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The Impact Of Student Mindsets In The Virtual Math Classroom

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THE IMPACT OF STUDENT MINDSETS IN THE VIRTUAL MATH CLASSROOM

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Abstract

Mindset has been studied in multiple traditional school settings, but its interaction with transactional distance in a virtual school environment is missing from the current research. This dissertation explores the experiences of students and learning coaches in a virtual high school through a series of interviews in order to present a better understanding of how students and learning coaches perceive the role of mindset and transactional distance in their interactions with each other, the content, and the teacher. The case study design applied the lenses of Transactional Distance Theory and Mindset Theory to descriptive coding of interview transcripts and relevant documents and concluded that transactional distance, while at least partially constructed by the student and enabled by the learning coach, contributes to the student's sense of isolation, the student's reliance on the learning coach, the increased need for a student to be able to function autonomously and exhibit a growth mindset, and the increased demands on the learning coach above what was initially intended in the virtual model design for that role.

Keywords: virtual education, mindset, virtual math achievement, transactional distance

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Table of Contents

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Cracking the code of mathematics achievement has taken many different forms from the tangible steps of integrating a set of Common Core Standards to the abstract realm of examining the role a student's mindset might play in his or her math achievement (Dossey, McCrone, & Halvorsen, 2016; Dweck, 2008). Questions of math achievement and mindset take on renewed importance with the increasing popularity of virtual education.

One of the most glaring differences between virtual and traditional mathematics classroom experiences is the source of instruction and primary support. In a full-time virtual school such as Horizon Cyber Academy (HCA), a pseudonym assigned to the school where this study was conducted, students work through the curriculum designed and provided by the educational management organization (EMO) from the comfort of their own homes under the supervision of a learning coach. The learning coach, in most cases, is the student's parent. To support content delivery, the full-time virtual school hires teachers licensed within the state to grade work, deliver live instruction to students at least once a week through web-conferencing software, provide learning support, and identify and respond to learning difficulties of students.

Despite the provision of a licensed teaching staff, however, it is the learning coach who most often finds him or herself monitoring and managing the day-to-day virtual learning. In a study of minority online learners, Kumi-Yeboah, Dogbey, and Yuan (2018) identified parental support as a key factor that promoted a positive learning experience and a positive academic self-concept. Similarly, parents reported on the importance of their role in two separate studies by Currie-Rubin and Smith (2014) and Curtis (2015) likening their daily role to that of a teacher. The intensive nature of the role of the parent is also supported by the findings of Smith, Burdette,

Cheatham, and Harvey (2016) whose study of parents of students with disabilities participating in online learning resulted in an agreement among all participants that the time commitment required by being a learning coach was equivalent to that of a part-time job.

The integral nature of the learning coach in the virtual teaching-and-learning paradigm is a shift from the typically teacher-centered model of instruction and becomes particularly significant when mindset is factored into the equation. Mindset is the set of beliefs a student holds about the development of intelligence. With a growth mindset, a student believes that intelligence can be developed through hard work and one's natural, innate ability is only the beginning. A student with a fixed mindset, on the other hand, believes that his or her intelligence is fixed, meaning that the amount of intelligence with which he or she was born will not change (Haimovitz & Dweck, 2017).

Dweck, the most recognizable name in mindset theory research, has contributed greatly to the body of knowledge regarding mindset and its impact on academic achievement. In a 2008 study conducted in a traditional classroom setting, Dweck found that a student's mindset predicted math achievement. Mindset in a virtual setting, however, has not yet been studied. Dweck documented the important role that adult feedback and praise play in cultivating a growth mindset. Cimpian, Arce, Markman, and Dweck (2007, as cited in Dweck, 2008) found that students who were praised for their intelligence as opposed to their process were more likely to avoid challenging tasks and were more likely to lose confidence when work became hard. Given the important role of the adult learning coach in providing feedback daily to students, Dweck's findings regarding the importance of process praise, the established importance of mindset as a predictor for math achievement, and the lack of research on mindset in the virtual school

environment, the virtual school presents an interesting setting for further study to contribute to the growing body of knowledge on Mindset Theory.

Toppin and Toppin (2016) called for additional study of virtual schools prior to allowing their continued growth specifically noting that the limited research in publication has not included the virtual student perspective. Out of the sources culled for this dissertation, for example, only two resulting studies were case studies, both of which were focused on researching the frequency and types of student-teacher communication and analyzing the impact this had on student achievement and satisfaction (Belair, 2012; Corry, Ianacone, & Stella, 2014). The call by Toppin and Toppin (2016) highlights a general need for more information surrounding virtual schools that is echoed in other literature. Morgan (2015) wrote that "although little research exists on K-12 online education," research needs to continue specifically on "the components of online courses that help at-risk students learn" (p. 76). Similarly, Miron, and Urschel (2012) highlighted the lack of research on virtual schools, demanding more stringent research that moves beyond solely an analysis of test scores. They presented a full page of suggested next directions for research, ultimately concluding that "answers to questions such as these will require multiple, well designed, large- and small-scale studies" (p. 66). Since there is limited research on the virtual student perspective and a demonstrated connection between mindset and math achievement (Dweck, 2008), the virtual school is a necessary setting for this research on mindset and math achievement.

Statement of the Problem

The problem addressed by the study is the dearth of research on K-12 full-time virtual education designed to assist educators and policy makers in understanding the subjective experience of virtual students and their learning coaches. This lack of research on virtual

mathematics students and their learning coaches has resulted in non-research-based solutions being applied as interventions to improve student outcome results in virtual schools nationwide (Toppin & Toppin, 2016).

Miron and Urschel's 2012 report for the National Education Policy Center showed that "only 27.4% of students showed Adequate Yearly Progress (AYP) in 2010-2011, versus 52% for public schools nationwide during the same period" (as cited in Toppin & Toppin, 2016, p. 1580). One specific area of concern for virtual school academic performance is math achievement (Woodworth et al., 2015). Student achievement on math assessments for virtual schools is low nationwide. One study by Woodworth et al. (2015) showed that the math achievement of virtual charter school students is equivalent to a loss of 180 days of math instruction per 180-day school year when compared to the growth experienced by their traditional public school counterparts (p. 28), a result comparable to not attending school at all.

At the local level, HCA's student performance data is similar to that of other virtual schools included in those larger studies. Student growth in the state where HCA is located is reported through a value-added model which measures the effect of districts, schools, and teachers on the academic progress of students, yielding a growth index. According to the state's accountability data for the 2015-16 school year, HCA had the second lowest value-added growth index in the state at -16.26. By 2017-18, the value-added growth index for HCA had improved to -13.13, which still placed this virtual school and its students in negative growth territory. These indices indicate that attending HCA has a significant negative impact on student academic growth in all areas, not just math.

Math is a specific area of concern for virtual schools nationwide and HCA's state accountability data demonstrates the staggering gap between virtual school students and the state

as a whole. According to state accountability data for the 2017-18 school year, only 26.6% of HCA students met grade-level proficiency standards on the Math I End-of-Course (EOC) assessment, and only 34.7% met grade-level proficiency standards on the Math End-of-Grade assessments (EOG) for grades 3-8. Looking at the state in which HCA is located as a comparison, students did not fare as poorly statewide in math as they did in HCA's virtual math classroom. The state rate of proficiency on the Math I EOC was 57.4% and 56.1% for the EOG in grades 3-8. These data are indicative of a vast achievement gap for students in the virtual math classroom.

Student outcome results such as these indicate that students in virtual math classrooms are not achieving at the same rate as their peers in traditional schools, but the research to which school administrators and policymakers can turn to draw research-based solutions for the problem of virtual math achievement is lacking. This research provides a first step in that direction by offering insight into the role that mindset plays in the experience of virtual math students and learning coaches as they encounter a challenging virtual math curriculum.

Purpose of the Study

The purpose of this study is to better understand how Mindset Theory can be applied in a full-time virtual math learning environment to identify and encourage successful responses to obstacles as identified by students and their learning coaches. Given that the National Alliance for Charter Schools (2016) identified students whose parents are able to be significantly involved with their learning as the most likely to be successful in a virtual environment, understanding the support and feedback learning coaches offer the student will be integral to gaining a full understanding of the student experience. Of particular interest will be how students perceive the

role of mindset in their reactions to learning obstacles and how students perceive and respond to different types of learning coach feedback.

The researcher sought to develop an understanding of the learning coach and student experience and how mindset influences their behaviors when they encounter a math curriculum that requires extensive self-teaching. A better understanding of the students' and learning coaches' subjective experiences will provide school administrators information that should enable them to provide more tailored support and preparation for students and learning coaches as they assume the virtual student and learning coach roles.

Research Question

This research provides virtual school leaders with a look into the subjective experiences of Math I students and learning coaches so that the instructional needs unique to their virtual roles can be better understood and supported. To accomplish the stated purpose, the researcher sought to answer the following questions:

- What are the obstacles to student success in virtual math courses as identified by students and their learning coaches?
- How do students respond to identified obstacles, learning coach support, and teacher interventions? What is the perceived role of mindset in these reactions?
- How do students perceive and respond to different types of feedback from their learning coaches?

Conceptual Framework

This researcher addressed these research questions by focusing on the student reactions to perceived obstacles as viewed and analyzed through the theoretical lenses of Transactional Distance Theory (Moore, 1997) and Dweck's (2006) Mindset Theory. Transactional Distance

Theory (TDT) identifies three important concepts—program structure, teacher-student interaction, and learner autonomy—to consider when evaluating the transactional distance in a virtual learning environment (Moore, 1997). Of great relevance to the current research, this theory specifies the relationship between teacher-student interaction and learner autonomy with relation to transactional distance. Moore (1997) theorized that as teacher-student interactions decreased the transactional distance increased, thereby creating learning conditions that necessitated autonomous learning in order to be successful.

Beliefs about the malleability of one's intelligence and the role of adult feedback in shaping one's growth mindset are key concepts from Mindset Theory (Dweck, 2006). One of Dweck's (2008) key findings—that students with a fixed mindset are more likely to avoid challenging tasks and more quickly doubt themselves when faced with challenging work—shows the importance that mindset plays in a learning environment that requires autonomous learning. A study designed to better understand how students perceive and react to obstacles would be incomplete without either of these theories.

Limitations and Bias

With previous employment in virtual education, the researcher was on guard for any potential bias that may have resulted from her past experiences. Triangulation from multiple sources of data and respondent validation were two methods by which the researcher mitigated any potential bias and enhanced the validity of the research study.

Significance

In theory, virtual charter schools as a component of the larger theme of school choice are touted as a great equalizer—a way to ensure that all students, no matter where they are located, have the opportunity to access a high-quality, challenging curriculum. However, the reality of

the implementation of daily virtual school for the most underserved and underrepresented populations leads only to an ever-widening achievement gap (Wang & Decker, 2014; Woodworth et al., 2015). The National Alliance for Charter Schools (2016) concluded that virtual charter schools should not be marketed to all students as the current model best serves those students who are self-motivated or who have parents who can and will be involved with their learning (p. 8).

The success of virtual school students is of importance to virtual schools that need to curb the negative trend of student performance. Additionally, the exponential growth noted by Stedrak, Ortagus, and Wood (2012) lends a sense of urgency and importance that extends beyond the schools. Stedrak et al. (2012, as cited in Toppin & Toppin, 2016, p. 1573) "indicated that virtual education for elementary and secondary students has grown into a $507 million market and continues to grow at an estimated annual pace of 30%," a trend that, if it continues, could eventually overshadow traditional school enrollment.

