Developing SEL Practices in Secondary Math Classrooms

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Abstract

There is a national push to implement Social-Emotional Learning (SEL) into the classroom. While implementation of SEL is mainly limited to primary school, explicit practices in secondary classrooms are sparse while implementation in secondary classrooms is even more limited. Our society continues to evolve and change while our education system stays the same. SEL offers an opportunity for our schools to adapt to fit our changing society. SEL practices I have found that can be implemented into Secondary Math classrooms fit into the themes of developing math identity, working with emotions while doing mathematics, developing critical math thinking, and social practices and relationship building through mathematics. This project aims to analyze the different SEL practices and how they can be implemented into the school.

Keywords: secondary mathematics, social emotional learning, math identity, critical math thinking, math emotions

Developing SEL Practices in Secondary Math Classrooms

This research paper investigates the exploration of the application of SEL practices in secondary math classrooms and their impacts on students. Social Emotional Learning helps develop the necessary skills for students to develop healthy identities, manage emotions, build strong relationships, and make responsible decisions. Math is a subject that develops logical processes and problem-solving. As a teacher, I want to understand the best SEL practices to apply in secondary math classrooms. To do this, I will answer the question: What SEL practices improve math skills and engagement? What SEL practices prepare students to be citizens of the world? And what information about students can help teachers develop better SEL practices? In this paper, I will first discuss the context of my research and then move into a preface of what Social Emotional Learning is. Then I will discuss the major themes I have found in my investigation of research on Social Emotional Learning in math classrooms. I have identified significant themes: math identity, emotions while doing math, mathematical thinking, and socializing math.

Implementing SEL has been a long process; as a new educator, I want to get ahead of the game and use these practices to give my students the best possible education. Math is about using logic and solving problems, and these skills can help students out in the long run. SEL practices and math skills are closely related. These are essential skills for students to develop going into the world. A typical comment about math is the difficulty of applying secondary math learning to life outside of school. The question “When am I ever going to use this?” is a frequent question I face. Students have a difficulty seeing the use of the hard skills learned in math due to advances in technology and AI. Students have the ability to take a photo of a math problem or

they can type a word problem in an AI and it will solve it for them. However, the soft skills learned through math, such as problem-solving, work ethic, effective communication, and emotional regulation, are necessary for students to develop.

There is a push to develop SEL practices at the high school where I work, but many teachers need clarification on what that means. Resources are given to teachers to review with students during advisory with topics such as mental health and being responsible community members. Still, outside of the advisory class, there needs to be more resources available to teachers regarding how to apply SEL in the classroom, especially for math classes. There is an apparent want by the administration to implement SEL in our classes, but most teachers are in the learning process of using SEL. With the administration wanting to apply SEL, many teacher groups, such as unions and PLCs, offer workshops to help teachers develop SEL skills. It is a trend education wants to head in, but the knowledge to practice SEL in the classroom is not yet widespread enough for most teachers to be experts. Nationally, SEL has been around since the 90s. In 2009, the federal act to use SEL was introduced, and in 2016 is when states started to support its implementation. Many practices take years to apply, and by the time practices are adopted, new ideas are being developed. SEL has the potential to help both students and teachers as we return to the classrooms after the pandemic, but teachers need the knowledge of how to apply these practices.

The purpose of this project is to research SEL practices across the globe. Many education researchers are investigating SEL-adjacent practices but finding specific SEL practices in math classrooms has been challenging. I hope to find these practices, their benefits, and how they work in the math classroom.

Focus Questions

There are three focal questions that guide my research which are:

- What SEL practices improve students' math skills and engagement?
- What SEL practices help prepare students as citizens of the world?
- What information about students can help teachers develop better SEL practices?

Literature Review

This section will cover the research on applying Social-Emotional Learning (SEL) in secondary math classrooms. I identify what SEL practices raise students' math skills and motivation to do the math and prepare students for life beyond school. In my research, I identified four major themes of SEL practices: developing students' math identity, students' ability to manage emotions during math, students' development of critical math thinking, and socializing in the school community.

