How Teachers Can Overcome Students’ Unease about Math and Achieve Learning Success

Zahra Hosseini

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF EDUCATION IN EDUCATIONAL LEADERSHIP
VANCOUVER ISLAND UNIVERSITY

We accept the Thesis as conforming to the required standard.

Diane Charles, Faculty Supervisor
Faculty of Education,
Vancouver Island University

Date:

David Paterson, Dean, Faculty of Education
Vancouver Island University

Date:

2020
Abstract

The aim of this study is to identify a deeper understanding of the teaching methods used by teachers to help students overcome math learning difficulties in British Colombia (B.C.) Secondary Schools. My first hypothesis, according to my experience as a teacher, is that if teachers are friendly and concerned about the students, they will inspire in the students to have a positive attitude, motivate them to learn, and even become passionate about learning mathematics. My second hypothesis is that technology can be used to improve students’ success in learning math. My study involved in-person interviews with a target of eight math teachers from Secondary schools in British Columbia, asking 18 open-ended questions. However, my actual sample size was seven secondary school math teachers. The qualitative data was recorded using the interview method and then collected and analyzed in relation to specific themes. The responses to the open-ended interview questions were compared with each other to seek and define cohesions and tendencies. The teachers’ ideas were also compared to find how they were different or similar.

Of equal importance for this research, all the teachers in this study agreed with using student-teacher relationships in order to address unease about mathematics, to get all students engaged in an activity, and to help students move forward. Six of the seven teachers (85.7 %) agreed about using technology, and it is evident from my research that all of them use technology in their classrooms to some degree. However, teachers in this study identified barriers to the use of technology, such as time, number of students, and budget.
Table of Contents

Title Page ................................................................. i
Abstract ................................................................. ii
Table of Contents ......................................................... iii

Chapter 1: Problem to be Investigated ........................................ 1
  Purpose of the Study .................................................... 1
  Research Problem ...................................................... 1
  Justification of the Study .............................................. 3
  Research Question and Hypotheses ..................................... 4
  Definition of Terms .................................................... 5
    Unease .................................................................. 5
    Learning Success ................................................... 5
    Overcome ............................................................. 5
  Brief Overview of the Study ............................................ 6

Chapter 2: Literature Review .................................................. 7
  Mathematics Anxiety ................................................... 7
  Teacher-Student Relationship ......................................... 8
  Relationship with the Use of Technology ............................ 11
  Effectiveness of Technology for Students and Teachers .......... 16
  Teachers’ and Students’ Views about Technology ..................... 19
  Positive Effects of Some Software and Laptops on Learning Math . 23
  Summary .................................................................. 26

Chapter 3: Procedure and Methods .......................................... 27
Description of the Research Design .................................................................................. 27
Description of the Participants .................................................................................... 27
Description of the Instrument Used ........................................................................... 28
Explanation of the Procedures .................................................................................. 29
Discussion of Validity ................................................................................................. 30
Data Analysis ............................................................................................................. 31
Chapter 4: Results and Findings .................................................................................. 32
Quantitative Data ........................................................................................................ 32
Answers and Explanations to Questions 1 to 6 ......................................................... 34
Teachers’ ideas about teacher-student relationships ................................................. 34
Teachers’ attitudes about using technology ............................................................... 35
Individual Teachers’ Teaching Practices .................................................................. 36
Issues in Using Technology ....................................................................................... 37
Teachers’ barriers to using technology in math classes ........................................... 37
Time limits ................................................................................................................ 37
Number of students .................................................................................................. 38
Lack of investment ..................................................................................................... 38
How Teachers Address Anxiety about Math ............................................................ 40
Chapter 5: Summary and Conclusions ........................................................................ 42
Brief Summary of the Study ..................................................................................... 42
Discussion ................................................................................................................ 42
Barriers ....................................................................................................................... 45
Limitations of the Study ............................................................................................ 46
List of Tables

Table 1. Teachers’ Techniques to Improve Student-Teacher Relationships.......................... 42

Table 2. Technologies That Teachers Use............................................................................ 44
List of Figures

Figure 1. Years of Experience and Number of Students ..........................................................33
Figure 2. Length of Time Teaching Math in Each Session and Grades.................................34
Figure 3. Barriers That Teachers Have in using technology to address math unease ...........39
Chapter 1: Introduction of the Problem to be Investigated

Purpose of the Study

In nine years of teaching, I have found that many students consider mathematics a difficult subject. Students complained about mathematics and made excuses in order not to participate in math class. This thesis provides an opportunity to investigate the ways students can be motivated to learn math. I wanted to discover how teachers can educate students better and prepare them for the future. After getting the approval from the Research Ethics Board and permission to interview teachers in a school district of British Colombia (B.C.), I interviewed seven secondary school mathematics teachers in B.C. in order to determine the ways in which teachers can overcome students’ general struggles with mathematics and help students to achieve learning success.

The author of the present study is curious to know in which ways teachers can help students to avoid suffering from difficulty in math to achieve learning goals, especially in B.C.’s secondary schools. The main purpose of this study is to find solutions that contribute to students overcoming general struggles with learning mathematics as well as teachers’ views and desires to help students in learning math. The research method of the study is in-person interview to collect qualitative data.

The main purpose of this study is to find solutions that contribute to students overcoming difficulties in learning mathematics. Additionally, the current study will raise awareness among math teachers of new ways of teaching math, especially for those who have been in the classroom for a long time and who, while having extensive experience, may not be familiar with the new ways of teaching. My target audience is secondary math teachers who will benefit from this research in that it may provide new methodologies for teaching math. The justification for
investigating this question and problem is that mathematics is not an easy subject for many students in the world. Di Martino and Zan (2010), in a study on Italian schools, stated that many students have negative attitudes toward math. Papanastasiou (2002) demonstrated that 19.4% of students from Hong Kong and 19.0% of students from the U.S. dislike mathematics, but only 0.3% of students from Cyprus did not like mathematics (p. 138). It was evident from this research that teaching method made a significant difference in student feelings regarding math. In another study, World Bank (2006) found that of the 74 countries that participated in the global stage Program for International Student Assessment (PISA) for mathematics, the Indian states that participated placed 72nd and 73rd. World Bank (2006) found that the main issue for the teachers in these states was the lack of activities of students. The results of the study by Soni and Kumari (2017) pointed out the strong correlation between parents’ anxiety around math and their children having similar anxiety in India in South-West Punjab schools 5th to 10th grades. Moreover, the attitude of the parents influences the math achievement of students. According to these studies, many students from different countries consider math a difficult subject and do not like it.

The purpose of the present study is to create a deeper understanding of the teaching methods used by teachers to help students overcome math learning difficulties in British Colombia (B.C.) secondary schools. The study sought to find out the extent to which the teachers in B.C. can motivate students to learn math. The author of the present study believes that one way that teachers can motivate students is making room for digital programs and resources to achieve success. Somyürek (2015) stated that students were also encouraged to solve problems with different information that they had gained from educational tools. The students can be creative, and they do not have to follow certain rules; they are free to choose the procedures, so
they have positive feelings when they use educational instruments. Somyürek (2015) argued that using technology helps students to work as a team and facilitates the learning processes; additionally, learners can exchange their ideas to gain knowledge. This provides a situation for students to be aware of the different opinions of their team members and compare their ideas with them. Different solutions can help students solve complex problems (p. 37). Two noticeable outcomes of Somyürek’s (2015) study were that students felt it was enjoyable and they had positive feelings about it (p. 37).

**Justification of the Study**

Beilock and Willingham (2014) stated that many students in every country are worried about math according to international evaluations of high school students. The author of the present study believes that some students have stress in math class, or they make many excuses to escape from math class. Teaching is not an easy career. The traditional teaching methodology may not be useful or meaningful for the current generation. If students are struggling, then teachers need to change what they are doing. Technology alone will not improve the outcome. It is merely one of the ways that can help teachers to teach and students to learn. NMAP (2008) mentioned that students in the United States lack mathematics skills, and many do not meet minimal mathematics proficiency by the time they leave school (p. 26).

Teachers should look at how the world has changed and then agree that teaching needs to change to reflect these changes. Technology can be used to improve teaching and learning; moreover, it provides new opportunities for learners to access many sources that help them, such as web sites and some software. Moreover, Muníoz (2013) mentioned that the attitudes of students have changed, and they are interested in learning math by using technology such as computers. According to the OECD (2015), on average across OECD countries, 72% of students
used desktop, laptop, or tablet computers at school, while 93% used computers for research and word processing at home (p. 64).