Change needs to happen within virtual charter schools to improve student performance and ensure that they are, at worst, doing no harm and at best, a viable school option where students demonstrate adequate yearly progress. John Kotter (2012) delineated the eight-stage process for leading through change with step one to "create a sense of urgency". This dissertation, while focusing on only a small portion of the problem, seeks to bring awareness to the forefront of the discussion on change within virtual charter schools by providing first-hand qualitative data from the consumers of virtual education themselves.

Definition of Terms

The researcher has defined the terms and concepts that follow to provide clarity within the specific context of the present research study.

Virtual School. An accredited K-12 school in which all instruction is delivered online and students do not report to a traditional classroom (Basham, Smith, & Greer, 2013).

Educational Management Organization. Organizations, mostly for-profit, that provide school operation services to public school agencies, private schools, and charter schools (Hentschke, Oschman, & Snell, 2003, p. 1).

Learning Coach. Osorno (2017), a blogger for Connections Academy's Learning Coach Central, defined the learning coach role as "a guide, supporter, and motivator to further stimulate learning and establish a suitable structure for the school day at home" (para. 3). The duties of a learning coach include motivating the student to complete lessons, encouraging the student to contact the teacher, answering questions and assisting with assignments, implementing learning activities to assist with areas of weakness, helping with organization and time management, and documenting daily attendance (Osorno, 2017). Typically, the student's parent or guardian serves as the student's learning coach.

Mindset. Dweck (2008) defined mindset as one's beliefs about intellectual abilities. Mindsets can be categorized as either fixed, meaning one believes that one has a certain amount of intelligence and there is nothing that can be done to change that, or growth, meaning that intelligence can be improved and developed. Dweck (2008) found that students with growth mindsets were more likely to respond to setbacks with mastery-related reactions and approached school-related tasks from an internal desire for learning and mastery as opposed to external motivators of grades and praise.

Conclusion

The achievement gap between brick and mortar schools and virtual schools, particularly in student math performance, raises myriad questions regarding important variables within the

virtual model that may have an impact on student performance. Before many of those variables can be affirmatively identified for future study, however, the researcher hopes a descriptive understanding of student and learning coach behaviors and mindset within this unique virtual environment will provide a more focused catalyst from which additional research may stem. This study will contribute to the knowledge and understanding of how students' mindsets about learning, specifically learning math, affect the ways in which they navigate the student and learning coach dynamic in a virtual school setting.

CHAPTER 2

LITERATURE REVIEW

One of the most popular psychological theories in education is that of Growth Mindset (Dweck, 2006). This theory of intelligence ultimately categorizes people as having either a fixed or growth mindset. Students with a fixed mindset define intelligence as a predetermined value, incapable of being changed by effort, while students with a growth mindset believe that intelligence is malleable and their effort can make a difference. Dweck (2006) pointed out that one's mindset, however, is about much more than intelligence; it is about the student's response to failure and the very definition of success not as a final outcome but as a process yielding personal growth. Dweck (2006) concluded that "failures don't define them. And if abilities can be expanded—if change and growth are possible—then there are still many paths to success" (p. 39).

This integrative literature review, organized thematically, explores the existing body of literature and research on the history and results of full-time virtual K-12 schools in order to provide a broad context of full-time virtual schooling, identify areas for additional study, and provide a framework for current research.

Several procedures were followed to ensure the resulting literature review on full-time virtual K-12 schools was comprehensive. A thorough search of peer-reviewed journal articles was conducted using key terms such as *virtual school, online school, full-time virtual school, virtual math instruction, online learning, K-12 online learning,* and *virtual high schools*. The databases used were ERIC-EBSCO and ProQuest in the hopes of locating literature that would assist in answering the following questions:

1. What does the literature of the last 10 years say about virtual schools and their educational impact?

2. What recurring themes are identified as areas of strengths and weaknesses in virtual schools?

3. What are the most relevant and well-respected theories related to student mindset, motivation, and/or resilience?

4. What do scholars identify as areas for continued research?

The references of each of the initially-returned results were consulted to identify additional relevant articles for inclusion. Additionally, authors' names that were found in multiple sources were used as search terms to explore additional research conducted by those authors as they seemed to be frequently cited as experts within the field of virtual education or motivation and mindset theory. Each article was analyzed based upon the type of research presented, methodology, sample size, and the relevant themes identified which provide a thematic organization for this literature review.

Operational Context of Virtual Schools

Multiple models and methods of delivery exist within the broad scope of *virtual or online education*. Upon hearing the term online learning, most people think of blended learning, an instructional model that uses both online and face-to-face instruction (Basham, et al., 2013). Blended learning has multiple models, including station-rotation, a la carte, and flex models, but all of the blended learning models involve a brick and mortar school offering some sort of online course or experience for students (Basham et al., 2013, p. 53).

For the purposes of this literature review and subsequent research, however, the term virtual school, and therefore the focus of this literature review, refers to accredited schools in

which *all* instruction is delivered online and students never set foot in a traditional classroom (Basham et al., 2013). Most virtual schools utilize a mainly asynchronous approach to content delivery, allowing students the flexibility to learn from their homes under the supervision of a parent or another adult on their own time (Miron & Urschel, 2012).

Delivery Methods

Fully online schools may use a combination of either asynchronous delivery methods, which can take place any time, or synchronous delivery methods which happen in real time, requiring the student to log in and participate at a specified time. Barbour, McLaren, and Zhang (2012) found that students were more engaged with the content during synchronous delivery, noting on-task behavior 55% of the time compared to only 30% of the time during asynchronous learning activities (p. 228). One area for additional research noted by Corry and Stella (2012) is in examining how different delivery methods impact the achievement of different types of students.

Student Engagement

Engaging in an educational environment despite being separated by time and space forms the basis of Moore's (1997) Theory of Transactional Distance. Moore (1997) hypothesized that the distance between teachers and learners created a "psychological and communications space" that had to be crossed, and one of the pedagogical techniques by which one could cross this transactional distance was instructional dialogue (p. 22). Moore (1997) defined instructional dialogue as a "series of interactions …purposeful, constructive…towards improved understanding of the student" (p. 23). In order for students to maximize the learning potential of an asynchronous curriculum, they must be actively engaged, interacting with the material, their peers, and their instructor. Hung, Hsu, and Rice (2012) defined engagement through a series of

variables that can all be monitored and quantitatively assessed through the Learning Management System. The variables that Hung et al. (2012) identified were average frequency of logins per course, average frequency of clicks per course, average frequency of module accessed per course, and average number of discussion board entries per course. Using these variables, Hung et al. (2012) found that students with higher levels of engagement usually had higher performance in the course.

There is also greater consideration to be given to student engagement when it comes to full-time virtual schools since those are not just one course but rather an entire school experience. Encouraging learners to engage with each other, their teachers, and the curriculum becomes a crucial component of establishing an online school community. According to research conducted by Barbour et al. (2012) however, most learners are unable to establish that larger sense of community. Most of the students involved in the study indicated that they felt little connection to their online teacher and classmates (Barbour et al., 2012).

Additionally, research has been done to investigate the types and frequency of student-teacher interactions and how those affect student performance and student engagement. Studies by Archambault et al. (2010) and Finn, Caldwell, and Raub (2006) indicated that increased communication between student and virtual teacher improved the student-teacher relationship and thereby increased students' sense of self-efficacy. Research on the quality of teacher-student interactions and research correlating the frequency and content of teacher-student communications with increased student performance is lacking (Belair, 2012).

Corry and Stella (2012) recommended additional research on student engagement in virtual schools that focuses on how opportunities for social interaction that are typically present in a traditional school could be replicated in the online environment. In addition, Corry and

Stella (2012) commented on the need for additional research into the types of interactions happening in virtual schools, the quality of those interactions, and how they affect student achievement. With the demonstrated need to continue to study the transactional distance inherent in virtual learning environments, Transactional Distance Theory (Moore, 1997) provides a theoretical framework for this study whereby the distance between the learner and the teacher can be documented and what mitigating role, if any, the learning coach may play in that distance.

Parental Engagement

With learning taking place at home, virtual schools rely upon parent or guardian oversight to ensure that students are engaging in school daily. The role of the learning coach was identified by Henderson and Mapp (2002, as cited in Currie-Rubin & Smith, 2014) as one of the most critical factors influencing a student's success in virtual schools. Black, Ferdig, and DiPietro (2008) reported that many parents in virtual schools, however, adopt an *absentee role* as students are left on their own without any in-person support (p. 38). Furthermore, few schools track and measure parental involvement leaving many virtual schools in the dark about what is taking place at home in daily instruction for their students (Black et al., 2008).

Historical Context of Virtual Schools

As with most issues related to school choice, the subject of full-time virtual schools is fraught with polemic rhetoric of supporters and detractors. Proponents of virtual schools believe that they are a critical component of school choice, providing access and variety to rural students, continuity to families who must move frequently, and equity to students who are homebound or hospital-bound and unable to attend their traditional schools (Miron & Urschel, 2012; Toppin & Toppin, 2015). Critics of virtual schools, however, cite the large number of students served by virtual schools and the negative student performance results as major

concerns with allowing continued growth of virtual schools without serious consideration to policy changes and research into improving the model (Miron & Urschel, 2012; National Alliance for Public Charter Schools, 2016; Wang & Decker, 2014; Woodworth et al., 2015).

History and Growth

With regard to the growth of virtual schools, the critics are quite right; enrollments in full-time virtual schools have grown exponentially. In 1997, the very first full-time virtual charter school opened when the Florida Virtual School (FLVS) was founded with 77 students (Sherbondy, 2008, p. 6). FLVS did not remain small for long and, as the idea of accessing a curriculum online from home gained popularity, FLVS enrollment grew. In 2006, FLVS boasted nearly 50,000 students (Sherbondy, 2008).

Virtual school growth has not been contained within Florida. As of 2016, 35 states and the District of Columbia are home to 135 virtual schools, run by various EMOs (National Alliance for Public Charter Schools, 2016). Many of these schools are listed as charter schools while their EMOs are for-profit businesses such as K-12, Inc. and Connections Education, a recently-acquired arm of Pearson Online and Blended Learning (Miron & Urschel, 2012). In fact, 70% of virtual charter schools utilize a for-profit EMO (National Alliance for Public Charter Schools, 2016, p. 3). Nationwide, almost 250,000 students are enrolled in these full-time schools, and the student population continues to grow (Miron & Urschel, 2012).

Virtual Student Demographics

To understand the context within which frequently-cited student performance results fit, it is important to consider who these 250,000 enrolled students are and how trends in virtual school enrollment compare to those of traditional schools against which virtual schools are so frequently compared. Miron and Urschel, in their 2012 study of virtual schools managed by one

of the largest EMOs (K-12, Inc.) noted that virtual schools enrolled significantly more white students than their traditional school counterparts in each state, with the white population accounting for 75% of all K-12, Inc. enrollments. Additionally, Hispanic students are underrepresented in K-12, Inc. schools' total enrollments at 9.8% compared to average enrollments of 27.6% within the states in which K-12, Inc. operates.