A student's math identity is a key theme I found in SEL practices of mathematics. A student's development of a strong math identity is foundational to improving a student's math skills and engagement. With a strong math identity, these students can contribute to society positively. Understanding how a student's math identity and other identities will help a teacher better respond to and understand the needs of their students.

Students face a variety of emotions throughout their day, and when students can focus and have a positive attitude toward mathematics, they are better able to succeed. The ability to regulate emotions is a critical skill in SEL. A student's emotion is an essential factor in a student's engagement in mathematics. Emotional regulation through difficult situations is an essential skill for a member of society.

Socialization while doing mathematics helps us attach meaning to our work. In doing so, we are developing strong relationship skills. When students can encourage and communicate

effectively with their peers, their math skills engagement increases. Communication and encouragement skills are essential skills for citizenship.

Critical thinking and logical reasoning are a cornerstone of mathematics and SEL. Critical thinking and logical reasoning is an important skill needed in everyday life. By improving this skill, students can better participate in class and stay engaged. Teachers can guide the lesson to the goal by understanding what a student thinks.

Social Emotional Learning (SEL) Background and Overview

Collaborative for Academic, Social, and Emotional Learning (CASEL 2023) is a leader in developing Social Emotional Learning (SEL). CASEL developed SEL, and its mission is to make SEL an integral part of the education system. CASEL is nonprofit and nonpartisan; most of its funding comes from federal and state grants. They began as a conference of people in New Haven in the 1990s to a partnership of people worldwide. CASEL defines SEL as an integral part of education and human development. SEL is the process through which all young people and adults acquire and apply the knowledge, skills, and attitudes to develop healthy identities, manage emotions and achieve personal and collective goals, feel and show empathy for others, establish and maintain supportive relationships, and make responsible and caring decisions (Fundamentals of SEL 2022).

SEL aims to bring equality to the classroom through relationships between students, a healthy identity, and a meaningful curriculum. CASEL has a framework known as the CASEL Wheel.

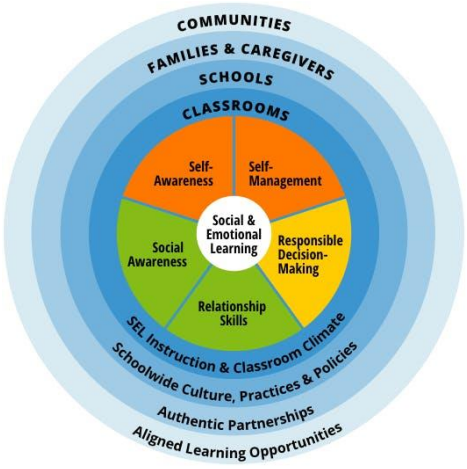

Figure 1: CASEL Wheel (Fundamentals of SEL 2022)

In the middle are the five core competencies of CASEL: Self-Awareness, Self-Mangement, Responsible Decision-Making, Relationship Skills, and Social Awareness. These core competencies are the skills SEL focuses on developing, and CASEL suggests practitioners should experiment, explore, and share the best way to develop these five core competencies in their students. Self-Awareness is the ability of students to understand their thoughts, emotions, and values. Self-Management is the ability to manage emotions and behaviors. Responsible decision-making is the ability to make decisions knowing the benefits and ramifications. Relationship Skills are the ability to develop and maintain healthy relationships. Social Awareness is the ability to understand another's point of view. The five core competencies are surrounded by the settings in which SEL occurs: the classroom, school, family and caregivers, and the community. Specifically, in the classroom:

> High-quality SEL instruction has four elements represented by the acronym SAFE: Sequenced – following a coordinated set of training approaches to foster the development of competencies; Active – emphasizing active forms of learning to help students practice and master new skills; Focused – implementing curriculum that intentionally emphasizes

the development of SEL competencies; and Explicit – defining and targeting specific skills, attitudes, and knowledge. (Fundamentals of SEL 2022)

This environment fosters SEL learning and allows the students to thrive. CASEL creates the environment for inequality to be challenged and equality to be fostered.