**Research Question and Hypothesis**

The research question is *What do current secondary school teachers in B.C. report as the contributing factors of unease in learning math?* The goal is to discover how secondary school math teachers can motivate math students in B.C. The present study is designed to define the ways in which teachers can help students to avoid difficulty with math and achieve learning goals in B.C. secondary schools. The second part of the research question focuses on whether teachers use technology to overcome student unease with mathematics. In presenting this study, insight from math teachers will be gained regarding how to build more effective teaching methods in math classes. Further, this insight will promote professional learning by sharing these helpful methodologies for teaching math with teachers in B.C.

The first hypothesis of this current research is that if math teachers are friendly and concerned about the students, they will inspire students to have a positive attitude, motivate them to learn, and even become passionate about learning mathematics. My second hypothesis is that math teachers can use technology to help students overcome their math anxiety.

If technology is used as a tool for education in math, then the result of students’ learning will be positive, and students will have fewer challenges in learning math. Teachers can change students’ attitudes and their views toward mathematics; they can motivate students to learn math by implementing new methodologies of teaching. Instructors are challenged to develop an in-depth understanding of students’ learning needs.
Definition of Terms

To avoid ambiguity, the author of the present study endeavoured to be clear in terms of defining some vague words. The term *unease* means “a feeling of being worried about something” (Cambridge Dictionary, 2019, n.p.). Many students claim that they do not like math. But for some students, the problem with math is more than disliking fractions or multiplication. Some students have negative emotions such as fear of failure, which affects their abilities to perform or to be successful, and they do not put their energy into it. They consider math a difficult subject that is not easy to learn.

The term *learning success* refers to the quality of students’ learning measured by their grades and their participation in class activities. Markowitz (2017) referred to learning success as “the convergence of assessment, student success, and career readiness” (n.p.). Many teachers believe that learning is the students’ responsibility. However, it is the teachers’ responsibility to enable students to learn. If students are struggling, then teachers need to change what they are doing to ensure success.

The term *overcome* means “to defeat or succeed in controlling or dealing with something” such as math anxiety (Cambridge Dictionary, 2019, n. p.). Overcoming unease with math involves students gaining understanding in a specific subject area and exploring the topic in depth as well as being able to discuss their difficulties in their problem area. On one hand, teachers continue to be aware of students’ problems, and on the other hand, students never give up and do their best to identify their learning problem and find a solution for it. Overcoming does not mean ignoring or neglecting the problem that students face in mathematics classes or paying no attention to students’ feelings about math classes.
Brief Overview of the Study

The study will define the ways in which teachers can help students become successful in mathematics and achieve learning goals, especially in B.C. secondary schools. The purpose of this study is to find solutions to overcome students’ difficulties in learning mathematics and improve their attitudes about mathematics so that they do not consider math a difficult subject at school. The present research is not restricted to determining the use of technology in teaching math; it acknowledges the necessity of maintaining a positive teacher-student relationship in addressing math anxiety. The two hypotheses of this thesis arose from the present researcher’s experience as a teacher as well as research. First, teachers can help students overcome their math anxiety by forming positive relationships with them. Second, technology can be used to improve students’ success in learning math because teachers witness the arrival of new technology, and the role of technology in today’s world is undeniable.

Many different types of technologies are available for classrooms; for example, smart boards and interactive white boards allow teachers to project an image from a laptop to the screen, and the teacher can draw on that image. Another technological tool is computer software that is helpful for the comprehension and solution of math problems. The author of this present study interviewed B.C. mathematics teachers to discover whether teachers consider technology a useful way to help students learn mathematics. The author also explored B.C. math teachers’ attitudes toward the use of technology in reducing math anxiety among their students.

Chapter two will review selected literature on mathematics anxiety, the relationship between teachers and students who have mathematics anxiety, and the positive effects of using technology in teaching mathematics.
Chapter 2: Literature Review

Chapter two presents a review of selected articles by researchers who stressed the importance of teachers establishing and maintaining positive relationships with their students in order to reduce math anxiety. Chapter two also presents research on using technology in the teaching process, specifically whether technology in the classroom enhances learning, has positive effects on learning, and helps students improve their learning ability and teachers enhance their teaching. For ease of reading, this chapter has been divided into six themes: (a) mathematics anxiety and its possible origins, (b) the importance of building good relationships between teachers and students, (c) the positive effect of implementing technology in the teaching process in both primary and secondary schools, (d) the effectiveness of technology for students who have some challenges in learning math or some disability in general learning and for teachers who have mathematics teaching anxiety, (e) teachers’ and students’ views about the effectiveness of technology and the challenges in using technology through learning, and (f) the positive effects of some software and laptops on learning math.

Mathematics Anxiety

Carey, Hill, Devine, and Szücs (2017) studied mathematics anxiety and exam anxiety in 1,746 British children and adolescents. These authors found that mathematics anxiety is a unique form of anxiety that is “separate from both test anxiety and general anxiety” (p. 1). Douglas and LeFevre (2017) in their study warned against applying theories regarding children with developmental disabilities to children without these disabilities. The authors also suggested that while mathematics anxiety may arise from a lack of numeracy skills, it was also plausible that students become anxious during math tests because they “involve numbers and are timed” (p. 659).
Students’ math anxiety may arise from several causes, and it is useful for teachers to know what causes it in individual students in order to help them overcome it. To address math anxiety in students, Beilock and Willingham (2014) recommended that teachers and parents enhance students’ basic numerical skills to help prevent math anxiety. They further suggested that identifying students who are at risk of developing math anxiety, along with targeted exercises that enhance the students’ basic math skills and reduce their potential anxieties, may help to prevent the development of math anxiety among these students.

Beilock and Willingham (2014) concurred with Douglas and LeFevre (2017) that math anxiety increases when students take a timed test. Beilock and Willingham suggested that teachers try to reduce students’ unease with mathematics by setting a ten-minute writing exercise before giving a mathematics test in which students record their emotions connected with mathematics (pp. 30-31). The authors argued that this type of exercise can help to improve students’ performance in math tests.

**Teacher-Student Relationship**

As a teacher, the present researcher recognized that each student enjoyed a subject and understood it more than other subjects as a result of the relationships students had with the instructor of that subject. The example of the inventor Thomas Edison, shared by a professor in my education training, illustrates this. As a boy, Edison was expelled from school because he was curious and asked his teacher too many questions. His mother then taught him at home. If Edison had had a different relationship with his teacher, he might not have been expelled. Like the young Edison, each student has his or her own individual needs. For instance, some students need informal conversation, which means that teachers should be able to exchange their ideas with a small group of students or individual students during break time or out of the class.
because learners feel more comfortable outside when they are in the schoolyard. Kaser and Halbert (2009) suggested that if instructors and parents have respect, honesty, and proficiency in their responsibilities, their students will trust them. Trust, respect, and mutual understanding are earned over time. Confidence and trust help teachers present themselves to their students. There are various ways to promote effective relationships between teachers and students according to the suggestion of Kaser and Halbert (2009) I believe relationships between teachers and students should be based on trust, respect, and mutual understanding.

The key to a strong relationship is trust. In their study, Cribbs and Linder (2015) talked about training teachers how to maintain a good relationship with their students so that the students can trust them. In the present author’s experience, when students trust their teachers, they can have a good relationship with them. Higgins and BuShell (2018) suggested that a positive connection between the instructor and the pupils would be challenging without collaboration and trust (p. 1081). By communicating openly, trust can be built more easily. Wilkins (2014) argued that teachers’ structural commitment decreases when there is a poor connection between instructors and students (p. 53). Wilkins (2014) found that if students select a teacher to speak with about their worries, it means that they trust this teacher. If there is a positive relationship between students and teachers, teachers will have fewer discipline problems with students, and in turn, students will trust them.

Trust is built over time based on honesty, and honesty is a key factor in building trust. Kaser and Halbert (2009) demonstrated that if there is consistency between words and performance, honesty will be shown (p. 53). As a result, at school, students can understand the truth and honesty of teachers by monitoring their words and their performance.
It is useful for teachers to communicate with one student every day to know him/her; this way, the teacher may find the strengths and weaknesses of each student. Wilkins (2014) demonstrated that respect is a two-way street. If teachers respect students, the students will respect instructors, too. All teachers in Wilkins’s study mentioned “respect as being important in their relationship with students” (P. 61).

The first way to strengthen respect is to listen. A practical way to improve a teacher’s effective listening is to have students do group work. Group work in classrooms not only helps the students learn better, but also helps the teacher to hear all the students’ opinions. Rothrock (2017) described some group work led by a teacher named Ms. Corazón. It was a “spaghetti and marshmallow tower” activity. The students formed groups and had 18 sticks of spaghetti, one large marshmallow, one yard of string, and a roll of masking tape for building the highest freestanding tower in 18 minutes. Ms. Corazón believed that group work provided a situation for the students to raise a sense of community; additionally, group work reinforced students’ perceptions about mathematics. This teacher stated, “It forces collaboration and communication and problem solving.” (p. 370).