In contrast, enrollments of special education students in virtual schools very closely mirror the state average (Carnahan & Fulton, 2013). In Pennsylvania's virtual schools, for example, a variety of disabilities were represented with Specific-Learning Disability representing 62.73% of the identified special education population, Emotional Disturbance representing 13.99%, Speech-Language Impairment 12%, and Autism 7.22% (Carnahan & Fulton, 2013).

Outcome Results

Challenges to perceived academic quality for virtual K-12 education abound nationwide. One of the most comprehensive studies of student performance outcomes was compiled by the Center for Research on Education Outcomes (Woodworth et al., 2015) and grew out of the dearth of reliable information on school performance. Woodworth et al. (2015) included performance data from 158 virtual schools in 18 different states matched with a comparison group of traditional schools comprised of similar demographic and academic profiles. The most astounding result of this study was the lack of overall growth of virtual charter students compared to traditional public school students for both reading and math. Woodworth et al. (2015) found that across all tested areas, the academic gains for virtual charter students in math were equivalent to 180 fewer days of learning than their traditional school peers and 72 fewer days of learning in reading than their traditional public school peers. Similarly, a study of virtual charter school student performance in Ohio found that, regardless of student prior achievement,

virtual school students performed worse than their peers who were at similar achievement levels (Ahn & McEachin, 2017). The academic performance of special education students should not be overlooked. Using Pennsylvania's virtual schools as the source of data, Carnahan and Fulton (2013) discovered that the proficiency rates of virtual schools' special education students also lagged behind those of their traditional school peers with 33.9% of special education students meeting proficiency standards in the virtual setting compared with 40% of special education students in a traditional setting.

Reflection on the Literature

While virtual schools have been in existence for 20 years, researchers are still citing the same and recurring areas for continued study. In 2007, O'Dwyer, Carey, and Kleiman (2007) pointed out that very little is understood about the impacts of virtual schools on learners, clearly noting "the current lack of sound empirical evidence about the impacts of online learning in K-12" (p. 290). Almost 10 years later, the same gap existed as identified by Toppin and Toppin (2016) when they concluded, "the need to curtail such growth until various aspects of virtual schooling can be more fully understood seems imperative" (p. 1580).

Most of the research on virtual schooling focuses on summative student results and frames those results within a negative lens, calling for policy changes affecting everything from student enrollment growth and the types of students virtual charters could accept to the renewal criteria for their charters (National Alliance for Public Charter Schools, 2016). Very few practical suggestions targeted toward improving student learning outcomes result from such summative, outcome-focused research.

O'Dwyer et al. (2007) accomplished a first step in narrowing this research gap in their quasi-experimental study of online Algebra I instruction in Louisiana classrooms, identifying

several key areas to which educators should pay close attention. Among those areas identified were student satisfaction, opportunities for meaningful social interaction, frequency of communication, and the need for the content teacher to be more than just a math teacher (O'Dwyer et al., 2007).

Archambault et al. (2010) took this a step further with their qualitative research survey results by providing a summary of what virtual schools were doing to impact the engagement and achievement of at-risk students. These strategies included flexible scheduling, identification of at-risk students as quickly as possible, and increased contact and communication with identified students (Archambault et al., 2010). This research, however, fell short of correlating any of these strategies or actions to increased engagement or achievement for at-risk students. Similarly, Corry and Stella (2012) identified some specific areas for additional research within the field of virtual schooling, noting that research needs to be conducted focusing on different populations of learners (at-risk, rural students, etc.) that will yield an understanding of how pedagogy and virtual instructional strategies impact learning outcomes.

Conceptual Framework

The review of the literature surrounding virtual math achievement and mindset presents connections among mindset and math achievement and engagement and achievement. To observe, describe, and define those abstract qualities and to identify and define the relationship between those variables as observed in interactions among participants, the researcher has drawn upon existing theories to provide a research-based framework. Moore's (1997) Transactional Distance Theory and Dweck's (2008) Mindset Theory provide the foundation upon which this qualitative study rests.

Transactional Distance Theory

Transactional Distance Theory (TDT) posited that the degree of separation between learners and teachers affects learning and teaching (Moore, 1997). Within that distance between teacher and learner exist three integral constructs that determine the degree of separation and relation: program structure, teacher-student interaction, and learner autonomy (Moore, 1997). Moore (1997) determined the relationship between these three variables and concluded that as teacher-student interaction increased, the perceived transactional distance would decrease; as the program structure increased, the transactional distance would increase while learner autonomy would decrease. Of great relevance to the current research, Moore's theory narrowed in on the student's learning environment as an environmental factor that could also impact transactional distance. Moore (1997) identified the *emotional environment* of students, specifically mentioning the regard that others in the home have for the student's learning (p. 23).

While TDT includes the student's home learning environment as a factor that might influence transactional distance, this theory does not explicitly account for the virtual learning model most prevalent in K-12 education where a learning coach, most often a parent, is thrust into this teaching-learning dynamic. Several studies that analyzed the role of the parent or family in online learning reported that parents of online learners viewed their role as being similar to that of the teacher, documenting daily tasks such as answering questions to increase student understanding, providing immediate feedback to students, guiding students through challenging problems, and providing instructional modifications to meet the individual learning needs of their students (Currie-Rubin & Smith, 2014; Curtis, 2015; Kumi-Yeboah et al., 2018).

This research utilized TDT as a framework to describe participants' virtual learning environment, specifically the existing program structure of the virtual math classroom, the nature

of teacher-student interactions and the participants' perceptions of their autonomy within the learning environment.

Mindset Theory

Mindsets are beliefs about one's capacity to improve intelligence (Haimovitz & Dweck, 2017). These mindsets can be categorized as either fixed (one's intelligence or ability is set and unable to be changed) or growth (one's intelligence or ability can be grown and developed through hard work and learning) (Haimovitz & Dweck, 2017). Mindset appears to influence learning by influencing how students think about themselves, how they characterize their successes and failures, and how they react to obstacles (Haimovitz & Dweck, 2017). In traditional schools, students' mindsets were found to predict their academic performance, especially when faced with challenging school work such as math (Dweck, 2008). In one experimental study of middle school students, Good, Aronson, and Inzlicht (2003, as cited in Yeager & Dweck, 2012) found that students to whom the treatment of being taught that intelligence was malleable and could be impacted by hard work was applied scored significantly higher on math and verbal achievement tests than their control group. The results from this experimental study were especially profound and statistically significant for middle school girls in math (Good et al., 2003, as cited in Yeager & Dweck, 2012).

Beyond mindset's demonstrated impact on math achievement, the theory is also significant for its explanation of the importance of the types of feedback offered to students. Cimpian et al. (2007, as cited in Dweck, 2008) found that students who were praised for their intelligence as opposed to their process were more likely to avoid challenging tasks and were more likely to lose confidence when work became hard. Similarly, in a quasi-experimental study of elementary school students, Truax (2017) found that following purposeful feedback focused

on process as opposed to praise, the experimental group finished the study with stronger growth mindsets and beliefs in their effort to yield learning.

Relationship to the Study

The study utilized Mindset Theory to begin peeling back the layers of the student's emotional environment. This research specifically focused on the perceived obstacles to math achievement and student and learning coach reactions to those perceived obstacles through the theoretical lenses of Transactional Distance Theory and Mindset theory. Guiding research and interview questions were grounded in Mindset Theory in order to capture and categorize reactions related to obstacles, failures, and success. Additionally, Mindset Theory, through the Revised Implicit Theories of Intelligence (Self-Theory) Scale provided the criteria by which participants initially were identified for the study. By conducting these interviews, the researcher worked to specifically address the concepts that have been absent from the existing research on virtual education: parental involvement and engagement and the impact specific types of communication have on student engagement.

CHAPTER 3

METHODOLOGY

In designing the present study, the researcher sought to better understand how Mindset Theory could be applied to identify and encourage successful responses to identified obstacles in a full-time virtual math learning environment by students and their learning coaches. Students whose parents are able to be significantly involved with their learning are more likely to be successful in a virtual environment (National Alliance for Charter Schools, 2016). Additionally, the type of praise that students receive has been found to influence their mindset which, in turn, can predict academic performance (Dweck, 2008), so understanding the learning coaches' reactions and feedback to their students' math performance will be integral to gaining a full understanding of the student experience in virtual math classrooms.

The researcher sought to develop an understanding of the learning coach and student behaviors when they encounter a math curriculum that requires extensive self-teaching and initiative in order to fully engage in the virtual learning environment. Before targeted improvements can be made to the virtual education math outcomes for students, school leaders must understand the students' and parent/learning coaches' subjective experiences. This research began that vital dialogue through the exploration of the following questions:

- What are the obstacles to student success in virtual math courses as identified by students and their learning coaches?
- How do students respond to identified obstacles, learning coach support, and teacher interventions? How does their mindset affect these reactions?
- How do students perceive and respond to different types of feedback from their learning coaches?

To accomplish the purpose and answer the research questions, this study employed case study methodology. Of utmost importance to the case study are limitations, or bounds, so that the study remains focused on the phenomenon at hand (Creswell & Poth, 2018; Merriam & Tisdell, 2016). As such, the necessary bounds for this case study included families enrolled in a high school virtual math course at Horizon Cyber Academy (HCA), a pseudonym assigned to a full-time virtual charter school located in the southern United States.

The intent of this case study was to understand how the mindsets of virtual math students affected their experience and, ultimately, their success when confronted with obstacles in the virtual math classroom. Since multiple cases were studied for their common experience of this concern, this study was a collective case study. Creswell and Poth (2018) wrote that a "hallmark of a good qualitative case study is that it presents an in-depth understanding of the case" (p. 98) accomplished by multiple methods of data collection over time. The results from the multiple methods of data collection in this study were analyzed across cases for similarities and differences within the theoretical frameworks of Moore's (1997) Transactional Distance Theory and Dweck's (2008) Mindset Theory in an effort to identify patterns.

Even though the study employed multiple methods of data collection and triangulation in an attempt to understand students' unique experiences within this setting, the results are not generalizable beyond the scope of the study. Like most case studies, the goal was understanding and knowledge-building around a particular issue (Bloomberg & Volpe, 2016).

Setting

In its first year of operation, HCA served a statewide student population of 1,500 students in grades K-9. Fifty-four percent of the student population identified as white, 13% Hispanic and 12% black. Currently in its fourth year of operation, HCA has expanded to include twelfth

grade, taking the number of students served to 2,500.

HCA has a mission that describes the virtual environment as offering a personalized learning experience. In this full-time virtual school, students work through the curriculum that was designed and provided by the school's for-profit educational management organization (EMO). Students work from their own homes under the supervision of a learning coach. The learning coach, in most cases the student's parent, is responsible for monitoring the day-to-day virtual learning. Comparable to most other virtual school models, HCA hires state-licensed teachers to grade work and provide feedback, deliver live instruction at least once a week, provide learning support, and identify and respond to learning difficulties of students.