Math Identity

In this section, I will discuss the research that has been done regarding math identity. I will define math identity as how students view themselves concerning mathematics. Math identity relates to SEL's self-awareness and self-management, as students have to understand themselves and their relationship with mathematics. The literature in this section will speak to how a teacher contributes to creating an environment that facilitates a math identity. I will first discuss the research done on how students' other identities affect their math identities. Then I will discuss classroom practices that affect students' math identities.

In research done by Otgonbaatar (2021), they examined how students evaluate themselves versus how they evaluate others in vignettes. Otgonbaatar examined over 300 ninth-grade students in rural and urban areas of Mongolia. By comparing how they evaluated themselves versus how they evaluated vignettes, they aim to find how critical students are of themselves versus others. They found that females and rural students underrated themselves in math perseverance compared to their counterparts. The author recognized some existing biases between different cultural groups and even noted that a particular student of the different cultural groups would be significant. While this is not a direct SEL practice, this research examines how students view themselves as math learners.

Similar to Otgonbaatar, Collie et al. (2018) examined how different identities affected math identity. Collie et al. used a model to examine the trajectory of engagement of almost 200

middle and high school mathematics students. Over three years, students were given surveys to answer. Socio-economic conditions and conditions were used to consider students' trajectories in mathematics. Collie et al. found that over time, both mathematical aspiration and disengagement increased. In particular, they found that students who struggled with English because of different language backgrounds strongly indicated mathematical disengagement. They found that self-efficacy was a strong indicator of student engagement. Collie et al. research is connected to SEL because it notes what groups of people have lower math engagement and motivation.

Gartland (2022) provided the first research I will review with practices that improved math identity. They reviewed a previous study containing audio recordings, self-reflections, field notes, and an interview with the teacher to determine how students respond to mathematical and social-emotional learning. The previous study contained the interactions between one teacher and four of her high school math class. Gartland recoded the data to highlight when there was mathematical and social-emotional learning. Gartland found that an important aspect the teacher mentioned in the interview was that there was high-level math learning when students felt comfortable and confident. Gartland recognized the practices used were 'rough draft thinking' and 'the right to be confused.' In this classroom, the teacher used the idea of 'rough draft thinking,' meaning students did not need to always come to the final answer but emphasized the thinking process to get to the correct answer. The classroom had the "right to be confused," emphasizing sharing ideas without being judged. Gartland found that an important aspect the teacher mentioned in the interview was that there was high-level math learning when students felt comfortable and confident. In Gartland's research, students built their self-confidence, as being wrong did not make them less of a learner.

Similar to Gartland, Landers (2013) researched practices that build math identity. Landers focused on homework as an identity-building social practice for students. Over three years, Landers worked with fourteen students from sixth to eighth grade in middle school math classes. Landers examined the theory that work is given its meaning in social spaces, and eventually, students took ownership of the learning process. Landers found that students who bought into doing homework see themselves as successful in school. Students who did not do their homework identified themselves as being checked out of school and disassociated from school and the classroom. Landers saw that if social spaces build a strong identity for students, they will buy into doing well in school spaces.

Horn (2007) research is similar to previous research on building math identity, but focused on students who have developed a negative math identity. In Horn's research, seven high school students were able to turn around and improve their math achievement over four years. Horn argued that a single class or experience does not form math identity. Still, teachers positively influenced students to develop an identity of math success. The students Horn focused on were originally placed in lower-tracked math classes, which put them in a narrative identity of inferiority. The teachers in the class worked under the framework that these students had not 'chosen to succeed yet,' meaning it is the student's choice to succeed or fail. The teachers used class discourse to instill in the students that they can achieve and to change their narrative from inferiority to success. When students were placed into different math classrooms that did not employ a discourse of success, the students did not achieve the same success. Horn recognized the discourse of success as a viable resource for students to find success.