In group work, students develop understanding. Kirtman and Fullan (2016) argued that group work is the key element in leadership. Leaders can reach their goals by creating an effective teamwork environment (p. 25). In the present author’s opinion, instructors can use group work in order to teach more effectively. This method also allows students to build strong relationships. By fostering these relationships among students as well as teachers and students, teachers can recognize the strengths and weaknesses of the students and employ student-centered teaching methods. The second way to build respect is for teachers to show they care. Caring in the curriculum means paying attention and encouraging students, which creates a sense of
belonging. When caring is considered a value in education, teachers provide a situation for listening and responding to students. When teachers are giving feedback to students, they should show their care. Teachers can show their attention and care to students by using technology that students prefer. Renwick (2015) mentioned that educational tools provide a situation for learners in which they can point out their classmates’ mistakes, recognize correct thinking, and guide them. This will foster a sense of community, and the students will help each other to learn better (p. 32).

Professional teachers not only focus on the students’ academic achievement, but also pay attention to the social and personal needs of the students. Wilkins (2014) stated that suitable relationships between instructors and learners boost students’ inspiration, academic achievement, high level of attendance, and approaches to school (p. 54).

**Relationship with the Use of Technology**

While student-teacher relationships are vital to success in learning math, the author of this study also believes that using technology to assist student learning is also important. Istance and Dumont (2010) stated that collaboration does not mean only face-to-face interaction; with the help of digital resources, it can be possible from a long distance, too. One way that teachers can show their attention and care to students is to use technology with a technique that strengthens relationships. Most of the time teachers want to give feedback to students about solving math problems, but it is impossible in a classroom with many students; technology can help with this problem. Istance and Dumont also mentioned that using technology not only boosts the relationship between teachers and students in classrooms, but also improves this relationship outside of classrooms (p. 324). Furthermore, the students assumed that their relationships with their teachers would be improved if teachers were involved with the
technology in the way that students were. Istance and Dumont found that both students and teachers believed that when technology was used appropriately, they were connected to each other more efficiently (P. 334).

Higgins and BuShell (2018) commented that if students and teachers use iPads in classrooms, the content will always be accessible for students and all assignments will be done digitally. Additionally, students and teachers can communicate with each other by using email, and they can discuss assignments as well (p. 1082).

All the teachers in Higgins and BuShell’s (2018) study believed that the learners were more prepared with the iPads than without them. The students became responsible for their classwork and homework activities. These authors also mentioned that using technology not only boosts interactions between teachers and students in the classroom, but also increases this interaction outside of the classroom. Moreover, students can get the results of their assignments by email in a short time (p. 1083).

Shih and Mills (2007) stated that using such technology as software messaging, web access, and email attracts students; additionally, it fosters relationships between students (p. 3). In fact, one student’s discovery of a tool and a solution can become useful knowledge for the whole class. Teachers should design students’ technology tasks to encourage discussions about what they are learning. This approach allows students to practice the life skill of teamwork while making connections with each other. Warren (2016) stated that instructors can encourage students to communicate with their classmates by using technologies beside presentations and games. Instructors can set collaborating exercises instead of providing information for students (Warren, 2016, p. 312). Teachers can also encourage students to work with partners at computers. If students do not know what to do or how they can work with a software application,
teachers can use this situation as an opportunity for the class to learn from collaborative problem solving.

Muníoz (2013) believed that it is essential for all schools to know about the technology to motivate students to learn. Moreover, Muníoz mentioned that the attitudes of students are changed and are interested to learn math by using technology like computers (2013, p. 13). Papanastasiou (2002) investigated how attitudinal and instructional variables affect teaching fourth-grade students in Hong Kong, Cyprus, and the United States, and sought to find out how those variables affected math scores on a Third International Mathematics and Science Study (TIMSS) test. Papanastasiou demonstrated that 19.4% of students from Hong Kong and 19.0% of students from the United States disliked mathematics, but only 0.3% of the students from Cyprus did not like mathematics (p. 138). Papanastasiou investigated the four factors, peer influence for mathematics, computer use, small group work, and extra mathematic lessons that affected students’ performance in the TIMSS test or the positive attitude of students (pp. 136-138). For peer influence in mathematics, Papanastasiou (2002) stated that students in Cyprus believed that “it is important for my friends that I do well in mathematics” (p. 138), while this was not a problem for U.S. students.

For computer use in math class, Papanastasiou (2002) found that while the majority of U.S. students used computers in their math classrooms, students of Cyprus and Hong Kong did not. In terms of small group work, Papanastasiou found that a large proportion of students from Cyprus and the U.S. had small group work, as opposed to Hong Kong students. Papanastasiou found that for extra mathematic lessons, more Hong Kong and U.S. students took additional mathematics lessons, as compared to a mere 2.0% of Cypriot students.
Papanastasiou’s (2002) findings suggest that the positive attitudes of Cypriot students toward mathematics could help students in Cyprus to have better performance in the TIMMS test. However, Papanastasiou’s study lacked useful instruction for teachers in other countries to improve mathematics instruction.

Domingo and Garganté (2016) conducted a study in Spain with 2,550 students and 102 teachers from primary schools. The teachers in this study used tablets and apps in teaching and were familiar with the use of these apps. The purpose of Domingo and Garganté’s (2016) study was to discover the influence of teachers’ insights about using mobile technology in primary education learning, and how these views could affect the use of particular apps in the learning process. Domingo and Garganté (2016) pointed out that teachers who use math and literacy skills apps consider technology a positive effect on learning engagement (p. 28).

Muníoz (2013) believed that it is essential for all teachers to know about technology to motivate students to learn. Muníoz (2013) mentioned that students in elementary school do not like math, but their attitudes change, and they become interested to learn math by using technology such as computers (p. 13). Teachers can apply this technology for elementary school students as well as older students because children in the younger age group are interested in getting engaged with technology. Cihak and Foust (2008) have pointed out, “Performing basic computational math is also necessary for independent-living skills such as purchasing, banking, and budgeting.” (p. 131).

Vorensky (2018) conducted a study of 14 third and fourth-grade teachers at an elementary school in New Jersey. The data in Vorensky’s (2018) study was collected through “teacher observations, teacher surveys and teacher semi-structured interviews” (Vorensky, 2018, p. 29). The researcher sought to discover the teachers’ self-efficacy in teaching mathematics
using computers and whether the teachers believed using educational technology in the classroom reduced students’ math anxiety.

Vorensky (2018) found that teachers who implement educational technology in their classrooms encourage students to achieve their goals. For example, during the interview, third- and fourth-grade teachers discussed how to adapt particular software programs to the needs of students regardless of the level of work the students required support in (p. 125). This subject of mathematics instruction was useful for students who were lower or higher-grade levels. One teacher discussed students who had difficulty reading and fought word problem formats. By setting level ten marks, a mastery-based software program, students were eager to solve problems rather than shutting down when doing math tasks (p. 130).

The educational software reduces the math anxiety of teachers and students; moreover, it prepares them for critical thinking. Technology enhances students’ confidence by building on math success. In fact, teachers use computer resources as tools for learning and planning for critical thinking among students. Vorensky (2018) observed two students working on the AAA Math program in order to solve math problems. The program showed the correctness of the question without any explanation. If one of the pupils answered wrong, the other one could comment on it and illustrate how to correct the answer (p. 127).

According to the OECD (2015), on average across OECD countries, 72% of students used desktop, laptop, or tablet computers at school, while 93% used computers at home (p. 64). Most 15-year-old students in 2012 had been using computers for at least five years, and in most OECD countries, students were nine years old or younger when they first used a computer. In Denmark, Finland, Israel, Norway, and Sweden, most 15-year-olds first used a computer when they were six or younger. These students had the advantage of gaining familiarity with ICT tools early in their education. It is evident from this study that the younger a student is when he or she
is introduced to computers, the easier it will be for the student to work with technology at school (pp. 48-49). Of significance, Vorensky (2018) found introducing educational technology to younger students helps to decrease their math anxiety; thus, when they enter high school, they are more likely to have greater confidence in their own math skills.

**Effectiveness of Technology for Students and Teachers**

Tatar, Zengin, and Kagizmanli (2015) conducted a study of 481 elementary and secondary school teachers. The purpose of Tatar et al.’s (2015) study was to demonstrate the connection between “pre-service teachers’ mathematics teaching anxiety” and their views regarding the use of technology in math classes and also the computer literacy levels of the teachers (Tatar et al., 2015, p. 69). Three devices that Tatar et al. used in this study were the Mathematics Teaching Anxiety Scale (MATAS), which determined pre-service teachers’ levels of mathematics teaching anxiety, the Perception Scale for Technology Use in Mathematics Teaching (PSTM), which determined the teachers’ perceptions regarding technology use in mathematics courses, the Computer Literacy Scale (CLS), which determined the teachers’ computer literacy levels (Tatar et al., 2015, p. 69).