Participants

The sampling strategy initially intended to be employed by the researcher was purposeful maximal sampling to select the cases that would provide the richest data to fully understand the experience of students and learning coaches in a virtual math class (Creswell & Poth, 2018). Creswell and Poth (2018) identified this sampling technique as the preferred method because it allows the selection of cases that illustrate different perspectives on the problem. As a part of the purposefully-selected sample, the researcher intended to select a representative sample of students with both fixed and growth mindsets. That plan, however, did not come to fruition due to low participation. The reality of the sampling conducted for this study was a self-selecting sample. This sample of 9 student/learning coach partners was drawn from an initial pool of students enrolled in the first high school math course (Math I). All Math I students and learning coaches were presented with the opportunity to participate in the study by first documenting their informed consent and completing the mindset assessment. The researcher sent out the email request for participation (Appendix A) four times. From a potential pool of 151 Math I students,

12 learning coaches responded to the request for participants. From those 12, only eight learning coaches returned consent forms for nine student participants. The nine student participants went on to complete the mindset assessment and both the student and learning coach participants participated in the interview portion of the study without purposeful sampling to account for variations in mindset representation.

Participant Rights and Ethical Considerations

As a part of the consent form (Appendix B), participants (and their parent or legal guardian if under 18) were informed of their rights related to participation in this study, specifically any anticipated risks, benefits of participation, measures taken to ensure confidentiality, and a statement indicating that they may withdraw from the study at any time without penalty. Care was taken to protect the privacy and confidentiality of participants through the use of pseudonyms for participants in the researcher's notes, transcripts, and drafts. The key matching the pseudonyms to participants was stored in a password protected file and destroyed upon completion of the research. No personally identifiable information is used in this report.

Data

Table 3.1 provides an overview of the alignment between the study's research questions, the type of data needed to answer the questions, and the instruments and methods of collecting that data.

Table 3.1 *Triangulation Matrix*

Research Question	Type of Information Needed	Method of Data Collection
What are the obstacles to student success in virtual math courses as identified by students and their learning coaches?	Contextual: Math Class context (expectations, course set up, lesson format)	Document Review – syllabus, teacher communication, static course content
	Descriptive: Ethnicity, Gender, previous math achievement	Existing demographic data and assessment data
	Perceptual: Participants' subjective experiences and thoughts	Interviews
How do students respond to identified obstacles, learning coach support and teacher interventions? What is the perceived role of mindset in these reactions?	Perceptual: Participants' subjective experiences, behaviors and thoughts	Interviews Mindset Assessment
	Theoretical Information	
How do students perceive and respond to different types of feedback from their learning coaches?	Perceptual: Participants' subjective experiences, behaviors and thoughts	Interviews Mindset Assessment
	Theoretical Information	

Document Review

To better contextualize the virtual math classroom, the researcher reviewed multiple documents including teachers' syllabi in which they establish communication expectations, available interventions in which students who need additional help may participate, and desired learning outcomes. Additional document review included the learning coach orientation course to better understand the expectations set for and support offered to newly-enrolling learning coaches. Existing achievement data in the form of the students' previous End-of-Grade math

exam scores was also included as descriptive data that provided context for the student's current perception of math and achievement reflected in his/her responses to interview questions.

Assessments

The Revised Implicit Theories of Intelligence (Self-Theory) Scale (Appendix C) was administered to participant students to assess their own beliefs about the fixedness of their intelligence and current capabilities. This scale is a revised version of Dweck's Implicit Theories Intelligence Scale that changes the wording from beliefs about intelligence in general to beliefs about personal intelligence by modifying Dweck's original third-person language to first-person. De Castella and Byrne (2015) pointed out that these changes were necessary for the scale because "personal and domain-specific beliefs tend to be more powerful predictors of goals, attributions, and academic performance" (p. 246). This scale is available within the public domain and does not require explicit permission as long as the use is non-commercial.

The mindset assessment was administered online to all identified students who opted into the study. The results from the assessment were originally intended to be used to select a smaller, purposeful sample of student and learning coach pairs for additional study participation in the form of interviews; however, due to the self-limiting size of the participant pool, all participants who opted in continued on to the interview phase of the study.

Interviews

The researcher drafted initial semi-structured student interview questions (Appendix D) and learning coach interview questions (Appendix E) based upon Mindset Theory (Dweck, 2008). These questions were intended to have the interviewee identify sources of support, perceived causes of success and failure, and behaviors when confronted by obstacles.

Information learned from the document review regarding the expectations of the learning coach role and contact expectations informed these interview questions.

Two semi-structured interviews were conducted with each student and learning coach participant. The bulk of the interviewing data was collected during the first interview. The second interview served as an opportunity to follow up to extrapolate additional data following the initial round of data analysis. The interviews were conducted on the phone and audio-recorded to allow for precise and accurate transcription provided by Trint.com transcription services.

Data Analysis

As with most qualitative research, identifying codes to create categories or themes was at the heart of the analysis of each piece of data obtained during the course of this research. This process involved multiple passes of the data—first to code, then to combine codes into categories, and finally to check the quality of the categories to ensure that the resulting list was exhaustive, descriptive, and mutually-exclusive (Merriam & Tisdell, 2016). The researcher included relevant documents for review as data, selecting learning coach support documents and the Math I teacher's syllabus to provide a context for expectations and communication. The researcher first conducted a content review of the documents, identifying sections of text that were relevant to the research questions and topic of the study. The information gleaned from the first pass of the documents shaped the interview questions. A second pass of those selected pieces of text was done to identify codes that were then pulled into conceptual maps linking categories between interview data, document data, and participants to identify thematic relationships that addressed the relatedness of the student and learning coach experiences.

More specifically, mindset assessment results data were used to identify student participants as having either a growth or fixed mindset as interpreted using the scale's categorization rubric and to describe different indicators of mindset in order to further contextualize interview data for the participants as it related to mindset-specific behaviors and beliefs. Interviews were transcribed, and the transcripts were then coded utilizing Dedoose qualitative analytics software to identify emergent codes and categories in the data.

Trustworthiness and Potential Bias

The researcher considered ways to build validity and reliability measures into the study in order to minimize questions related to the trustworthiness of the results. In this study, the researcher utilized triangulation by using multiple data sources—assessments, documents, and interviews—collected from multiple participant perspectives at different times during the study (Merriam & Tisdell, 2016). Additionally, opportunities for member-checking were built into the interview schedule so that participants were able to respond to the initial data analysis and ensure that the researcher did not apply her own interpretation or allow a potential bias to misrepresent the participants' experiences. Ultimately, as any interpretations extrapolated from the data pass through the researcher's filter, it was imperative that these measures were in place to ensure that the researcher's potential bias did not impact conclusions drawn from the research.

Limitations

The researcher initially wanted to conduct observations in order to get a more objective view of participants' behavior. After careful consideration, however, the researcher determined that conducting observations in families' homes may have limited the subject pool even further, so the decision was made to not conduct observations and instead to include self-reporting

behavioral questions in the interviews with both students and learning coaches. Self-reported behavior may not provide an accurate depiction of actual student and learning coach habits.

Additionally, the selection method limited the potential diversity of respondent experiences. The students and learning coaches who elected to participate, one might argue, were more likely to participate in the school and, therefore, might have brought a more positive perception of interactions and engagement to the study. Furthermore, the researcher initially intended to purposefully select nine interview participants from a larger pool in order to cultivate a diverse representation of mindset. Due to the low number of volunteers, however, there was no purposeful selection and all volunteers proceeded to the interview, regardless of their mindset.

Summary

To better understand the role a student's mindset plays in his or her perception of and reaction to obstacles in a virtual math curriculum, the researcher conducted a case study of nine student and learning coach partners currently enrolled in a Math I online course at HCA. Moore's (1997) Transactional Distance Theory and Dweck's (2006) Mindset Theory provided the theoretical framework, defining variables and constructs for further exploration in interviews.

CHAPTER 4

RESULTS

The purpose of this collective case study was to develop an understanding of the obstacles students and learning coaches face as they navigate the waters of learning math virtually. To accomplish this purpose, the researcher posed the following three research questions:

- What are the obstacles to student success in virtual math courses as identified by students and their learning coaches?
- How do students respond to identified obstacles, learning coach support, and teacher interventions? What is the perceived role of mindset in these reactions?
- How do students perceive and respond to different types of feedback from their learning coaches?

The research design of the study provided for interviews with multiple participants, a mindset assessment administered online to student participants, and a thorough document review to supply data to address the research questions. This chapter summarizes the results as they relate to the research questions. Chapter 5 connects these results to existing research as well as Mindset Theory and Transactional Distance Theory, which provided the theoretical framework for the research.

Analysis Method

The researcher conducted two one-on-one telephone interviews with each participant over the course of eight weeks. Each interview lasted between 20 and 40 minutes and was audio-recorded and later transcribed. Those transcriptions provided the bulk of the data that was analyzed for this study. In addition to the transcripts, the researcher included the Math I course

syllabus and learning coach support resources as documents that she analyzed and coded as part of a document review to provide a contextual understanding of expectations.

The researcher engaged in descriptive coding as the first cycle coding method. During second-cycle coding, the researcher reanalyzed the first cycle codes and excerpts, condensing the number of codes from 49 to 26. These codes were then grouped into corresponding categories and then emergent themes by research question as depicted in Table 4.1.

Table 4.1

Summary of Codes, Categories and Emergent Themes

Research Q	Codes	Categories	Emergent Themes
Q1: What are the obstacles to student success in virtual math courses as identified by students and their learning coaches?	Balance Student Independence LC Math Ability LC obligations Materials Student Motivation Pacing Transactional Distance Uncertainty Alone No one to Care Math Ability	Juggling priorities Uncertainty Isolation Mindset	Learning coaches find the demands of the learning coach role difficult to meet. Frequency and type of teacher contact matter
Q2: How do students respond to identified obstacles, parent support and teacher interventions? What is the perceived role of mindset in these reactions?	Mindset Clicking Perception of LC Role Teacher help Last resort	Apathy Teacher contact	Students rely on learning coach because of perceived transactional distance with teacher. Learning coaches recognize a student's belief in his or her ability is important but are uncertain how to cultivate that belief.
Q3: How do students perceive and respond to different types of feedback from their learning coaches?	Frequency Uncertainty Conflict Probing Together Points/Grade Time Teacher Focus Confidence Conflict Teacher Resources Frequency	Frequency Process focus Outcome focus LC-ST relationship	Outcome-centered feedback led students to engage in clicking, not learning.

Participant Profiles

Nine students and their learning coaches participated in this study. All of the learning coaches included in this study were the mothers of the student participants. Pseudonyms were assigned to each participant for reporting purposes. The background profiles of the nine student participants are presented in Table 4.2. Included within the information presented in these background profiles are the students' 8th grade math End-of-Grade test scores where levels I and II are considered below grade level, or not proficient, and levels III and IV at or above grade level. Students fell into two categories: They had either been with HCA since the school opened (3.5 years), or they were new to HCA in the 2018-19 school year. Two students were enrolled in Math I for the third time, two for the second time, but the remaining five students were attempting Math I for the very first time. Out of the nine student participants, only three students' mindset assessment results indicated that they had a fixed mindset. These three students had all previously failed Math I and did not earn credit for Math I on this attempt either.