Lopez (2001) research focused on how identity is developed, but in this context focusing on math achievement and career identity. Lopez investigated how different guidance programs

affected students' math and career identity. Lopez worked with 115 Latino high school students during this study. Lopez looked at two methods of guidance, assisted guidance and individuation. Assisted performance is students receiving support from community members to learn new skills. Individuation is guidance given to students during career identity development. Lopez found that students on college-level tracks improved their math skills when given assisted performance; however, students on remedial tracks did worse when they were given assisted performance. A higher level of individuation correlated with career identity, meaning students felt confident in the career paths they wanted to explore. Overall they found that assisted performance could predict math achievement, and individuation could predict career identity.

While the previous research investigates how to develop positive math identity, Langer-Osuna (2016) research defined a practice that negatively affected math identity. Langer-Osina investigated how authority in a classroom impacts elementary math learning, especially in small group and partner time. Data was gathered from one recording of a 90-minute elementary class. Langer-Osuna paid particular attention to one pair of students and recorded their observations. Langer-Osuna saw that when students worked in partners, one student gained intellectual authority over the other. The uneven power dynamic was because the confidence of one student was overwhelming, while the other had little confidence in their math ability. In this instance, the student with a low confidence level in math allowed the other student to take over the group work while they watched. The uneven power dynamic overall became detrimental for the student with low math confidence as they needed to engage in the work being done. Langer-Osuna found that heterogeneous grouping can be detrimental in cases where students have different levels of confidence in their math abilities.

According to the research, proper social-emotional support can create steadfast math thinkers and develop healthy math identities. Students of marginalized identities often had poor views of themselves as math learners. Research showed that a student's identity and confidence in math could be more advantageous than competency.

Emotion and Mathematics

This section will discuss the research into emotions and mathematics. Understanding oneself and how we relate to the world is a core principle of SEL. This section will cover the research on how students process their emotions while doing mathematics, then move into different SEL practices that increase student engagement and math efficacy.

The first set of research I examine is focused on how students feel during math. Di Leo et al. (2019) studied over 100 fifth and sixth-grade students to understand the change in students' emotions when working on challenging math problems. This research was a mixed study, with students answering a survey while taking a test. The first group reported their issues and feelings after a test. The second group reported their feelings via a talk-out-loud method of their strategies and emotions while using cognitive and emotional learning strategies. The research compared this qualitative data and observation with each student's score on their test. They found that confusion is dynamic, and educators must learn to work with it. It can be good if students transition from confusion to curiosity, but it can be detrimental if confusion leads to frustration.

I examine Heyd-Metzuyanim’s (2015) to contribute how students feel towards math and how those feelings can develop over time. Heyd-Metzuyanim performed a case study that investigates math learning and the emotions connected to it. Heyd-Metzuyanim started by privately teaching a math class to twelve Israeli students in addition to their regular school courses. The research began in seventh grade and lasted until ninth grade. Heyd-Metzuyanim

would interview the students at different points, exploring their emotions towards mathematics. They found that one student, in particular, developed a strong emotion of failure in mathematics, which stunned their growth in mathematics for over two years. They identified that the student's descent into failure is not theirs alone but shared amongst their community. Research by Heyd-Metzuyanim shows how emotions can negatively affect our skills in math.

Similar to the previous research I examined, Tulis and Fulmer (2013) studied the effects of interest and boredom on math engagement when increasing math difficulty. Tulis and Fulmer studied 140 middle school students from Germany and ninety middle school students from the United States. Students completed both an interest survey and a challenging math task. They found that students with low persistence had a low engagement in math; however, students with higher persistence had higher anxiety and engagement during their challenging math tasks. Boredom and disengagement were also found in low persistent students, while persistent students had increasing or similar levels of engagement throughout their tasks. Research from Tulis and Fulmer showed that students' persistence level, especially during difficult tasks, affects a student's engagement and emotions towards math.