Tatar et al.’s (2015) findings show that teachers had lower mathematics teaching anxiety when they had positive perceptions about using technology in teaching math. Moreover, these authors found that “pre-service mathematics teachers’ teaching anxiety in terms of content knowledge, self-confidence, attitude towards mathematics teaching and teaching knowledge decreased” (p. 73) when they increased their level of their computer literacy. The authors suggested that mathematics teaching anxiety could be decreased by increasing technology consciousness. It is essential to pay attention to the combination of technology in teaching and learning math in the courses that the pre-service teachers take during their university education.
Additionally, the authors recommended courses that teach how implementing technology in teaching math will contribute positively to the pre-service teachers’ views about technology.

Roberts (2019) conducted a study of 12 third-grade students. These included four Caucasian, five African American, and three Hispanic students. They were regular education, special education, English as a Second Language (ESL), and Tier 2 students. The latter are students who struggle in math but do not qualify to receive special education services. Roberts explained that the Tier 2 students are simply monitored until it is found necessary to refer them for further testing to see if they have learning disabilities (Roberts, 2019, p. 36).

The purpose of Roberts’ (2019) study was to determine whether math fact fluency in multiplication could increase by using the Reflex Math computerized intervention. The group of students in Roberts’ study used the Reflex Math program three times per week for 15 to 20 minutes each day for eight weeks. Roberts used qualitative and quantitative data in the study to show the improvement of students in math from their pre and post-test assessments by using Reflex. Roberts stated that Reflex helps students who have problems in concentrating in class in order to be successful in math. Roberts demonstrated that Reflex is a computer-based program that students like to use in the classroom when they learn multiplication. One hundred percent of the students in Roberts’ study mentioned that Reflex Math, by using fact families, helped the students learn multiplication facts; moreover, it gave them an amusing instrument for learning (p. 46). In this study, the participants from pretest to post-test revealed an average range of gaining 50 to 120 multiplication facts.

The results of Roberts’ (2019) study showed that students who have learning disabilities showed significant gains with multiplication fact fluency. All the students had improved from
their pre- to post-test scores. Roberts stated that Reflex Math increases the understanding of multiplication facts for the students in third grade (p. 49).

Yılmaz et al. (2010) conducted research with 24 grade 7 students at a public school in Ankara, Turkey. Students were selected based on their math exam results and their class teacher’s observations, and were divided into three groups: Successful, average, and unsuccessful. In semi-structured interviews, the researchers asked students about their feelings about math and the factors that affect their attitudes towards math.

In this study, successful students said they enjoyed math, and average students found math courses enjoyable if they understood what was being taught. Some unsuccessful students reported that they found math courses enjoyable when they could understand and solve problems. Most relevant to the present study, Yılmaz et al. (2010) found that only three of the students said their teachers used computers in their classrooms, and 12 of the participants wanted to see audiovisual materials, games, and other activities used in their classrooms (p. 4504).

Garcia Joven (2018) stated that the use of technology helps teachers to improve their lessons and their students’ learning process (p. 39). As Garcia Joven has pointed out, not only has technology changed the way people live and learn, but also the presence of technology in classrooms has increased recently. Teachers are now incorporating more technology—SMART boards, tablets, and other electronic devices—into their lesson plans because this technology enhances their lessons and their students’ learning process.

Technology can boost students’ learning by giving them a clear picture of subjects and facilitating learning even when students are not in classrooms (Lumpkin, Achen, & Dodd, 2015, p. 7). As Renwick (2015) found, online learning with digital tools provides a situation for learners to repeat the subject or the part that they have problems with. Students like to do their
assignments online or in a different way, not just by writing with pens or pencils (Renwick, 2015, p. 31).

**Teachers’ and Students’ Views about Technology**

Stieler-Hunt and Jones (2015) interviewed 13 educators in Queensland, Australia. The authors conducted this study to discover the participants’ philosophies about learning and using digital games (DGs) and how they have used information communication technology (ICT) and (DGs) for student learning.

Stieler-Hunt and Jones (2015) found that digital gameplay (DGP) inspires student motivation and interest, and therefore teachers value it. The authors stated that teachers who believed in using DGP “felt they experienced subjective success when using DGP in the classroom.” (p. 13). The limitation of this study was its small scale; the authors recommended that more research on this topic should be carried out in other settings and locations.

Almekhlafi and Almeqdadi (2010) conducted a study of 40 female and 60 male grade 6-9 schoolteachers in the United Arab Emirates. The purpose of this study was to explore “teachers’ views about technology incorporation aptitudes, obstacles frustrating such incorporation, and incentives to increase this integration in the class” (p. 168). The authors found that teachers are confident in their ability to incorporate technology in their classrooms. The participants in this study demonstrated they had insight into their students’ use of technology to collaborate and communicate with each other and to increase their independent learning, their engagement in learning, and their understanding of academic subjects.

The male teachers in this study stressed the importance of training teachers in the use of technology so they can implement technology successfully in their classes. “Most male teachers believed that using technology is important, but not all the time” (p. 171). On the other hand,
they indicated that technology has many advantages for the teaching-learning procedure. Technology saves class time, minimizes teachers’ efforts, holds students’ attention, and makes learning interesting (p. 171). Students’ understanding is the most important factor that teachers could use to evaluate the effectiveness of using technology in their classrooms.

Facilitates learning and teaching, increases student participation, and provides visual support for students with different learning styles were the female teachers’ perceptions about using technology in the classroom (p. 171). Female teachers also used different types of technology, such as computers, visual projectors, and the internet, more often than male teachers. The female teachers had greater involvement, understanding, and information about technology resources and applications than the male teachers (p. 171).

The male teachers believed that technology should be a part of the curriculum plan and that teachers should receive rewards for incorporating technology in their lessons (p. 172). Both male and female teachers concentrated mainly on using computers in their classes, and all the teachers thought technology should be used when teachers use a variety of teaching techniques. All the teachers agreed that the most important factors defining the type of technology teachers should use are lesson goals and the nature of the subject (p. 172).

One of the obstacles to using technology in the classroom was parents’ and teachers’ negative attitudes toward the importance and benefits of technology for learning and teaching. Female teachers pointed out other obstacles, such as the large number of students, technical problems, and expensive tools. They suggested that schools should provide professional development workshops for teachers. They also recommended that schools should co-operate with each other so that teachers could exchange ideas and discuss techniques for effectively
incorporating technology in classrooms. They further suggested that the curriculum should be supported by technology-enhanced resources (pp. 172-173).

Guimarães, Ribeiro, Echeveste, and de Jacques (2013) conducted a study of 63 students and 15 teachers of two Brazilian public schools that participated in a pilot test of educational laptops. The objective of this study was to discover students’ and teachers’ perceptions of the laptops (p. 264). Guimarães et al. found that the laptops made lessons more attractive to students because they could use them for collective research. Boys used the laptops for recreation, while girls used them for social interaction and to improve their learning (p. 270). Younger students played games and older students used the laptops for social interaction and internet research. Some teachers were initially skeptical about this technology because they had no training to use it. However, they came to accept the laptops in their classrooms because they recognized the technology’s ability to enhance their students’ learning, communication, and social skills (p. 271).

Pamuk, Ergun, Çakir, Yilmaz, and Ayas (2013) evaluated the early implementation results of a project in Turkey in which interactive boards (IBs) and tablet computers were distributed to 11 pilot schools. The researchers administered questionnaires and semi-structured interviews to the 181 teachers and 918 students who participated in the project. The researchers also used in-class observations and focus groups. Pamuk et al. (2013) investigated whether the participating teachers and students made use of these technologies. They evaluated the effectiveness of these technologies in teaching and learning and examined the problems that emerged when IB and tablet computers were applied in the classroom.

Pamuk et al. (2013) found that most of the participating teachers and students in their study appreciated having access to IBs in their schools and classrooms despite some technical
problems (p. 1817). The researchers determined that the teachers’ problems were limited access to e-content and e-materials developed specifically for their content areas (p.1817). Some teachers also stated they had no central resource for material to use in their classroom teaching (p. 1817).

Teachers expressed concern about the lack of interactivity between IBs and students’ tablet PCs. They also stated that the lack of interactivity between IBs and tabled PCs created an environment in which students were “in passive mode” (Pamuk et al., 2013, p. 1817) and it became difficult to engage the students with the content of the lessons. However, the researchers noted, while this appeared to be a technical problem, it had more to do with pedagogical and classroom management problems (p. 1817). Teachers stressed that to involve students in the learning process and engage them with the content, the students’ tablet PCs must be able to communicate with the IBs so that teachers could transfer the activities and resources on IBs to the students’ tablet PCs.

