachers used in the virtual setting to what they still use now that they are in-person, we can see how their experiences during the COVID-19 pandemic impacted their return to traditional classroom settings. This unique time period has caused teachers to reconstruct their teaching techniques, and it is natural for all of those experiences to mold how they approach teaching now. Furthermore, current teachers can use the knowledge provided by the experiences of these teachers to reflect on their own teaching. While this study only showcases the talents and efforts

of five teachers, across the world teachers were facing similar situations. This study also serves to provide a sense of community for all teachers that worked tirelessly to create an effective educational environment for students through a global pandemic. By reading this study and learning about the experiences of the participants, teachers can feel comforted that others have felt similar challenges and triumphs as them.

While this study focuses on how the remote learning period has impacted teachers and the classroom strategies and activities they utilize, the remote learning period has impacted the students as well. The participants of this study recounted in several capacities their observations of how the remote learning period directly impact the students academically, emotionally, and socially. Further research is needed to study how the remote learning period impacted these students so that teachers can be better equipped to support students as they continue to transition back to in-person instruction.

Appendix A

Initial Interview Questions

1. Describe your feelings/thoughts when you found out you would be switching to virtual teaching.
 - a. Sub-bullets for each question are follow-up questions that may or may not be used depending on if more information is needed.
 - b. Why did you feel that way?
 - c. Did you have experience with teaching online? What was it?
 - d. Experience with using technology for instruction? Like what?
2. What were the first steps you took in preparing to teach remotely?
 - a. First steps they took/where they started?
 - b. Why?
3. What kinds of sources did you use to prepare, and how did you find out about them?
 - a. Did the school give them to you, friends, online search, etc.?
 - i. What type of online source?
 - b. How did you use them/What did you gain from them?
4. What did a typical class (virtual) look like for you in the beginning stages of remote teaching?
 - a. How did you greet students?
 - b. Did students get to work in groups?
 - c. Did students often have cameras on? Microphones on/talked? Used chat?
 - d. What platforms were used to share content? PowerPoints, Canvas, etc.?
 - e. How did you end class?
 - f. Ask what were their activities? Did you use them before online? How if at all did you have to modify them?
5. Describe how your students were engaged during the class. Were they as engaged as you wanted them to be?
 - a. What did your students physically do in the class?
 - b. How did you communicate with your students in class? With each other?
 - c. How did monitor their engagement?
6. How if at all did you change your typical online routine as the virtual learning period went on?
 - a. Why did you change the things you did?
 - b. How did you know you needed to change those things?
 - c. Were their things that you wanted to change but didn't? why?
7. What teaching strategies worked the best for you? What were your 'go-to' strategies/activities?
 - a. Can you show me one of them or share one with me?
 - b. How often did you use that?
 - c. What did you like about that strategy?
 - d. Did your students seem to like it?
 - e. How did it seem to work with students?

8. How could you tell that the strategy you were trying to use with your students was working?
 - a. What specific actions/words came from students?
9. Were there things that did not work as well or in the way that you wanted it to? Why did you think they did not work and how did you 'pivot'?
 - a. Can you show me one of them or share one with me?
 - b. How often did you use that?
 - c. When did you realize it did not work? Why?
 - d. What was your next step when it did not work?
 - e. Did your students seem to like it?
10. Tell me about one of your best classes you held in the virtual environment.
 - a. Ask for a step-by-step if needed.
 - b. Why did you feel this was one of your best?
11. Tell me about a class in the virtual environment that was on the opposite end.
 - a. What made it not-so-great?
12. What was your biggest struggle to overcome during the period of remote learning, and how did you overcome that?
 - a. Did it seem like a big struggle in the moment? When did you realize?
 - b. What do you wish you knew then that you know now?
 - c. if you did not overcome it, what made it so difficult? (or if they did overcome it, what made it difficult)
13. How did your students progress as virtual learners throughout the year?
 - a. Did they stay engaged, become more engaged, or less?
 - b. How would you compare your students you had in the virtual environment to average students pre-pandemic?
 - c. Why do you think these changes occurred?
 - d. Was there anything that could have been in place that could have minimized or enhanced these changes?
14. Now that you are back in-person, do you notice anything different/unusual about how your students learn, behave, interact, etc.? It could be an improvement or not! Obviously you might not have the same students you had last year, but just in general?
 - a. Were any of these changes positive, and why?
 - b. Do you think your students will go back to the average pre-pandemic student behavior?
 - c. How to you adapt to any negative changes you notice?
 - d. How to adapt to positive?
15. Have there been any changes in you as a teacher since we have been back?
16. Looking ahead to now in-person learning, what are strategies and/or activities if any have you started using during virtual learning that you plan to/are using in-person this year?
 - a. Why do you see yourself continuing to use them?
 - b. If none, why?
 - c. How are you changing the strategy you started using in remote learning to fit an in-person format? How is that strategy in remote learning compare to same in-person strategy?