Expanding on previous research, Tarkar et al. (2022) examined how emotions towards mathematics affects the choices student’s make. Tarkar et al. researched student choice and anxiety in a math class of twenty-six elementary school students. These students were given a choice of what math problems they could do, which were either below or above their proficiency level. The students were given an anxiety and emotional self-efficacy survey. Tarkar et al. found that students with math anxiety related to students who struggled with class-level math problems and chose below-proficiency-level math assignments to work on. They found that students with high emotional self-efficacy tended to choose above-proficiency-level math and had higher

success rates. Tarkar et al. focused on how math anxiety and emotional self-efficacy affect student-guided work and its essential role in learning.

Having examined both positive and negative contributions to math emotions, I will move into research of practices used to help foster positive math emotions. Griggs et al. (2013) conducted a cross-sectional study of over 1500 fifth graders that examined the impact of gender, math and science anxiety, and SEL practices. Griggs et al. studied schools implementing the Responsive Classroom (RC) program, an SEL program with practices that improve the social environment and create positive experiences between teachers and students. They study 20 different American elementary schools with varying levels of ethnic and socioeconomic groups. Some practices that RC implemented were 'Morning Meetings,' where students and teachers start their day with meetings going over their day's activities, greetings, and other activities; 'Teacher Language,' where teachers considered student's emotions and helped encourage them; and 'Guided Discovery and Academic Choice,' where students had autonomy over their learning material. Over a year, participating classrooms would give out surveys that students would fill out, which contained a scale on how students were feeling about math. The investigation found that students who responded that they feel anxious during math also responded that they have lower self-efficacy in math. To address self-efficacy issues, they implemented Responsive Classroom practices to help students. Specifically, they found that students had higher math self-efficacy when they believed their teachers emphasized effort and understanding, not just answers. Through these practices, they found that by implementing RC, students responded with lower anxiety levels and higher self-efficacy rates.

Similar to the previous research, Kamour and Altakhayneh (2021) investigated counseling programs that reduce math anxiety in middle schoolers. The researchers examined

207 private middle school students in Jordan, with one control and experimental groups. The experimental group took counseling programs that promote social-emotional skills, while the control used traditional methods. Students would be surveyed on their math anxiety after the program by having students respond to statements of varying levels of agreement. The counseling in the experimental group helped develop those students' social and emotional competencies. In the experimental group, they improved the student's ability to recognize and regulate their emotions and thoughts, which helped students control their behavior. The counseling program helped students reduce math anxiety.

The last research I examined investigates practices students can use while doing math to assist with thinking and emotions. In Peltier et al. (2022), they looked into interventions in math classrooms for students with emotional or behavioral disorders (EBD). Peltier et al. looked into student-mediated interventions such as cover-copy-compare, self-monitoring, or self-instruction strategies. The research was an analysis of nineteen different research cases over thirty years. Peltier noted that these strategies aim to increase students' independence to use and acquire different skills. They found that students increased their math abilities with this intervention but at least half of their skills regressed after they stopped practicing the intervention strategies. Peltier suggested that educators consider what strategies or interventions to use depending on which skill is being learned and the student's abilities.

From the research, emotions play an essential role in a student's engagement and math skills. With the right strategies, students can effectively regulate their emotions which will help them succeed. Teachers who effectively create a positive learning environment for their students can help them navigate negative emotions.

Mathematical Thinking

This section will discuss the research into mathematical thinking. In the SEL framework, responsible decision-making is a core component related to mathematical thinking. In this section, I will first cover research into how critical thinking impacts students, then move into moments students critically think after I discuss how teachers can develop critical thinking habits for their students.

The first research I examine is the impact of critical math thinking skills on students. Arisoy and Aybek (2021) performed a research study on a subject-based critical thinking curriculum on a student's critical thinking ability. Arisoy and Aybek research contained 60 sixth-grade students in Turkey. Subject-based critical thinking is defined as understanding different components of a theme or topic and how the components fit together as a whole. The subject they chose to teach was mathematics believing math contributes to critical thinking skills. Arisoy and Aybek found that students who took the math critical thinking curriculum improved the student's intellectual perseverance, empathy, and courage.