Another problem the researchers discovered was the fact that some students did not use the technology appropriately. Those with knowledge of the technology were able to unlock them and install games and other applications. Therefore, some teachers saw the tablet PCs as distractions from the lessons and banned them from their classrooms.

In addition, participants encountered difficulties with limited data transfer from portable devices such as thumb drives into the tablets as well as the loss of lecture notes saved on them. Furthermore, teachers commented that their lack of knowledge about these technologies and the limited e-materials and the increase in their workload, combined with the decreased attention of students, were major problems in using technology in their classrooms.
Among the researchers’ suggestions for dealing with these problems were the following: E-content should be enriched and diversified, teachers should be trained to use technology and be provided with compatible software to prepare content themselves, and IBs and tablet PCs must be enabled to communicate and exchange data (p.1820).

Positive Effects of Some Software and Laptops on Learning Math

Technology can engage students in learning, and when students are engaged, they will become interested. Mitra and Steffensmeier (2000) stated the favourite classes for students were the classes in which they used computers. Similarly, Somyürek (2015) stated that educational tools help students to participate in classroom activities because they have positive feelings when they use educational instruments (P. 38).

Norazah, Rahimahm, Effandi, and Amin (2010) discussed Geometer’s Sketchpad (GSP). This software allows students to change their tools (books and pencils) to a computer platform and to solve the mathematical and geometric exercises without any risk. Norazah et al. conducted a study in Selangor and Malaysia that examined 34 secondary-school teachers of mathematics. These instructors administered this software module in their educational centres for two weeks. Most of the teachers (94%) in this study agreed that GSP can increase the motivation of the students to learn mathematics (p. 115).

A similar study by Tajudin (2013) investigated the use of the graphic calculator (GC) and Geometers’ Sketchpad (GSP) to teach and learn math in Malaysian secondary schools. In this study, 30 mathematics instructors from three diverse schools in Malaysia participated. The instructors tested the module for two weeks in their schools. Then, the teachers used an educational usability form to explain the reaction of the students. This form recorded data in the categories of inspiration, consciousness, student management, student actions, objective
concerned, request, worth added, flexibility, and reaction. Tajudin (2013) stated that the use of technology is one element that could influence the teaching and learning of mathematics (p. 53).

Tajudin’s results reflect those of Norazah et al. (2010) in terms of educational usability and standard forms (Tajudin, 2013, pp. 56-58). The two studies have demonstrated that GSP can motivate students in learning. In Norazah et al.’s study, almost all the teachers were in favour of GSP as an instrument to boost motivation; in Tajudin’s study, all the teachers believed that GSP enhanced the students’ motivation level.

Vogt (2018) studied the positive and negative influences of using digital game-based learning (DGBL) in classrooms. Through face-to-face interviews, Vogt discovered how eight middle-school teachers used DGBL in the classroom and what factors influenced their decisions to use it. The teachers interviewed in this study employed DGBL in their classrooms because it enabled students to engage with the content and experience real-world situations that required math skills (p. 38). The teachers reported that DGBL increased the students’ creativity and enhanced their teamwork and communication skills. It also fostered individualized learning, improved feedback and assessment, and supported easier lesson planning and classroom management (Vogt, 2018, p. 116).

According to Vogt (2018), the negative influences of DGBL were technical difficulties, the lack of self efficacy, the perception of more difficult classroom management, the need for flexibility and a backup plan, and time constraints (pp. 116-117). Classroom management was an issue for all the teachers, and all the teachers mentioned time constraints as a strong negative influence. However, the teachers in this study stated that their use of DGBL “enhanced students’ learning, collaboration, critical thinking, and motivation and engagement” (Vogt, 2018, p. 120). All the teachers believed that “DGBL helped students retain information better and do better on
assessments” (Vogt, 2018, p. 120). In addition, teachers found that “DGBL improved communication and collaboration among students and with the teacher…The teachers also used DGBL to develop and support critical thinking and problem solving” (p. 120), and all the teachers observed that students’ motivation and engagement increased with DGBL.

Vogt (2018) acknowledged that the limitations of this study were the fact that only eight teachers participated in it, and this small sample size limited the study’s utility and generalizability. Also, only middle school teachers participated in the study. In addition, there was the possibility that the participants might not have answered the researcher’s questions truthfully in the interview or might not have remembered their experiences accurately.

Garcia Joven (2018) investigated the use of existing and emerging technologies to enhance math learning and engagement in the classrooms of English Language Learner (ELL) students. The participants in this study were 64 Hispanic students in two of the researcher’s geometry classes. Students in another of the researcher’s geometry class made up the control group. The study was conducted over 18 weeks.

Garcia Joven collected quantitative data. A formative pre- and post-test, the STAR Math Assessment, was administered to measure the math proficiency of each student, along with a student survey instrument, the Motivated Strategies for Learning Questionnaire (MSLQ) Survey, which was used to measure the students’ motivation for learning math when using technology in the classroom (p. 14). The pretest and post-test were given to both the control and experimental groups. To measure the effect of technology on the math skill and enthusiasm of ELL students, the researcher administered a series of t-tests. Garcia Joven conducted independent t-tests to measure whether there was any significant difference in the mean scores between the two groups on the STAR Math test and the MSLQ Survey. Additionally, the researcher conducted a
dependent t-test to measure if there was any significant difference in the means between the preMSLQ and postMSLQ and between the preSTAR and the postSTAR within the same group. From the t-tests, Garcia Joven (2018) found that students in the technology classroom made greater progress toward motivation and math proficiency. Students in the experimental group, who used technology, had higher STAR Math scores than students in the control group. The use of technology in lessons improved students’ math knowledge and practice. The technology gave the students the flexibility to explore mathematical concepts, and it kept them more engaged in the classes (Garcia Joven, 2018, p. 142).

**Summary**

To overcome mathematics anxiety, students must have positive relationships with their teachers and support from their parents or caregivers. Both parents and teachers can work with students to enhance their basic numerical skills. Students’ unease with mathematics can diminish when they have relationships with their teachers that are based on trust, honesty, respect, and caring. The researchers discussed above also support the use of technology in classrooms both to help reduce math anxiety and to motivate students to learn math.

The role of teachers and students in the inclusion of technology in the classroom is critical. Mathematical technology can help students to learn better and solve problems. Not only is using technology helpful for the general population of students, it is also beneficial to those learning with designations and special needs. I believe these studies make an important contribution to advancing knowledge about using technology in mathematics classes.

Chapter three discusses the procedures and methods of the present study. The chapter includes a description of the participants interviewed by the researcher and a discussion of the instruments used.
Chapter 3: Procedure and Methods

Description of the Research Design

The present study is designed to define the ways that teachers can help students to avoid difficulty with math and achieve learning goals in B.C. secondary schools. The research question asked the following: What do current secondary school teachers in B.C. report as the contributing factors to students’ unease at learning math, and what tools do they use to overcome that unease?

The purpose of the present study was to create a deeper understanding of the teaching methods used by teachers to help students overcome math learning difficulties at secondary schools in B.C. The present study makes use of an interview method to collect qualitative data. The questions asked in the interviews were open-ended questions. Seven math teachers from secondary schools in B.C. participated in this research.

Description of the Participants

In order to be participants of the present study, it was required that the participants (a) be math teachers, (b) teach in secondary schools, (c) be teachers in B.C., and (e) be willing to participate in the interview of the present study. Seven math teachers from B.C. secondary schools participated.

The author of the present study received approval from the Vancouver Island University Research Ethics Board and permission to interview math teachers from a B.C. school district prior to approaching any schools. The interviews took place at the schools where the participants teach and a public place like a cafe, and their answers to the questions were typed directly into a Word document. The participants contributed voluntarily, and their privacy was ensured. All the interview questions were typed on the researcher’s personal laptop, which is password protected.
Coding was used to identify teachers to protect their anonymity, and permission was obtained before any direct quotations were used. The teachers interviewed in this research were also informed that they could withdraw their participation in the research at any time during the interviews and a week after finishing the interviews. The participants were able to review their answers at the end of the interview. In addition, they were able to request revisions or withdraw their answers to the interview questions.

**Description of the Instrument Used**

The instrument used in the present study was a face-to-face interview consisting of 18 questions. The questions were scripted and open-ended. Question one was designed for categorizing the techniques that teachers use. The present author sought to discover the different techniques that teachers use for different students, those who are comfortable with learning math and those who feel unease in learning math. Question two asked whether teachers had students who were uneasy about learning math. Part A of the question asked for each teacher’s definition of students who feel uneasy in learning math; Part B examined how teachers define these students. Additionally, Part C determined which method teachers utilize. Question three informed the author of the present study whether teachers use any educational tools in the teaching process. In asking the questions in Part A, the researcher wanted to know which types of tools teachers use. Moreover, in Part B, teachers stated whether they had any difficulties in using tools, and Part D asked whether students cooperate in teaching and learning.