Table 4.2

Participant Profiles

Student	Learning Coach	Grade	Age	# of years at HCA	# of prior Math I attempts	Math End-of-grade 8 score	Final Math I Grade	Mindset
Brad	Riley	9th	15	3.5	0	Level III	85	Strong Growth
Caleb	Riley	9th	15	3.5	0	Level III	85	Strong Growth
Saige	Monk	9th	14	3.5	0	Level III	83	Strong Growth
Hailey	Miller	9th	14	3.5	0	Level I	86	Growth with Some Fixed Ideas
Mark	Prentice	11th	19	0.5	2	Level I	41	Fixed with Some Growth Ideas
Macy	Lanier	9th	14	0.5	0	Level IV	82	Strong Growth
Shawn	Heath	10th	18	0.5	1	Level I	26	Strong Fixed
Aaliyah	Farrell	9th	16	3.5	2	Level I	33	Strong Fixed
Ethan	Pope	11th	18	0.5	1	No Score	66	Growth with Some Fixed Ideas

Presentation of Results

Within the interview responses related to learning coach-identified obstacles, student-identified obstacles, student reactions, and learning coach feedback, multiple converging categories emerged that depicted similar experiences and perceptions not only among students and learning coaches as separate groups but also between students and learning coaches.

Learning Coach-identified Obstacles

Learning coach participants identified myriad obstacles that interfered with their ability to fully meet the needs of their students and obstacles that they perceived as barriers to their students. The researcher identified three primary categories from the obstacles that learning coaches identified: juggling priorities, uncertainty, and isolation.

Juggling priorities. Whether work or family obligations, the idea of juggling priorities was identified as an obstacle in interviews with all learning coaches. The EMO-created learning coach orientation assures learning coaches that at the high school level they only need to spend 30 to 60 minutes each day assisting with learning management and daily schedules. Pope was the first to paint a contrasting picture citing "the time commitment trying to balance work and family with supporting two kids in online school. I had no idea they'd need so much from me. I thought I'd just be able to check in with them at the end of the day but that hasn't been the case at all." Miller echoed this sentiment, stating, "In some instances, you're giving more than what you signed on for because you're not a teacher." Other learning coaches expressed that committing the necessary time to the learning coach role was not feasible because of the demands of adult life—work, childcare, and school. This has led learning coaches such as Miller to sometimes ask her student to save work she needs help on for a time when the learning coach

is free. All of the learning coaches identified work commitments as obstacles to them fulfilling the role of learning coach and thereby creating barriers to their students' subsequent success.

Uncertainty. The second major shared obstacle among all learning coach participants was uncertainty. This took two primary forms—uncertainty about the math content and uncertainty regarding how to motivate their students. Five of the learning coaches expressed considerable self-doubt in their own ability to help their student with math. Heath explained, "This new math that they've got these kids doing...well, I don't know how to help my boy with that." Farrell identified her own unfamiliarity with math as a reason her student could not come to her for help as did several of the other learning coaches. One parent, however, expressed her concern about the learning in homes where learning coaches were not confident in their own math ability stating, "There are parents out there who aren't [confident] and that poses a question of if they're not, then how are their kids learning it?"

Other concerns related to uncertainty were more generally related to student motivation and less specific to math instruction. This concern was shared by two of the learning coaches with older students. Prentice described their dynamic at home and described her biggest obstacle as figuring out how to enable her student to be self-sufficient and figure things out on his own. Farrell detailed a similar dynamic that she was uncertain how to change, explaining that her daughter would soon turn 17, and she was unsure how to make her do the work.

Isolation. Compounding the prior discussion of uncertainty was the degree of isolation experienced by many learning coaches, leading them to feel that they were instructing their students without the support of licensed staff. Prentice felt that she had been left alone in dealing with her son's learning disabilities. She had an expectation that when her son was failing everything that someone, be it a teacher, a case manager, or counselor, should demonstrate

concern about his progress by initiating contact with her. By her count, however, she had had one phone call from the case manager and one from a teacher, which had caused her to feel frustrated by the lack of communication and that she alone was invested in his success.

Heath's experience with isolation was characterized by a sense of futility seemingly due to the design of the virtual model and staffing. She expressed an understanding that with each student moving at an individual pace, the teachers would not be able to offer as much direct instruction as her son would need to understand the complex math concepts. Her awareness of the virtual staffing model contributed to a why-even-bother attitude when it came to encouraging her student to contact the teacher for help.

One learning coach picked up on her student's sense of isolation. Lanier indicated that she had encouraged her student, Macy, to reach out to her teacher for help, but that the student had created a barrier between home and the teacher. Pope likewise expressed concern that being isolated from the teacher might increase the difficulty of learning math online, explaining, "Math is where they struggle the most. Learning math online is hard and trying to learn it on their own without daily in-person support just hasn't been working." Similarly, Riley attributed a lack of immediate feedback and the time that it takes to communicate virtually as a contributing factor to her student's difficulties learning math online. She detailed her frustration with the loss of instructional time caused by multiple back and forth attempts at clarification for math concepts and feared that her students were not genuinely learning the math material but were instead merely memorizing enough to briefly pass a test.

Student-identified Obstacles

Students also identified multiple obstacles that prevented optimal learning for them in the virtual environment. The researcher identified isolation and mindset as commonalities among the students' responses.

Isolation. Learning coaches were not alone in perceiving a degree of isolation. Students, in a greater degree than the learning coaches, shared feelings of isolation over the course of the interviews. All nine students expressed some degree of isolation within their responses, ranging from feelings of being alone to descriptions of the degree of the distance they perceive with their teacher.

Mark and Shawn shared similar feelings of being alone that they perceived as significantly impacting their performance. Mark identified his biggest obstacle as "having to try to understand the math on my own. It's just so different from having someone who is there to help when you are working on it." He went on to conclude that the ideal situation would be having someone there to help when he needed it. Like Mark, Shawn shared feelings of isolation. When asked about his biggest obstacle, he responded, "Most everything? I don't know. It's...there isn't anyone to care if I'm not doing my stuff." Unlike Mark, however, Shawn would prefer to be left alone.

> I don't get stuck too much. I mean, I know I haven't passed anything but as long as I keep moving and no one is calling to talk about being behind then my mom kind of leaves me alone. I'd rather be left alone.

Other students explained that the turnaround time in communication with their teacher led them to feel that they needed to utilize other resources to figure out the concepts. Students attributed this lengthy turnaround time to the primary method of communication relied upon at

HCA. The internal email system was the primary form of communication between student and teacher and did not result in the immediate, or at least more prompt, response that students were craving. Students reported they were hesitant to use their only other form of communicating with the teacher—the phone—even though it might have been faster. Most students allowed this frustration with email response time to serve as an excuse to not contact the teacher at all, thereby resorting to other methods to answer their content-related questions.

Mindset. Four students expressed doubt in their own abilities to do math, usually due to previous experiences with math. Mark, who assessed with a fixed mindset, saw his previous failures as evidence of an inability to do math, confiding, "I've never really been good at math. This is my third time taking Math I, and I just don't see the point honestly." When asked about his confidence in doing well in the subject, he again referred to previous failures as evidence that he was not very good and that these failures had affected his belief that he could do well in the subject. Similarly, Ethan, who assessed with a growth mindset with some fixed ideas, relied upon grades as the measure of being good at math, saying that he had never really been good at math and had always gotten bad grades. Ethan's learning coach had picked up on his frustration, noting that she believed that "his biggest challenge is his lack of faith that he can figure it out and how quickly he shuts down." One other learning coach, Miller, also believed that getting her daughter to believe she could do it was a barrier to learning for her student. Aaliyah and Shawn, whose assessment results both indicated strong fixed mindsets, also measured their successes and failures within the context of grades. Even when Aaliyah was doing well, she attributed her success to her teacher without acknowledging any of her own effort that might have contributed to her prior success.

Breaking with that pattern, however, were Caleb and Saige, who were both assessed with growth mindsets. Caleb, when asked about his successes in Math, noted that he had been able to "learn some new things, definitely" and Saige attributed her success to her own actions, including the particular way she organized her notes.

Student Reactions

Research questions two and three centered on understanding how students react and perceive obstacles, teacher interventions, and learning coach feedback. Within student descriptions of their perceptions and reactions, the researcher identified the categories of teacher contact, learning coach-student relationship, and apathy.

Teacher contact. The learning coach support documents indicate that the teacher should be the point of contact for questions about course material. The learning coach resource document entitled "Coach for Success: High School" leaves the learning coach out of the content-teaching pathway completely, documenting the following description of student behavior:

> The student continuously checks him or herself for understanding by asking, "Do I understand this?" If the answer is no, the student takes action by rereading the lesson slides or textbook content, watching videos or tutorials found in the lesson again, or contacting the teacher. (p. 2)

All of the students, in some way, described their perceptions of teacher contact and interventions, and in almost all cases, teachers were viewed as the last resort for help, and the learning coach as a substitute for the typical role of the teacher. All nine students reported that they would ask their learning coach before even considering asking the teacher. If the learning coach was unable to assist, seven students indicated that they would try to find the answers on

their own, relying on outside resources such as Kahn Academy, YouTube, and Google. The other two students confessed that, if their learning coaches were unable to assist, they would just submit the assignments so that they could move on and not fall too far behind.

The interview with Brad shed additional light on the students' thinking behind the order of operations when stuck on their learning. When asked about feeling comfortable asking the teacher for help, Brad confided that he did not do it and instead preferred asking his learning coach for help. When questioned further about why this might be the case, he posited that "my parents can help me immediately, and asking the teacher is just inconvenient because it takes too long." Both Caleb and Hailey confirmed that if the response time could be immediate, they would be more willing to approach their teacher for help.

Learning coach-student relationship. Most of the students provided valuable insight into the unique dynamic of having a parent as the at-home learning coach. Two students indicated that this dual parent-learning coach relationship was beneficial to their learning. Saige shared that it was the 24 hours-a-day, seven-days-a-week access to her learning coach that she found most beneficial. She really appreciated being able to ask her learning coach questions any time she had them. Saige's characterization of the learning coach-student dynamic may be unique because of her learning coach's background in education, which Saige used to explain why she is so comfortable going to her learning coach for help. "My mom is a teacher, so I feel like I can go to her anyway." The sentiment regarding the benefit of having a parent for a learning coach, however, was supported by only one other student, Brad, who said that having a parent for his learning coach was great because it helped him focus more.

The remaining seven student responses, however, were indicative of the dual parent-learning coach relationship being a source of conflict within the parent-child relationship. They

characterized learning coach behaviors as being overly involved and controlling, leading a few students to resort to doing whatever it took—even just clicking to keep moving in the lesson—to keep their learning coaches from fussing at them for being behind. One student, as he described the actions of a learning coach he termed "too involved," seemed wistful for more freedom and independence.

Interestingly, only one learning coach, Miller, described a relationship characterized by conflict when she described how she tried to help her student as "getting mad because she won't tell me when she needs help, and then she gets an attitude." Her student, Hailey, however, did not characterize their relationship that way but noted that her mom was the first place she turned to for help and that her mom's feedback has helped her feel better about math.

Apathy. A common thread among the students who were repeating the course was a sense of apathy and hopelessness. These three students were also the three students whose assessment results indicated that they had fixed mindsets. Mark did not believe that he had experienced any successes this year in math and when asked about his failures his response was "All of it. I don't really care...I just click through to get to the end." Similarly, Aaliyah shared that her failure was not doing her work and getting behind and admitted, "Now I don't know what to do, so I guess I've kind of given up." Shawn shared a similar lack of desire to try when he stated, "I don't get it, and it is easier not to try to get help sometimes."