Converse to the previous study, the next research I examine speaks to what other skills fosters critical math thinking. Skagerlund (2016) researched students' logical thinking processes, such as space, time, and numbers contribute to their math ability. Skargerlund worked with 133 elementary-age students in Sweden. The objective was to see if processing space, time, and numbers could predict a child's mathematical ability. Of these skills, Skagerlund found that mental rotation ability correlated with overall mathematical ability. They believed this mental process allows students to visualize mathematical operations better. This research relates to SEL because it informs teachers what different practices can help math abilities outside of practicing just math.

The research I examine next are the moments students use their critical thinking skills. Headrick et al. (2020) examines when students and the use of spontaneous problem-posing (SPP) on student engagement in four early high school classrooms across the United States. They studied two suburban regions in the southwest and mid-Atlantic. They used mixed methods to gather data from video-recorded student observations and surveys. Headrick et al. then coded both the video recording and transcripts. From these codings, they developed a summative description of what occurred. Headrick et al. found instances where SPP took place and compared it to days when SPP did not occur, and they investigated the conversations that took place on those days. Headrick et al. found that students who used SPP that day tended to extend their desire for mathematical thinking. An issue from Headrick et al.'s research is that SPP can not be forced onto students; it is up to the students to practice it.

Having examined research into signs of critical thinking and its importance, I will examine practices that teachers can use to foster critical thinking. Using mixed-methods research, Steuer et al. (2013) studied students' perceptions of errors in the learning process. The student's perception of error was based on the classroom climate, such as a teacher's tolerance to error, the teacher supporting students who make errors, and the absence of adverse reactions towards errors. One thousand one hundred sixteen middle school students from Germany participated in this research. Students took a survey that Steuer et al. quantified using various scales regarding students' responses to errors in a classroom, perceived goals, personal achievements, and personal behaviors. They saw that students' achievements linked strongly to adapting to errors. They also saw that if a teacher can influence the perceived classroom climate to errors, it could help motivate students in the learning process.

In a similar research is a social practice that fosters critical math thinking. Kotsopoulos (2012) studied the effects of "math congress" on an eighth-grade class of 28 students for a year. "Math congress" is a method where students present their work, share and defend their math thinking. From these presentations, artifacts are kept throughout the year on display for their community. Results from this practice varied, but they were able to identify strengths and weaknesses from the study. During this practice, they found that while some math concept understanding may be strengthened, there may be confusion from the students. They recognized that students need to open up about their misconceptions to allow for consensus building and maintain a positive learner attitude. They found that in this specific practice, the teacher must be willing to interject to clarify students' misconceptions.

Similar to the previous research, Inoue (2010) examined practices that foster critical thinking. Inoue and other teachers from Japan worked with six teachers from America on Japanese teaching methods. They focused on math lessons for middle school grade levels. Inoue recognized that in inquiry-based problem-solving activities, students may use different strategies to solve problems; however, there is rarely any time for students to discuss their strategies with one another. He noted in Japan, teachers follow a method called Neriage that allows students to build consensus in their learning. Neriage main points are to know what questions you are asking the students, anticipate questions they have, release control to the students, provide support when needed, and follow up with a generalization from the consensus students built. Throughout the joint program, they found that students would increasingly speak their ideas without being prompted by teachers.

The next set of research examines critical thinking done outside the classroom in different learning environments. Chittum et al. (2017) researched the effects of a STEM summer

program on middle school-age students and how it changed their view on STEM. Chittum et al. (2017) worked with 102 middle school students, with 19 enrolled in an extra program based on animal conservation. They found that the summer school program increased many students' interest in STEM after completion. In particular, they found that students were motivated by the animal conservation program because it was a topic the students wanted to learn. The students could relate and see how animal conservation affects the world around them.