The fourth question was designed to obtain more details about whether technology is useful. If the teachers answered “yes” to the question, “Does technology help students or not?” they were asked to describe the areas in which technology was helpful in learning. Further, the author of the present study sought to understand students’ participation in class and how the
participants’ students engage in class when they use technology. This was intended to ascertain whether technology is being used effectively to improve student outcomes.

Question five had two options, teachers who use technology and teachers who do not use technology. For option one, the teachers discussed the methodologies that they had used and whether the students’ engagement improved. This question helped to identify the type of instruction that results in the highest student engagement and the kind of teaching methods and tools the teachers use. In the second option, for teachers who do not use technology, participants were asked to discuss the difficulties that they had in their methodology or tools that they used. This question was intended to discover why they do not use technology.

Question six helped the author to understand whether the teachers wanted to use new methods to engage students but could not use the new methods. Was there a lack of resources for teachers in relation to the use of new methodologies? The author hypothesized that sometimes there could be a lack of ministry support or a result of having too many students. Then, participants were asked how many students they had in order to discover whether the proportion of students could be defined as presenting a problem in using new methodology.

**Explanation of the Procedures**

The author of the present study received approval from the Vancouver Island University Research Ethics Board, as well as permission from a B.C. school district to interview their teachers. The author of the present study used email to contact teachers who indicated they wanted to participate, then sent them consent information. The data was collected by interviewing seven math teachers from four different secondary schools in January 2020 over four weeks. The interview for each teacher was face to face and lasted 45 minutes; the teachers’ responses were typed directly into a Word document on a password-protected laptop computer.
The interviews occurred in safe and comfortable environments; out of the seven math teachers, five of the interviews were held at their schools and two of them at coffee shops. Two teachers (A, G) teach math in one of the online secondary schools of B.C., while the other five teachers represented three traditional brick and mortar secondary schools. In discussing the results, teachers from the online schools will be referred to as Group I teachers, while all other teachers will be referred to Group II teachers.

The present researcher used a qualitative analysis of the responses by organizing all results into a table. A tally was collected on how many teachers used technology, as well as other teaching methodologies, including a focus on the student-teacher connection. A further component of the data analysis focused on which teaching method caused the greatest change in student outcomes, based on teachers’ opinions.

**Discussion of Validity**

The author of the present studied collected qualitative data through an in-person interview format. The open-ended questions for the interviews provided a situation for the participants to speak about their experiences to give their personal responses, which were identified and analyzed. The strength of the interview method is that all the participants are real and the data in the study is correct based on participants’ responses. Therefore, the data has accuracy. With the face to face interview format, the author of the present study kept the teachers focused throughout the interviews. Furthermore, it was possible to ask the participants for clarification and more examples. For interviews, there was a limitation related to time; the teachers might not have had time to fully finish all responses.
Data Analysis

This study employed a qualitative method with data presented in a visual format, including tables. The qualitative data was recorded using the interview method and then collected and analyzed in relation to specific themes. The responses to the open-ended interview questions were compared with each other to seek and define cohesions and tendencies. The teachers’ methods were categorized and organized. Key words and phrases were identified. Keywords were counted in order to determine how many times each math teaching method was used by the teachers. Providing a clear and complete interpretation of the data was the first priority for the author of the present study. The qualitative method was suitable because the participants reported their teaching methods, allowing for authentic data to be analysed.

Chapter four summarizes the responses of the seven teachers who participated in this study. The teachers’ ideas were also compared to find how they were different or similar.
Chapter 4: Results and Findings

The purpose of the present study is to create a deeper understanding of the teaching methods used by teachers to help students overcome math learning difficulties in British Columbia (B.C.) secondary schools. The study sought to find out the extent to which the teachers in B.C. can motivate students to learn math. The author of the present study conducted face-to-face interviews with B.C. secondary school teachers in order to answer the following research question: What do current secondary school teachers in B.C. report as the contributing factors to students’ unease in learning math, and what tools do they use to overcome that unease? The research was conducted to discover the ways in which teachers can help students to overcome math anxiety and achieve learning goals in B.C.’s secondary schools. The main purpose of this study is to find solutions that contribute to students overcoming mathematics learning difficulties as well as teachers’ views and desire to help students in learning math. The questionnaire consisted of qualitative data, which has been summarized in the following section.

Quantitative Data

The participants in the current study consisted of seven math teachers. Five of the teachers represented three different traditional brick and mortar secondary schools, while the last two teachers taught in an on-line learning platform. For ease of discussion, the online teachers will be termed “Group I” and the brick and mortar teachers will be termed “Group II”. Teachers who participated in this study had a wide range in teacher experience (4-39 years), with the mean being 19 years.

All respondents were male. The teachers reported a range of 20-30 in students taught per class, as well as a total semester load of 120 on average. There was significant difference in the number of students taught between the online teachers and the traditional teachers. The range for
number of students for teachers in both groups I and II is 80-120 students, mean 118, median 120, minimum 80, and maximum 200. For the purpose of this study, secondary schools include Grades 8 through 12 in both group I and group II schools.

Figure 1. Years of Experience and Number of Students for Teachers

Each teacher interviewed for this study is responsible for math instruction to more than one grade level of students. One teacher had two grades (8 and 9), while three taught all grades 8-12. The other four teachers taught three or four different grade levels over the course of a school year. Similarly, the length of the math class lessons varied between the participants. The minimum class length was 60 minutes, while the maximum was 90 minutes.
Group I teachers do not have regular math class. They work with their students on an as-needed basis.

**Answers and Explanations to Questions 1 to 6**

Teachers’ ideas about teacher-student relationships. Among the seven teachers interviewed, six agreed and directly mentioned one-on-one support in teaching math as important for reducing math unease. Even for the teachers in the online school, one to one support was important, yet delivered in a different manner. For these teachers, when students need support or have difficulties, they can come to school or send an email. All the teachers (100%) agreed about one-on-one support by teachers for teaching and learning math. Teachers B and F mentioned one-on-one support after or before school or during lunch. Also, students can request one-on-one help from Group I teachers. Further, two of the Group II teachers reported offering extra support outside of class time, which supports the hypothesis that student-teacher relationships are important for student success in math.
Of the seven teachers interviewed, five stressed the importance of maintaining a positive relationship between the teacher and the student. The teachers believed that a strong student-teacher connection would be helpful in teaching. For example, one teacher mentioned, “I try to establish a connection with the students concerning hobbies, extracurricular activities, [and] interests.”

Another commented, “We can engage them to talk more about the area that they are good in. Sometimes students are good at something else other than school and math, so we can make the connection.” This teacher emphasized the importance of “one-on-one conversation in order to get a lot of information about students.”

Other comments regarding the importance of one to one student-teacher interactions included:

- I find individual motivations through relationship building
- One-on-one to try problems so they can get their own understanding and give a positive impact.
- “If someone is slow to get started, I’ll sit with them to find out if they don’t understand what to do.” “I try to be friends with students, and I will NEVER call on students if I see they have the wrong answer, as that would make them feel bad.”

Teachers’ attitudes about using technology. In their responses to questions about using technology as a tool for teaching, six out of seven teachers supported using technology as a teaching tool. The teacher who did not support technology does rely on using scientific or graphing calculators. A concern was raised by one of the teachers in regard to using technology:
“In math I find that the only time that technology helps is when graphing. It’s just faster. In a lot of cases the students do not understand what the technology is doing. I find that the students should be allowed to use technology only when they can show that they understand the concepts presented.”

**Individual Teachers’ Teaching Practices**

For the group I teachers, the use of technology is central to the teaching approach, given that the students are enrolled in an on-line course. However, they mentioned that technology has improved comprehension of math concepts. Moreover, this teacher mentioned, “Student engagement for anxious students improved greatly. Without the technology, anxious students are often withdrawn, and will avoid participation in a group setting.”

Further examples of technology that the participants in this study reported as being effective to help students be successful in math included:

- Microsoft Excel (two teachers)
- Graphing calculators (Desmos)
- Projector for video presentations
- Games like Kahoot and Quizlet
- Manipulatives, i.e. Tangrams
- Chunking
- Windows Journal
- Project notes
- Screencastify and Windows Journal (two teachers)
- iPads
Issues in Using Technology

Teachers identified the issues that they have in using Technology as follows:

- Due to the nature of distributed learning, using technology in a group setting is difficult.
- Some students are anxious about technology. Also, some students lack the independence to use the technology effectively. The distraction of using technology.
- Students enjoy the technology, but they struggle to maintain focus on the projects to fully develop their conceptual understanding.