Learning Coach Feedback

All eight learning coaches vividly described the feedback and interactions that were typical of a given school day and of their math coaching with their students. The learning coach resources included in the document review of this study specified that learning coaches should commit 30 to 60 minutes daily to interacting with their student. Those documents also described

what these interactions should focus on—motivating the student and determining whether or not the student comprehended the day's work. The learning coaches included in this study, however, provided differing views of the feedback they provide and the support role they play in their students' learning.

Frequency. For learning coaches Riley, Monk, Miller, and Lanier the frequency of generic check-ins about school was daily. Their math-specific conversations were three to four times a week depending upon the needs of their student. Learning coaches Pope, Farrell, Heath, and Prentice indicated that they provided general check-ins with their students about how school was going less frequently, averaging about two to three times a week and math-specific conversations ranging in frequency from never to once or twice a week.

Process focus. Four of the learning coaches were able to provide rich descriptions of process-driven feedback that they provide to their students. This was feedback that was less focused on grades and performance and more focused on the processes of learning the material. Three of these four were among the group who provided more frequent check-ins with their students.

Monk encouraged her student to take great notes, and they went over how to retrieve the materials given throughout the lesson. Riley's students described the end of their day check-in as a time where they reviewed what they had studied that day and, based upon their feeling of mastery, made a joint decision on whether they needed more help. This was corroborated through Riley's description of the support she offered her students.

> At the end of the day I'll ask, 'Did you struggle with anything? Do we need to review anything?' Just probing those questions a bit further. If they did get feedback from the teacher, what was that feedback?

Pope shared that her feedback to her student usually involved them sitting down and watching Khan Academy videos to figure concepts out together and reviewing teacher feedback together to plan next steps to make improvements. Miller did the lessons with her daughter as often as her schedule allowed, coaching and encouraging her along the way, stating that she felt this coaching style of feedback helped her daughter feel more confident in math.

Outcome focus. The remaining three learning coaches focused more on outcomes in their feedback or the only feedback they provided was to encourage their students to ask the teacher. Lanier fell into that first category, seemingly prioritizing lesson completion and pacing in her interactions.

> I'll ask how many lessons she completed for the day...I try not to bother her too much, but when she gets behind it's like 'okay, you've been working on school for hours; I need you to rethink your strategy. You can't spend nine hours on one problem, honey, that's not going to work.'

Farrell and Heath fell into the category of directing their students to ask the teacher, and more often than not their feedback did not focus on specific support. Farrell, when asked about their math-specific interactions, shared that she never asks about math; instead she directs the student to contact the teacher, although she knows her student does not do that. Similarly, Heath explained that the one or two times her son had come to her with a question, she tried to help, but ended up directing him to call the teacher instead, an idea she says he does not really like. Lanier, like Farrell and Heath, also deferred math questions to the teacher, explaining, "That is outside of my pay grade and she [the student] needs to reach out to the teacher."

Themes

By analyzing the intersection of the categories of responses, five themes emerged: (a) learning coaches find the demands of the role difficult to meet, (b) the frequency and type of teacher contact matter, (c) students rely on the learning coach due to transactional distance with teacher (d) learning coaches recognize that mindset matters, and (e) outcome-centered feedback led students to engage in clicking, not learning.

Learning Coaches Find the Demands of Role Difficult to Meet

For the learning coach of a high school student, the informational material describes a supportive role where the learning coach supplements the teacher's instruction by following up on what the student learned, providing in-person motivation, and establishing daily routines. Multiple times the documents reviewed for this study stated that these tasks should be able to be accomplished in 30 to 60 minutes per day.

All of the participant learning coaches agreed, however, that the requirements for the role were far more than what had been advertised. The learning coaches found it difficult to fully support their students in online learning while also working full time and balancing family needs. Not only was time identified as a surprisingly greater-than-advertised necessity for the learning coach role, but learning coaches also identified math content-knowledge and knowledge of basic pedagogical principles as barriers to their fulfillment of the learning coach role to the degree needed by their students. As a result of the delays inherent in asynchronous email communication, the students had, out of necessity, redefined the learning coach role to become that of a substitute for their distant virtual teacher. That change in role description, however, left learning coaches ill-equipped to meet those demands in the form of time and instruction.

Frequency and Type of Teacher Contact Matter

Learning coach responses indicated that they encouraged their students to contact teachers when they were unable to answer the students' questions, but that this was something they said and kept repeating with little to no action on the part of the student. Learning coaches, therefore, recognized their students' reluctance to contact teachers and worked with their students to find other ways to solve their problems through Khan Academy, YouTube, and/or Google internet searches. Indeed, learning coaches themselves indicated that they did not contact the teacher if they had questions. In all cases, for both students and learning coaches, contacting the teacher was viewed as a last resort once all other options had been exhausted. Both learning coaches and students agreed that this hesitation was due, in large part, to the time delay in teacher-student communication. Students and learning coaches relied most often on email and expressed frustration at having to wait for answers. Students and learning coaches shied away from phone communication, with students citing feelings of awkwardness and unfamiliarity with the teacher as the primary reasons while learning coaches who worked cited that it was usually after teachers' work hours when they encountered questions, so email was more convenient.

Students Rely on Learning Coach because of Perceived Distance with Teacher

For all students included in this study, the learning coach was their first point of contact for all questions, even content-related questions that a teacher would have been better poised to answer. The reason students gave for going to their learning coaches first was that of immediacy. In short, their learning coach was present, and they perceived that the virtual teacher was not present. All of the learning coach/student pairs involved in this study also had dual parent-child relationships, so there was a degree of familiarity that students felt with their

learning coaches but lacked with their teachers. Shawn, for example, felt that there was no one to care, and this was a limiting motivational factor which led him to click through lessons and not ask for help. Four of the students included in this study indicated that they had never had synchronous communication with their math teacher. The remaining students had, but it had only been in the group live lesson format. It was apparent throughout their interviews that the students had not developed a relationship with the content-area teacher, and thus, because of the ability to get immediate feedback and having an established relationship with their learning coaches, students relied upon their learning coaches instead of seeking help from the teacher.

Learning Coaches Recognize Mindset Matters

The learning coaches of students who were not doing well in math attributed that low performance to the student's lack of belief in his or her ability to do well. The stories that these learning coaches told, and that their students corroborated, were of repeated failures in math that had led the students to give up and stop trying. The common behaviors that these students described were clicking to get through lessons without reading and being unable to identify personal successes in the course. If they were able to identify successes within the course, they attributed that success to external sources. The learning coaches of these students, however, also had patterns of thought and behavior that they all shared—infrequent check-ins with their students, feedback that was focused on outcome (i.e. number of lessons completed or grades), and uncertainty about how to change student behaviors. The learning coaches recognized a problem, but they had become frustrated that verbal directions such as repeating the refrain "call your teacher" were not resulting in changes in student behavior. Many times this frustration bubbled over into getting angry with the student which led to a deterioration of the learning coach/student relationship and fewer school-related conversations.

Outcome-Centered Feedback Led Students to Click, Not Learn

Three of the learning coaches focused on outcome-centered feedback in that they rarely discussed learning and quality and instead honed in on the number of lessons completed for the day. The students of these learning coaches were the students who were most likely to mention clicking through lessons as a strategy that they employed when they encountered an obstacle. The students attributed this behavior as a solution to keep their learning coaches off their backs or avoid getting in trouble with their learning coaches. One student, Mark, was the exception to this pattern. He also shared that he would frequently just click through assignments, but his learning coach offered process-focused feedback. The difference here, however, may be the frequency with which Mark's learning coach provided this feedback. Compared to the other process-focused learning coaches who offered daily check-ins and math-specific support multiple times a week, Prentice only checked in with Mark on school once or twice a week, citing an awareness of his clicking behavior, but her work and his age for reasons she did not do this more frequently.

Summary

This chapter described the experiences of students and their learning coaches as they navigated learning Math I content in a virtual school. Their responses were organized and presented categorically. Five themes emerging from the intersection of the categorized responses: (a) learning coaches find the demands of the role difficult to meet, (b) the frequency and type of teacher contact matter, (c) students rely on the learning coach due to transactional distance with teacher, (d) learning coaches recognize that mindset matters, and (e) outcome-centered feedback led students to engage in clicking, not learning.

The themes resulting from this study summarize the learning coach and student experiences in relation to the three research questions posed by the study and demonstrate considerable overlap in the experiences between the nine student participants and eight learning coach participants. The shared student and learning coach experiences unearthed by this study related to the demands of the learning coach role, the frequency and type of teacher contact, and the cultivation of a growth mindset, and underscore the importance of purposeful design in virtual schools as it relates to closing the distance between the home learning environment and the virtual teacher and equipping learning coaches with the tools needed to support their students in adopting a growth mindset. The final chapter presents interpretations and implications of these themes as they relate to the theoretical framework and existing research in order to make recommendations for additional research and action.

CHAPTER 5

DISCUSSION

The purpose of this study was to better understand the subjective experiences of Math I students and their learning coaches as they work through the obstacles presented by learning math virtually. A comprehensive review of the literature revealed an agreed upon lack of research in K-12 virtual school settings (O'Dwyer, Carey, & Kleinman, 2007; Toppin & Toppin, 2016), specific gaps focusing on the areas of parental involvement and engagement, and the impact specific types of communication have on student engagement and performance (Belair, 2012).

Nine students and eight learning coaches relayed their personal experiences related to learning and supporting math online to the researcher over the course of two interviews to provide the qualitative data at the heart of this study. Data analysis led to the identification of codes that were subsequently grouped into categories. The relationships between those categories of responses led the researcher to identify the following themes: (a) learning coaches find the demands of the role difficult to meet, (b) the frequency and type of teacher contact matter, (c) students rely on the learning coach due to transactional distance with teacher (d) learning coaches recognize that mindset matters, and (e) outcome-centered feedback led students to engage in clicking, not learning. These themes highlight the importance of virtual school efforts to close the distance between the home learning environment and the virtual teacher as indicated by Moore's Transactional Distance Theory (1997) and efforts to cultivate within students the behaviors indicative of a growth mindset (Dweck, 2006).

Interpretation of Findings

The five themes resulting from this study demonstrate considerable overlap in the experiences of the nine student participants and eight learning coach participants that are supported by current literature related to the frequency and quality of virtual student, learning coach, and instructor communication patterns and the motivational effect of virtual student, learning coach, and instructor communication patterns—both concepts related to the theories of Transactional Distance and Mindset. Included within this chapter is a discussion of how these findings relate to Transactional Distance Theory and Mindset Theory presented in relationship to the study's research questions.

Research Question One

The first two themes answer the research question: What are the obstacles to student success in virtual math courses as identified by students and their learning coaches? The primary obstacle identified by learning coaches was the demand of the role itself, while for students, the primary obstacle was the transactional distance caused by the frequency and type of teacher contact.