- d. Do any of these strategies relate to how homework or assignments look like in your class?
17. How do you think the period of remote learning impacted:
 - a. you as a teacher?
 - b. your teaching style?
 - c. Your teaching philosophy?
 18. What did you do in the remote learning period that you are most proud of?
 - a. Why?
 - b. Can you give more detail?
 - c. Was this a change going into, or during online?
 19. Anything else you want to share?
 - a. Likes/Dislikes about remote learning?
 - b. Things about before the pandemic?
 - c. Predictions for this coming year?

Appendix B

Second Interview Questions

1. What does a typical class look like for you now?/as in-person year went on what was your normal routine
 - a. How did you greet students?
 - b. Did students get to work in groups?
 - c. What platforms were used to share content? PowerPoints, Canvas, etc.?
 - d. How did you end class?
 - e. Ask what were their activities? Did you use them before this year? How if at all did you have to modify them?
2. You mentioned last time we spoke that you started using (fill in blank) OR stopped using (fill in the blank). Do you still use/not use this? Why?

(2.1) FOLLOW UP TO ANSWER FOR EACH ITEM: Is there something else you do instead or have you altered it in anyway? (to what extent)

 - a. Did you do that and for how long?
 - b. Were the outcomes that occurred what you expected?
 - c. If you stopped using an activity, why? What could have been modified to make it more effective?
 - d. Were there any new strategies that you started using?
3. Describe how your students were engaged during the class since we last spoke. In general, are they as engaged as you wanted them to be? [if applicable:] I know that this may be different depending on the time of year, especially since it is the end of the year right now, but you can answer this generally speaking.
 - a. What did your students physically do in the class?
 - b. How did you communicate with your students in class? With each other?
 - c. How did monitor their engagement?
4. How if at all did you change your typical routine as the year went on?
 - a. Why did you change the things you did?
 - b. How did you know you needed to change those things?
 - c. Were their things that you wanted to change but didn't? why?
5. What teaching strategies worked the best for you? What were your 'go-to' strategies/activities?
 - a. Can you show me one of them or share one with me?
 - b. How often did you use that?
 - c. What did you like about that strategy?
 - d. Did your students seem to like it?
 - e. How did it seem to work with students?
6. Are there strategies that you used previously (online or in-person) that did not work as well this year as they previously did?
 - a. Can you show me one of them or share one with me?
 - b. How often did you use that?
 - c. Did your students seem to like it?

7. What was your biggest struggle to overcome this year, and how did you overcome that?
 - a. Did it seem like a big struggle in the moment? When did you realize?
 - b. What do you wish you knew then that you know now?
 - c. if you did not overcome it, what made it so difficult? (or if they did overcome it, what made it difficult)
8. How did your students progress as back-to-in-person learners throughout this year (since September 2021)?
 - a. Did they stay engaged, become more engaged, or less?
 - b. How would you compare your students you had this year to average students pre-pandemic?
 - c. Why do you think these changes occurred?
 - d. Was there anything that could have been in place that could have minimized or enhanced these changes?
9. I asked this question last interview, but would like to hear if you still feel the same way as last time we spoke. Throughout this in-person year, did you notice anything different/unusual about how your students learn, behave, interact, etc.? It could be an improvement or not! Obviously you might not have the same students you had last year, but just in general?
 - a. Were any of these changes positive, and why?
 - b. Do you think your students will go back to the average pre-pandemic student behavior?
 - c. How did you adapt to any negative changes you notice?
 - d. How did you adapt to positive changes?
10. During the remote period, there was a lot going on and teachers had a ton on their plate, which may have caused certain things to not happen or not be a priority. How do you think you prioritized what you focused on or what you spent time on during the remote period?
11. After teaching this past year back in-person, do you believe there was a loss in learning or loss in studentship skills due to the remote learning period?
 - a. If so, what are the losses?
 - b. Have they regained from them?
 - c. Are there strategies being used to make up for that?
12. Have you found and implemented ways to combat those losses? What were they?
 - a. How did they go?
13. Can you discuss your connection to your students, and how if at all it has been affected by the remote learning period.
 - a. In general how connected do you feel to your students?
 - b. Do you think that the way and amount in which you connect to students has been affected by remote learning period? Why?
14. Have there been any changes in you as a teacher since we have been back?
15. How do you think this past year (first year being back to fully in-person learning) impacted:
 - a. you as a teacher?
 - b. your teaching style?