Although four teachers talked about the issues that are mentioned above, some teachers mentioned that teachers should keep students focused while they are using technology in math class. They also said that function transformations, regressions, and statistics are the areas that are more impacted by using technology as a teaching tool. Desmos is a particular technology tool that three teachers found helpful.

**Teachers’ barriers to using technology in math classes.** Teacher participants identified some common barriers to the use of technology as a regular teaching tool in their math classes: Time limits, number of students, and investment.

**Time limits.** In response to question 6, regarding a method that the teacher wants to try but cannot, teachers’ comments in regard to the time limits as a barrier for using technology are as follows:

- “I am limited by time and distance barriers.”
- “The technology for doing this is somewhat cumbersome and needs more development to work more smoothly.”
- “Some students just need more time to complete a task.”
• “It takes time to check the videos for usefulness. Are they appropriate or not?”

Teachers in group I have a solution for this barrier: “The online situation allows students to take more time to work through any problem areas they might have.”

**Number of students.** Teachers’ comments in regard to the number of students as a barrier for using technology are as follows:

• “I work with a very large number of students. I would like to explore using newer technologies, but the demands on my time by current students limits my ability to do this.”

• “A class of 30 is significantly more challenging than a class of 20.”

• “If I had less students, I would have more time to work out the best course of action for each student.”

• “We do have class sets of Chrome books available for use, if you book in advance, so there is not a problem with not enough for each student.”

Teacher B stated that the number of students does not affect the methodology that he wants to use. In this section, Teachers E and F had the same idea; they both work at the same school and the number of students “does not really” affect the methodology that they want to use. Teacher G mentioned that the number of students does not really affect the methodology that he wants to use. Teacher G also said, “I would like to also use group work to supplement the idea, but the number of students won’t impact that.”

**Lack of investment.** In response to question 6, which is about the barriers that teachers encounter in changing their methodology, the reason for these barriers are as follows:

• A lack of investment by the school district in newer technology.

• Not enough guidance and in-services. Lack of support.
• The only situation that the size of the class would be a problem would be with cost if all students in the classroom need access to that specific tool.
• Resources in the school are always limited.
• In my school there is not enough tech for all students to use it.
• Money access and understanding of how to use it. Difficulty of getting money from school and district.
• Sometimes getting access to a class set of Chrome books can be a bit difficult; you have to book them in advance.

![Figure 3](image)

*Figure 3.* Barriers that teachers have in using technology to address math unease.

As this figure shows, five out of seven teachers experience budgetary constraints as a barrier to using technology in their math classes. Three out of seven teachers mentioned time constraints as a barrier; the same number thought that number of students was an impediment to technology use.
How Teachers Address Anxiety about Math

The most prominent comment among teachers was that students’ negative and unhidden reaction to math reveals their strong math anxiety. Teachers address anxiety about math as follows:

- Students self-identify their math anxiety. It is not shameful and maybe socially acceptable to fear math.
- Students are not focusing on math
- Making noise, acting out, talking too much, not focusing, and phasing out.
- When topics are introduced as having been learned already but they don’t know how to do it.
- They tend to shut down.
- Fractions cause a lot of problems.
- Students are not paying attention, whether on phones or other things. Often exhibit signs of stress or withdrawal. Students withdraw from lessons and activities.
- They are withdrawn, quiet, disruptive, crying, hostile, or try to leave class
- Self-identify and look confused.

Students do not focus on math; they act out and shut down. Why do students not focus? Because they show signs of anxiety such as crying, being hostile, and being confused. Students who self-identify as having math anxiety require more support and personal attention from their teachers. Participants in this study mentioned the teacher and student relationship when they see the signs of math anxiety. The participants have different techniques such as one-on-one support, plenty of positive feedback, sitting with students, and volunteering answers to address these concerns.
All the participants in this study mentioned that students self-identify about math anxiety by making noise, acting out, talking too much, not focusing, and phasing out. The interviewee answers reveals strategies used to overcome mathematics anxiety. Mathematics anxiety can be overcome by improving mathematics performance. Certain teaching methods can also be used to reduce math anxiety. For example, all the teachers in this study address unease by having one on one connection to students by friendly connection, volunteer answers, give positive feedback, offer extra help in the area that students have difficulty, examples in daily life or related to what they do outside of school, example in the work place, and writing test with no limit in time and having a sheet of formula. Two teacher who work in online schools mentioned about using video lessons on YouTube on the concepts students are learning. Other teachers mentioned different technology for certain difficulties that students have in math subject for example, Graphing calculator, Microsoft excel, email, Games, manipulating, tangrams Math practice games Kahoot and Quizlet online. All teachers in this study use technology and one on one support to address unease of math and overcome mathematics anxiety. Sun (2009) came to a similar conclusion about overcome anxiety by using technology. Sun (2009) stated software technology is a fundamental skill that can enhance the teachers and students in the development of skills, through the use of the technology, anxiety and other difficulties are reduced. Information are easily acquired on the internet and creates an anxiety free environment for both teachers and students (p. 43).

Chapter five presents a summary of the present research. It discusses the results of the investigation and the limitations of the research. In chapter five, the present researcher also suggests further research into this topic and discusses conclusions reached through analysis of the interviews.
Chapter 5: Summary and Conclusions

Brief Summary of the Study

The aim of this study is to identify a deeper understanding of the teaching methods used by teachers to help students overcome math learning difficulties in British Colombia (B.C) Secondary Schools. The first hypothesis of this current research is that if math teachers are friendly and concerned about the students, they will inspire students to have a positive attitude, motivate them to learn, and even become passionate about learning mathematics. My second hypothesis is that math teachers can use technology to help students overcome their math anxiety. According to my experience as a teacher, is that technology can be used as a way to improve students’ success in learning math. We witness the arrival of new technology almost daily, and the role of technology in classrooms is undeniable. My study involved in-person interviews of seven math teachers from Secondary schools in British Columbia, asking 18 open-ended questions. A discussion of the results follows.

Discussion

Table 1

*Teachers’ Techniques to Improve Student-Teacher Relationships*

<table>
<thead>
<tr>
<th>Teachers’ Techniques</th>
<th>Number of responses</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-on-one support</td>
<td>6</td>
<td>To specifically address student unease in learning math, to get all students engaged in an activity, and to help students move forward.</td>
</tr>
<tr>
<td>Lots of positive feedback on responses and encourage.</td>
<td>2</td>
<td>To get all students engaged in an activity</td>
</tr>
<tr>
<td>Eye contact, sit with students who is slow to get started.</td>
<td>1</td>
<td>To get all students engaged in an activity</td>
</tr>
<tr>
<td>Silently mouth and students read their lips, volunteer answers, never call on students if they have wrong answers. Try to be friendly with them.</td>
<td>1</td>
<td>To address unease and the techniques for these students.</td>
</tr>
</tbody>
</table>
As this table shows, all the teachers in this study agreed with using positive student-teacher relationships in order to address student’ unease about mathematics, to get all students engaged in an activity, and to help students move forward. The findings of this study reflect the benefits of teachers maintaining supportive relationships with students. Providing one-on-one support, plenty of positive feedback, and encouragement in responses, making eye contact, sitting with students who are slow to get started, and being friendly with students are useful techniques that teachers can employ to help students overcome their unease with mathematics. Other researchers have concurred. Kaser and Halbert (2009), Cribbs and Linder (2015), Higgins and BuShell (2018), and Wilkins (2014) suggested that a positive connection between the instructor and the pupils is based on trust. All teachers in Wilkins’s study (2014) mentioned respect as an important element in their relationship with students. Rothrock (2017) asserted that group work reinforced students’ perceptions about mathematics because it “forces collaboration and communication and problem solving” (p. 370). Papanastasiou (2002) came to a similar conclusion about group work in learning mathematics.