Learning Coaches Find the Demands of the Role Difficult to Meet. The learning coaches in this study all agreed that the time commitment needed to successfully serve as a learning coach was far greater than they anticipated based upon the preliminary material they had at their disposal prior to signing up and as support in the early days of serving as a learning coach. The learning coach orientation, included in the document review, encouraged daily interactions between learning coach and student; that role, however, was described as that of a motivator—an at-home supplement to the teacher to encourage and motivate the student that should necessitate a commitment of only 30 to 60 minutes per day. That was not the reality

experienced by any of these learning coaches, however. The learning coaches felt that they were far from a supplement to the teacher; rather, they had to fill in by providing instruction and answering content-related questions because of the distance between teacher and learner. The learning coaches in this study were not alone in feeling that way. Smith et al. (2016) discovered that parents of virtual students with disabilities likened the time commitment of the learning coach role to that of a part-time job. In a quantitative study of 82 virtual students and learning coaches in Utah, Borup, Graham, and Davies (2013) found that learner-parent interactions indeed accounted for a greater percentage of total interactions (21%) than learner-instructor interactions (7%).

The learning coaches in this current study, likewise, ended up serving in the capacity of teacher, being the first stop for students' content-related questions. In studies conducted by Currie-Rubin and Smith (2014) and Curtis (2015), learning coaches at these virtual schools also compared their role to that of a teacher. Borup et al. (2013) in their quantitative analyses of student-parent and student-instructor interactions, found that the student-parent interactions had a content focus an equal percentage of time as the student-instructor interactions, meaning that given the increased occurrence of student-parent interactions when compared to student-instructor interactions, students were getting a majority of their content support from parents. Instead of lessening the transactional distance between teacher and student, the at-home learning coach role seemed to enable that distance to persist, providing an easy and convenient, yet unqualified, substitute for a licensed teacher on whom students can rely.

Frequency and Type of Teacher Contact Matter. This study's conclusion that the frequency of contact and the type of contact can increase the transactional distance, thereby increasing feelings of isolation among students and parents was borne out through other research

as well. The infrequency of contact with a teacher was also apparent in the study by Borup et al. (2013), which found that out of the time that students spent engaged in learning, only 7% of that time was devoted to student-teacher interaction, either synchronous or asynchronous. The transactional distance, however, was influenced by the actions and perceptions of the students at HCA. They engaged in behaviors they believed would keep them from having to contact the teacher or from having the teacher contact them—relying on their learning coach, utilizing internet searches to find the answers, and clicking through lessons to stay on pace. This finding was supported by a study conducted by Belair (2012) where it was concluded that the transactional distance was a product of teacher and student actions and perceptions.

Research Question Two

The themes of student reliance on learning coaches and the learning coaches' perceptions of the role of mindset address the research question: How do students respond to identified obstacles, learning coach support, and teacher interventions? What is the perceived role of mindset in these reactions?

Students Rely on Learning Coach Due to Perceived Transactional Distance with Teacher. The reliance on asynchronous email communication as the primary method of communication between students and teachers resulted in students first turning to their learning coaches and alternative internet resources for content support before ever attempting to reach out to the teacher for assistance. Huang, Chandra, DePaolo, and Simmons (2016) discovered that students who relied on primarily asynchronous communication perceived a higher degree of transactional distance. For the students in this current study, the idea of more immediate feedback as a result of synchronous communication prompted confirmation that that change in

communication design would make a difference in the frequency of their communications with the teacher.

Students also perceived a difference in relationship; they had an established relationship with their learning coaches, but lacked a relationship with their teachers. Multiple studies, not in a virtual environment, have shown that positive teacher-student relationships can result in increased student motivation (Farmer, 2018; Furrer, Skinner, & Pitzer, 2014; Ridwan, Opdenakker, & Bosker, 2013). For the students in this study, that positive teacher-student relationship did not exist, so for students like Shawn, whose learning coach did not foster a positive learning coach/student relationship as a substitute, students expressed decreased motivation.

Learning Coaches Recognize that Mindset Matters. The learning coaches of struggling students in this study recognized that the student's belief in his or her own ability to succeed was something they needed to try to cultivate in order to motivate their students to stick with school in the face of the challenges presented by the online environment. Their intuition was supported by research on Mindset Theory. Yeager and Dweck (2012) found that if students could be taught to see intellectual ability as being malleable through effort and assistance from others, or coached into having a growth mindset, then they were more resilient in the face of challenging learning tasks. In order, therefore, to have students who can continue self-directed learning in spite of challenges, parents must be able to foster a growth mindset.

The importance of a growth mindset in the virtual environment was further highlighted by the experiences of the three students—Aaliyah, Mark, and Shawn—whose assessment results indicated that they had fixed mindset beliefs. All three students' responses showed some degree of apathy and a feeling that success in the virtual math classroom was unlikely. These feelings

of hopelessness could be due to the fact that all three students had failed the online Math I course previously. Unfortunately, their feelings became a reality, and all three of these students with fixed mindsets failed Math I again by the conclusion of this study.

A review of the syllabus for the course makes it apparent that the self-directed, autonomous learner is the one who will be successful in the course. There was no indication that the teacher would monitor performance and reach out to students whose grades made it apparent they needed help. Instead, the responsibility was placed on the student. For extra help, students were directed to book appointments with the teacher and these tutorials were by appointment only. Additionally, even though point recovery for any grade less than a 60 was required, again the onus of initiating remediation was placed upon the student—they must ask via email for permission to do the point recovery and list the actions they had taken on their own to review the material. Only after that process was completed, would the teacher allow the student to redo problems the student missed in order to recover points on the assignment. The setup created within the expectations of this course syllabus favored students who already possessed a growth mindset by requiring more self-initiated effort (Bedford, 2017).

Research Question Three

The final theme addresses the research question: How do students perceive and respond to different types of feedback from their learning coaches?

Outcome-Centered Feedback Led Students to Engage in Clicking, Not Learning.

The students of learning coaches who provided feedback focused on lesson completion instead of quality of learning were the students who were most likely to report that they just clicked through lessons without really reading and engaging with the content. Mindset Theory's take on feedback contributes some understanding to this observed phenomenon. According to Cimpian

et al., (2007, as cited in Dweck, 2008), students who received feedback that was fixed mindset oriented, as opposed to praise for their effort and process, were more likely to avoid tasks that they viewed as hard and were more likely to lose confidence when a task was challenging.

Implications

Moore's (1997) Transactional Distance Theory identified three main constructs that impact the degree of distance, or separation, between the learner and teacher—program structure, teacher-student interaction, and learner autonomy. The relationship between Moore's constructs of teacher-student interaction and learner autonomy is especially relevant to this study's findings. Moore theorized that as dialogue between teacher and student decreased, the transactional distance would increase, and as that distance increased, the more the learner would need to be able to function autonomously (Huang et al., 2016). Moore (1997) defined an autonomous learner as one who, without the assistance of the instructor, could approach the content directly. Within the interviews conducted for this research, students continually mentioned the lack of immediate feedback and their infrequent communication with the teachers. The presence of a learning coach had done nothing to mitigate the students' perceptions of transactional distance with the teacher. Instead, their perceptions of that transactional distance had led the students to replace teacher with learning coach. Indeed it appears as Belair (2012) concluded that transactional distance is constructed at least partially by the students. The Belair (2012) study, however, neglected the learning coach role in this construction of distance, but as this current study found, the presence of a learning coach with whom students had an existing relationship and who was in closer physical proximity to the student played an important role in enabling that transactional distance to persist.

Those students who were successful at the conclusion of the study by finishing the Math I course with a passing grade were those who assessed with a growth mindset and were already equipped to learn autonomously, an identified factor of success according to Transactional Distance Theory when there is a high level of perceived distance (Moore, 1997). Mindset Theory contends that the two mindsets (fixed and growth) orient themselves toward different learning behaviors and thought patterns, specifically different views of effort (either productive or undermining), different reactions to setbacks (either mastery-oriented or helplessness), and different goals (either learning or validating their ability) (Haimovitz & Dweck, 2017). It is these thought and behavior patterns within the context of learning that make students successful autonomous learners.

In order to successfully navigate an online course, research has shown that students must be adept at self-regulation, defined by Lowes and Lin (2015) as having initiative, intrinsic motivation, and personal responsibility. The question then becomes how virtual schools can encourage and teach students to be successful autonomous learners who demonstrate these growth mindset-oriented thought and behavior patterns, a necessity within a learning environment with a high degree of transactional distance.

Recommendations for Action

In 2016, the National Alliance for Charter Schools concluded that virtual schools should not be marketed to all students since the model best served students who were autonomous learners and self-motivated or who had parents who could be extensively involved in their learning. This current study found that those two factors are indeed important to successful course completion in a virtual school, but according to the student and learning coach feedback

provided, there are ways that virtual schools can begin adjusting the model to make it more accessible for all students and learning coaches.

According to the students interviewed for this study, increased methods and opportunities for synchronous interactions would be a welcome first step for the virtual school serving as the setting for the study. The student participants echoed the findings in the Borup et al. (2013) study, sharing that they spent most of their time engaged with the content or the learning coach, and very infrequently engaged with their teachers, if they did so at all. The students in this study who were able to report on engagement with their teachers described motivational interactions that aided their understanding of the math content, a finding supported by the Borup et al. (2013) study which concluded that even though students spent the least amount of time (7%) engaged with teachers, these were the interactions they found most motivational. Efforts must be made, then, to decrease that transactional distance in order to increase the percentage of time students are spending in the most motivational interactions with their instructors.

Additionally, according to Borup et al. (2013), students perceived the interactions with their parents to be more motivational than their parents did. The researchers hypothesized that this could be because parents did not understand the motivational value of their communications with their students. Likewise, in this study, learning coaches of students struggling with motivation seemed at a loss as to how they could possibly impact their students' motivation. It is the recommendation of the researcher, as a result of the findings of this study, that virtual schools make a concerted effort to explicitly teach learning coaches how to provide feedback that encourages growth mindset behaviors during the learning coach onboarding and ongoing throughout the school year in biweekly calls with content-area teachers. Due to the dual relationship that exists between most learning coach and student partners and the close physical

proximity that learning coaches share with their students, virtual schools need to maximize the potential of this role so that the addition of the learning coach to the instructional team can contribute to decreasing the sense of transactional distance and increasing student motivation.

Limitations and Future Research

The limitations of this study should be addressed by future research. This study was limited to participants in a single math course, in a single school. Future research should attempt answering similar research questions on a larger scale and include other disciplines in order to produce results that would begin moving the conversation outside of the specific bounds of this study and into the realm of generalizability.

The scope of this research was also limited to the exploration of only two of the constructs of Transactional Distance Theory—teacher-student interaction and learner autonomy. Future research should investigate how program structure impacts K-12 students' perceptions of transactional distance so that the design of virtual content and delivery platforms can be used as tools to decrease transactional distance.

Interviews where students and learning coaches self-reported behaviors also served as the bulk of the data analyzed for this study. It is the researcher's recommendation that future research attempt to obtain a more objective view of student and learning coach behavior by utilizing observational data, interviews, and survey results from available measures of engagement and transactional distance for a mixed-methods study design. Additionally, to build upon the concept of transactional distance being constructed by student and teacher perceptions and actions as found in the Belair (2012) study, the researcher would also recommend that future studies include teacher interviews and observations.

With a response rate of 6%, this study suffered from a limited sample selection. Future studies should utilize methods other than asynchronous email invitations to solicit participants and return a higher rate of participation.