- c. Your teaching philosophy?
16. What did you do this year that you are most proud of?
- a. Why?
 - b. Can you give more detail?
 - c. Was this a change going into, or during online?
17. Anything else you want to share?

Appendix C

Sample Data: Coded

The following sample has been modified to exclude any identifying information. The purpose of this inclusion is to demonstrate the coding technique rather than focus on specific data. Therefore, several different pieces of the entire interview have been extracted from the full data set to showcase as many different types of codes as possible.

“So it was really interesting because you know, we had always talked about doing remote lessons for snow days like that was already in the works, and we were preparing to do a possible virtual snow day. So when the pandemic hit we administration gave us an in service on March 13, that was a Friday, and said let's try some things out, let's have a workshop, learn some things and then on Monday we're going to do a practice day. Before we left on Friday, we got the news that we were going to be out for two weeks. And then of course we never went back. yeah so it was a whirlwind it was very overwhelming extremely overwhelming, to say the least um that workshop was a godsend”

“So I was able to write my work show my work under the document camera use loom to record myself and then put up videos and then my students would ask me Homer questions, and I would build videos for homework explanations.”

“I chose Zoom is because the waiting room, so I was, I really wanted to be able to control when they came in, who came in, because you're hearing about all these zoom bombings right.”

“So the live days they had to have their cameras on. I was sensitive, though, because you didn't know what was going on in the home life right you didn't know so I really look for volunteers. I did not cold call students pretty much that spring semester now last year I did so last year we had half the kids on zoom and half the kids in the room, and then the next week, it would flip flop.”

“I definitely still use Google classroom so that allows me to have a picture of their homework. It's still more time consuming to go check their work that way, but now I have you know proof of whether they're showing their work or not. I think it makes them do it more diligently because they have to take a picture.”

Appendix D

Sample Data: Chart

One topic of one teacher's chart can be seen below. For each teacher, a chart was filled out after their first interview and then added to after the second interview. Each teacher had, on average, about 13 topics in their chart.

Topic	Before Remote Learning Period	Why was there a change to go to remote?	During Remote Learning Period	Why was there a change to return back in-person?	After Remote Learning Period
Video Lessons/Recording Lectures	Did not use any type of video lessons or recorded any lessons.	No longer could host live, in-person lessons due to pandemic	Taught live on Zoom and recorded the meeting if students wanted to go back and review. Teacher also posted supplemental videos to Google Classroom assist to student learning.	Teacher returned to in-person learning and no longer records new videos	Teacher does not record videos in an effort to teach students effective note-taking skills and attention skills. Teacher does now have a library of videos from the remote period that are used when a student is absent.

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ACADEMIC VITA OF JULIE MONTAGUE

Education

The Pennsylvania State University, University Park, PA

Schreyer Honors College

Bachelor of Science in Secondary Education/Mathematics Option, May 2023

Minor in Mathematics, May 2023

Bachelor of Science in Dance, May 2022

Work Experience

Student Teaching, State College Area High School

Student Teacher, September 2022-April 2023

- Taught Advanced Geometry, College Preparatory Algebra 2, and 12th Grade Consumer Mathematics courses.
- Assisted with Testing Center and Tutoring Center duties from January 2022-April 2023.

Upward Bound Programs, Penn State Educational Equity

Instructional Designer and Tutor, April 2021-Present

- Created and taught a curriculum that prepared motivated low-income and potential first-generation college high school students for their upcoming mathematics course.
- Support students year-round through virtual tutoring after school hours.

Philadelphia Urban Seminar, Mathematics

Pre-Service Teacher, May 2019

- Assist high school math teacher in explanation of lessons, distributing materials, and proctoring assessments

Volunteer Experience

Penn State THON

Entertainment Captain (April 2020-Present)

Dancer Relations Committee Member (September 2018-March 2020)

- Contact and contract performers from around the world for several events, including THON, the world's largest student-run philanthropy.
- Oversee volunteers to create and execute engagement opportunities for all stakeholders and spectators.
- Ensured safety of all performers and volunteers through consistent enforcement of health and safety precautions.