There are a number of similarities between the present study and Wilkins’s (2014) study. Wilkins found that suitable relationships between instructors and learners boost students’ inspiration, academic achievement, level of attendance, and approaches to school (p. 54). The interviewees in the present study also commented that positive student-teacher relationships help students to engage and advance. Although this study does not address attendance, the subject of participation arose. Interviewees noted that when students have the option of volunteering answers and know they will not be embarrassed, strong relationships between teachers and students will be developed.
Table 2

Technologies That Teachers Use

<table>
<thead>
<tr>
<th>Type of Technology</th>
<th>Users</th>
<th>Purpose of Technology Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online video lesson</td>
<td>4</td>
<td>To learn the concepts at home, as their homework, which would allow students to then use the classroom time to work through the problem sets while teachers are with them, as opposed to working through concepts in a place with no instruction. Students can re-watch at their own pace with no time requirement to complete a course.</td>
</tr>
<tr>
<td>Graphing calculator, Desmos (online graphing website more intuitive than graphing calculators)</td>
<td>3</td>
<td>To transfer between equations, tables, and graphs very quickly. To improve in learning math, as it is far more user-friendly than the old TI-83 graphing calculators.</td>
</tr>
<tr>
<td>Email</td>
<td>2</td>
<td>To provide students with one on one support and/or solves difficulties in online schools</td>
</tr>
<tr>
<td>App Projected notes (different colours), Screencastify, and iPad</td>
<td>2</td>
<td>To allow teachers to use multiple colours to highlight certain aspects of lessons. Also, if a student has to be away from class, they can request a copy of the notes in advance. If a student has difficulties following along and taking down notes during class, teachers can print the notes for them, and ask them just to follow along without trying to write at the same time.</td>
</tr>
<tr>
<td>Microsoft Excel (Mean, standard deviation)</td>
<td>1</td>
<td>To obtain data quickly about the sums when two dice are rolled.</td>
</tr>
<tr>
<td>Projector</td>
<td>1</td>
<td>To provide visuals for video presentation</td>
</tr>
<tr>
<td>Games, manipulating, tangrams Math practice games Kahoot and Quizlet online</td>
<td>1</td>
<td>To help students practice, to allow students to actually solve questions. The advantage of Quizlet is acquisition of math vocabulary and teamwork.</td>
</tr>
</tbody>
</table>

Table 2 shows the different technologies that mathematics teachers use. One respondent did not agree with using technology because he believes it as a distraction; however, he does use a graphing calculator. In addition, this teacher had more teaching experience (39 years) than the other teachers in this study. As a result, he may not be as familiar with new technology. Thirty-
nine years ago, the main teaching tools were pen and paper and chalk and blackboards, so changing this habit takes time, and it may be challenging to learn how to use new technology. Nevertheless, all the teachers in this study use technology to some extent. Six of the seven teachers (85.7%) agree about using technology, and all of them use technology in their classrooms. The findings about the use of technology to help students to learn and teachers to teach also compare well and show many similarities.

The findings in the present study are similar to those of Istance and Dumont (2010), who stated that digital resources can help students to interact and teachers to give feedback to students about solving math problems, which is impossible in a low-technology classroom with many students. Technology can help with this problem. For instance, email allows teachers and students to discuss assignments, as Higgins and BuShell (2018, p. 1082) found.

In regard to using iPads, the present study found that these devices enable teachers to use multiple colours to highlight certain aspects of lessons. Also, if a student must be away from class, they can request a copy of the notes in advance. If a student has difficulties following along and taking down notes during class, the teacher can print out the notes for them, and ask them just to follow along without trying to write at the same time. This finding reflects Higgins and BuShell’s (2018) comment that if students and teachers use iPads in classrooms, the content will always be accessible for the students.

**Barriers**

Teachers in this study have some barriers in using technology such as time, number of students, and budget. Five of the seven teachers interviewed wanted to use new technology in their class; they were open to using technology and learning how to use it. However, they mentioned the problems with investment by school districts or schools.
In order for technology to be effective for reducing math anxiety, school districts will need to ensure that they are supporting it with budget and other resource decisions. Regarding the number of students, some of the teachers (three out of seven) mentioned that a class with a small group would be easier to try new technology. Similarly, a teacher with a smaller class will be better able to make connections with students and have more time to sit with them and address their difficulties. As three of the teachers mentioned time constraints in using technology, it would be beneficial if the schools or school district could provide opportunities for teachers to learn how to use the technology and new techniques during the summer break or at monthly meetings in addition to professional development days.

In referring back to the original hypothesis for this research on how to address math unease for secondary students, according to the participants’ answers, the most effective way of teaching math to address anxiety and overcome mathematics anxiety are to maintain a positive teacher and student relationship by one on one support, and to use technology to assist with instruction, practice, and feedback.

**Limitations of the Study**

One limitation of this study was the small sample size (seven were interviewed), which limits utility and generalizability. Furthermore, the participants in this study may not be representative of teachers in other parts of B.C. For instance, teachers’ experiences in rural locations may not reflect what happens in urban school settings. In addition, this study only focused on teachers who teach in a certain district. Only secondary school teachers were represented in this study. This limits the ability to generalize the findings to other grades. The final limitation is that the present researcher just interviewed B.C. teachers in Canada. With a larger number of teachers, it is possible that more of the techniques that teachers have in helping
students overcome math anxiety could have come to light. This might have made it easier to discover the methods that most teachers use to help students having unease in mathematics.

**Suggestions for Further Research**

Through this study, it became apparent that further studies are needed on the topic of unease in mathematics in Canadian secondary schools. Although the use of technology and the role of teacher-student relationships to improve student success has been valued by schools and universities in recent years, the relevant research related to these areas is still limited. The key purpose of this study was to find solutions that contribute to students overcoming difficulties in learning mathematics. This study found that teachers and students forming strong connections and using technology are two important components of reducing students’ unease with mathematics. The current study will increase awareness among math teachers of new ways of teaching math, especially for those who have taught for many years and may not be familiar with the new techniques of teaching. Further research may focus on barriers that teachers have to using technology that were not mentioned in this study. As the present study did not receive many qualitative responses, another recommendation would be that further research could utilize different research methods such as surveys and observations of math classrooms to gather more information regarding math unease.

**Conclusion**

Wilkins (2014) stated that positive relationships between instructors and learners boost students’ inspiration, academic achievement, level of attendance, and approaches to school (p. 54). Further, Cribbs and Linder (2015) recommended training teachers to maintain good relationships with their students so the students can trust them. Creating a positive climate in a curriculum area can instill trust between teachers and students.
Teachers should design students’ technology tasks to encourage discussions about what they are learning. This approach allows students to practise group working while making connections with each other. Teachers can encourage students to work with partners at computers. If the partner does not know what to do, the teacher can use this situation as an opportunity for the class to learn from collaborative problem solving.

Teachers can turn learning into an enjoyable experience by implementing group work, designing enjoyable tasks as part of leisure time activities, identifying weak points in students’ assignments and explaining those points, and using technology. Teachers need to make sure that learning takes place. The current researcher believes that teachers never want to use technology just for technology’s sake, but only to support their students’ learning.

Students and instructors can collaborate in the education process by using technology. When students use updated technology as a tool for learning, they play an active role instead of a passive role of only receiving the information transmitted by the teacher. Students are actively involved with learning how to produce, gain, operate, or display hand-picked information. The use of technology allows many students to think actively about the information they receive and to select and achieve skills. The role of teachers is to help and provide suggestions and also support students’ activities. Given that students with math anxiety do not show any motivation in math class, teachers face a greater challenge. Recent studies have shed light on new approaches in motivating learners to learn by using technology in math classes, which can make a significant difference in the learning and teaching process.

When students are sure that teachers are the best people to help them, they will be more enthusiastic about the class and listen to the lesson. Some students might not have a good relationship with their teachers on the first day of school, but teachers should do their best to win
the confidence of the students. Teachers should identify the students’ talents by communicating with them individually. Having a sincere connection between student and teacher leads to mutual understanding between them; in combining this approach with the use of technology in teaching math, teachers can help students overcome mathematics anxiety, and the talents of all students will flourish.
References


Appendix A: Interview Questions

General Information

1) What grade levels do you teach?

2) What is the length of time for teaching math in each session?

3) How many years’ experience do you have in teaching math?

4) How many students do you teach at one time? Altogether (if you teach more than one section of math per semester).

Methodology That You Use in Teaching Math

1) What are some techniques you use to get all of your students engaged in an activity?
   
   1a) Is there a difference in technique for students who are at ease with learning math, and those who are not at ease with learning math?

2) Can you talk about a time when your students were uneasy about learning math?
   
   2a) How do you identify students who are uneasy about learning math?
   
   2b) What do you do to address this unease?
   
   2c) What are the teaching methods that you use to specifically address student unease in learning math?

3) Do you use any educational tools in Math class that helps them overcome difficulties with math concepts?
   
   3a) Which tools do you use?
   
   3b) Is it easy to use these tools?
   
   3c) How do students engage in class when you use this educational tool?

4) Do you think your students like technology in math class according to your experience?
   
   4a) Has technology improved comprehension of math concepts?
4b) Are there some areas that are more impacted by using technology as a teaching tool than others?

4c) What kind of teacher methodology did you use to help move students forward?

4d) Did the student engagement improve in the class?

5) Have you used technology to address student unease in math? If yes:

5a) Did you find any difficulties with your methodology or tools?

5b) Did you see any improvement in learning math? Can you clarify about the improvement?

5c) What tools in particular did you find most helpful?

If no:

a) Can you identify any reasons for not using technology to address math unease in students?

b) What are the barriers that you see that may be preventing you from using technology?

6) Is there a method that you want to try and you cannot?

6a) What barriers do you have in the way of changing your methodology?

6b) Does the number of students affect the methodology that you want to use? Can you describe how?