Conclusion

Research on virtual schools shows that students who are self-directed and who have involved parents function the most successfully within the online environments (Lowes & Lin, 2015; National Alliance for Charter Schools, 2016). As virtual schools continue to grow, it follows that virtual school leaders and policymakers need to understand how virtual schools that do not pre-select for these success indicators can take the students and learning coaches they have and equip them with the thought and behavior patterns necessary to experience success. This research began that critical conversation by seeking to understand the learning coach and student experience as it related to approaching obstacles within the context of a high school virtual math classroom.

The findings of this study underscore the importance of Transactional Distance Theory and Mindset Theory when considering the student and learning coach experiences in a fully virtual school environment. Five related themes were identified as: (a) learning coaches find the demands of the role difficult to meet, (b) the frequency and type of teacher contact matter, (c) students rely on the learning coach due to transactional distance with teacher (d) learning coaches recognize that mindset matters, and (e) outcome-centered feedback led students to engage in clicking, not learning. The primary theme among the shared learning coach experience was that they were performing many of the functions of a teacher which resulted in a greater demand on their time than they had anticipated and led to feelings of uncertainty as they were not trained in pedagogy or content. Learning coaches had been thrust into this role of

substitute teacher because of the students' perceptions of the transactional distance with the teacher, but by stepping into that role, learning coaches enabled the persistence of a high degree of transactional distance. Students viewed the lack of immediate feedback and a reliance on asynchronous communication as reasons not to reach out to their teacher and relied on the learning coach who was there in person instead. Decreasing the transactional distance by increasing synchronous methods of communication and training learning coaches to provide feedback that develops the capacity for students to learn autonomously are the first stepping stones on the path to creating virtual learning environments that will enable all students to experience success and growth.

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Appendix A: Email Invitation to Participate

Dear ,

My name is Kate Kremer and I am [redacted] and also in the dissertation phase of my doctoral studies at the University of New England. I am writing to invite you and your child to participate in my research study about student mindset in the virtual math classroom. You're eligible to be in this study because your child is currently enrolled in a Math I course.

If you decide to participate in this study, the first step will be to provide written consent. After that is obtained, your child will be asked to complete an 8 question mindset assessment that will determine to what degree he or she believes that intelligence is able to be impacted by effort. You and your child may be selected for two follow-up telephone interviews of about 30-45 minutes each. I would like to audio record these interviews so that the data collected will be the most accurate. All responses and participation will be kept confidential and more details on how that will be done can be found on the attached consent form.

My hope is that this study will provide valuable information for virtual schools to better assist students and learning coaches as they undertake the monumental task of learning math online! Remember, this is completely voluntary. You can choose for you and your child to be in the study or not. If you'd like to participate, you as the parent will need to complete the consent form labeled "Parent/learning coach" and your child who is currently enrolled in Math I will need to complete the second, labeled "Student assent". If you have any questions about the study, please email me at [redacted].

Thank you very much.

Sincerely,

Appendix B: Parental Consent Form

UNIVERSITY OF NEW ENGLAND

CONSENT FOR PARTCIPATION IN RESEARCH (Parent/Learning Coach Consent)

Project Title: The Impact of Student Mindset in the Virtual Math Classroom
Principal Investigator(s): Katrina Kremer

Introduction

- Please read this form. You may also request that the form is read to you. The purpose of this form is to give you information about this research study, and if you choose to participate, document that choice.

- You are encouraged to ask any questions that you may have about this study, now, during or after the project is complete. You can take as much time as you need to decide whether or not you want to participate. Your participation is voluntary.

Why is this research study being done?

To better understand the influence of mindset on student and parent/learning coach behaviors in a virtual math environment

Who will be in this study?

Participants will be selected from students (and their parent/learning coaches) who are enrolled in HCA's Math I course

What will my child and I be asked to do?

Students and parents who consent to participate in the study will be asked to complete an online mindset assessment. You may be asked to participate in two 30-45 minute in-person, audio-recorded interviews with the researcher.

What are the possible risks to me or my child as a result of taking part in this study?

To the best of the researcher's knowledge, the things that you would be doing in this study present no risk to harm beyond that of everyday life. As with all research, there is a chance that the confidentiality of the information collected about you could be breached. The researcher will take steps to minimize this risk as described in more detail below.

What are the possible benefits to me or my child as a result of taking part in this study?

Taking part in this research is not likely to benefit you personally. This study is designed to learn more about the impact of mindset on student and parent/learning coach behaviors and as such, results and findings from the study may be used to help future students and families.

What will it cost me?

Participation in this study will involve no cost.

How will my privacy and the privacy of my child be protected?

Results of this study may be used in publications and presentations. All personal data will be handled as confidentially as possible. If results of this study are published or presented, individual names and other personally identifiable information will not be used.

How will my data be kept confidential?

To minimize the risks to confidentiality, the researcher will use pseudonyms to identify participants in research notes, transcripts and drafts. The key matching pseudonyms to participants will be stored in a password protected file and destroyed upon completion of the research.

What are my rights as a research participant?

- Your participation is voluntary. Your decision to participate will have no impact on your current or future relations with HCA.
- Your decision to participate will not affect your relationship with HCA.
- You may skip or refuse to answer any question for any reason.
- If you choose not to participate there is no penalty to you and you will not lose any benefits that you are otherwise entitled to receive.
- You are free to withdraw from this research study at any time, for any reason.
    - If you choose to withdraw from the research there will be no penalty to you and you will not lose any benefits that you are otherwise entitled to receive.
- You will be informed of any significant findings developed during the course of the research that may affect your willingness to participate in the research.
- If you sustain an injury while participating in this study, your participation may be ended.
- Parents, please be aware that under the Protection of Pupils Rights Act (20 U.S.C. Section 1232(c)(1)(A)), you have the right to review a copy of the questions asked of or materials that will be used with students. If you would like to do so, you should contact Kate Kremer to obtain a copy of the questions or materials.

What other options do I have?

- You may choose not to participate.

Whom may I contact with questions?

- The researcher conducting this study is Katrina Kremer. You may contact her at [redacted]
- If you choose to participate in this research study and believe you may have suffered a research related injury, please contact Marylin Newell, PhD, Committee Lead Advisor, at

[redacted]

- If you have any questions or concerns about your rights as a research subject, you may you may call Mary Bachman DeSilva, Sc.D., Chair of the UNE Institutional Review Board at (207) 221-4567 or irb@une.edu.

Will I receive a copy of this consent form?

- You will be given a copy of this consent form.

Participant's Statement and Parental Consent

I understand the above description of this research and the risks and benefits associated with my participation and the participation of my child as research subjects. I agree to take part in the research and do so voluntarily. I also give permission for my child to take part in the research.

_____ _____

Parent Signature (also Parent/learning coach participant) Date

_____

Printed name

Researcher's Statement

The participant named above had sufficient time to consider the information, had an opportunity to ask questions, and voluntarily agreed to be in this study.

_____ _____

Researcher's signature Date

_____

Printed name

Appendix B: Student Assent Form

UNIVERSITY OF NEW ENGLAND
CONSENT FOR PARTICIPATION IN RESEARCH (Student Assent Form)

I am working on completing my doctorate from the University of New England and would like to ask you to be in a research study. We do research studies to learn more about how the world works and why people act the way they do. In this study, I want to learn about the impact that student mindset plays in your success in the virtual math classroom.

What we are asking you to do:
I would like to ask you to take a short mindset assessment that will be administered online through a google form. You and your parent/learning coach may then be asked to participate in two 30-45-minute interviews with me to help me learn more about your experiences in Math I. At any time, you can choose to not answer a question.

Do I have to be in this study?
You do not have to participate in this study. It is up to you. You can say no now, or you can even change your mind later. No one will be upset with you if you decide not to be in this study. Your grades and your relationship with your school, teachers and classmates will not be affected if you choose to not participate in the study or if you choose to stop participating at any point.

Will being in this study hurt or help me in any way?
Being in this study will bring you no harm. There are no direct benefits to you for participating in this study. It will hopefully help us learn more about what it's like to have to learn math online!

What will you do with information about me?
We will be very careful to keep your answers to the assessment and interviews confidential. When the results are published or shared with others, all participants will be identified using a pseudonym (fake name) so no one will know you've participated in the study. Before and after the study we will keep all information we collect about you locked up and password protected.

If you want to stop doing the study, contact Kate Kremer at [redacted] or [redacted]. If you choose to stop before we are finished, any answers you already gave will be destroyed. There is no penalty for stopping. If you decide that you don't want your materials in the study, but you already turned them in, just let Kate Kremer know.

If you have questions about the study, contact:
Kate Kremer

Agreement:

By signing this form, I agree to be in the research study described above.

Name: _____

Signature: _____ Date: _____
You will receive a copy of this form.

Appendix C: Revised Implicit Theories of Intelligence Scale

National Mentoring Resource Center (NMRC)
Measurement Guidance Toolkit
Ready-to-Use Measures

DOMAIN: Academics
OUTCOME: Growth Mindset for Intelligence
MEASURE: Revised Implicit Theories of Intelligence (Self-Theory) Scale

The following questions are exploring students' beliefs about their personal ability to change their intelligence level. There are no right or wrong answers. We are just interested in your views. Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

	Strongly disagree	Disagree	Mostly disagree	Mostly agree	Agree	Strongly agree
1. I don't think I personally can do much to increase my intelligence.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
2. I can learn new things, but I don't have the ability to change my basic intelligence.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
3. My intelligence is something about me that I personally can't change very much.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
4. To be honest, I don't think I can really change how intelligent I am.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
5. With enough time and effort I think I could significantly improve my intelligence level.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
6. I believe I can always substantially improve on my intelligence.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
7. Regardless of my current intelligence level, I think I have the capacity to change it quite a bit.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
8. I believe I have the ability to change my basic intelligence level considerably over time.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

The full measure can be found here. A shorter 3-item version that includes only the items referring to fixed views of intelligence can be found in Dweck's book, *Self-theories: Their Role in Motivation, Personality, and Development*, or here.

Appendix D: Sample Student Interview Questions

Interview questions subject to change based upon initial document review

1. What has your previous experience in math classes been like?
2. What has been the most difficult part about learning math virtually?
3. On an average day, how confident do you feel in your ability to do well in your Math I class? What has led you to feel that way?
4. On an average day, how often do you interact with your teacher? With your parent/learning coach? What are these interactions like?
5. Can you tell me about one success you've had in Math I this year? Why do you think you were successful?
6. Can you tell me about one failure you've had in Math I? Why do you think you weren't successful?
7. How often in a typical week do you work with other students on math? What does that group work look like?
8. When you're stuck on math, where do you turn for help? How effective is that help?
9. In an ideal situation, where would you like to go for help and what would that help look like?

Appendix E: Sample Learning Coach Interview Questions

1. What was your experience with math like in school? Do you think that has impacted how you support your student in online Math I?
2. What has been the most difficult part of being a parent/learning coach, specifically when it comes to supporting your student in Math I?
3. How confident do you feel in your ability to support your student in learning math online? What has led you to feel that way?
4. How many times per week do you sit down with your student to talk about math? Do you think you should be doing more or less?
5. What feedback do you typically give your student on his/her math work?
6. When your student is stuck on math, how do you respond?
7. In an ideal situation, what do you think the parent/learning coach should be doing daily to ensure student success? From your experience, what barriers get in the way of making that a reality?
8. How effective did you find the parent/learning coach orientation and other provided resources at preparing you for this role? What would be more helpful?
9. How do you encourage your student to take risks with his/her learning? What does that look like?