Similar to the previous research regarding the effects out of the classroom experience has on math thinking , Simpson and Kastberg (2022) investigated math thinking generated by their environment. An essential aspect of SEL is the environment in which it takes place. By extending learning outside of the classroom, we can develop higher-quality thinking. Simpson and Kastberg observed two environments, a museum and a Tinkerlab, where students gathered for learning. The students observed in these environments were third to fifth-graders. Simpson and Kastberg's study is grounded in the idea that learning and meaning-making are developed through the social context. They found that students used math when making measurements, using spatial reasoning, and showed curiosity. They recognized these informal uses of mathematics as important skills in the workplace.

Critical thinking and logical thinking skills are developed in a positive and rigorous environment. Teachers can facilitate critical thinking through various practices, but much of the control belongs to the students. Strong critical thinking skills in mathematics can also translate to critical thinking in other subjects, which develops students into responsible citizens of society.

Socializing Mathematics

This section will discuss how socialization and relationships can develop necessary math skills. I will first cover practices done in classroom that promote socialization, positive

relationships, and student voice. Then I will cover practices done around the community that promote healthy math identity and skills.

The first research I cover is social and academic support's effect on students. Jansen et al. (2019) performed a mixed research study on the connection between teacher support and student engagement. Jansen et al. looked into different student engagement types: cognitive, affective, behavioral, and social engagement. Social engagement is engaging in discourse with another about mathematics. Observations were recorded, and students responded to a survey that gauge their interest levels after the recording. The study found that when teachers provided academic and social support, it led to higher self-efficacy by students.

Next I will move into social practices that promote math skills and identity. Kennedy and Smolinsky (2015) provided a case study of a math circle designed for low-income, minority middle school students. A math circle is a social structure for members to engage in discussion, develop a culture of math, and partake in philosophical discussion. The math circle took place over a year, with 24 students participating. They met once a week for 90 minutes. During this process, a culture developed within the circle where students were willing to engage and compete with one another. Social interaction was one of the highlights of the math circle. Students felt safe to explore and engage in mathematics with a robust support system. As circle leaders and students often encouraged others throughout the process, encouragement was a key factor. At the end of the study, these students developed a positive math identity. The math circle impacted the dynamic of the classroom and home, as these students had now been labeled as good mathematicians.

Similar to the previous study, Ackerman (2020) examined different social practices that promote student ownership. Ackerman worked with six elementary teachers from a community

school to implement SEL into their curriculum. In one insight from Ackerman, he focuses on SEL practices in a math classroom. The main practices in the classroom were hand gestures from teachers that they could use to communicate with their students, student responsibility over their space and time, and collaborative work. In particular, during collaborative work, they focused on complimenting students on their work. Students were taught how to help each other by asking leading questions. Ackerman recognized that this practice increased student voice and ownership of learning.

The next two studies looked at social practices between teacher and students. Middleton et al. (2019) investigated the mathematical engagement of students with the use of teacher and peer support. During this investigation, they studied over 250 students across the United States in first-year math classes in High School. They video-recorded class engagement and coded those to gather data coupled with surveys answered by students. They found that most teachers provided academic and social support or neither to their students. Academic support meant that teachers gave students opportunities for sense-making and reasoning. Social support meant teachers raised student status through whole-class and motivational discussions. Middleton et al. found that when teachers provided students with opportunities for social support, they showed higher math efficacy.

Similar to the previous study, Staples (2007) explored how a teacher facilitates a collaborative classroom and students' engagement during class. Staples conducted a year-long study in a ninth-grade classroom, averaging 20 students a class, with 14 students being the core of the class throughout the study. In this collaborative classroom, Staples noted that the teacher had a 'go with the kids' way of moving the discussion, where the teacher let go of the class conversation, trusting an important point would come up in the discussion. Staples noted that the

'common ground' held in the classroom was where students' ideas and thinking were publicly available to all students. Students were asked to explain why they chose specific strategies to solve their problems. Students became thinkers and mathematical decision-makers in the classroom through this practice.

Moving to social support outside the classroom, the next research investigates relationships between students, parents, and teachers. Friedel et al. (2007) studied how achievement goals set by parents and teachers affect students' achievement goals and how that plays a role in self-efficacy. Research assistants entered classrooms during math class and surveyed 6th to 7th-grade children. The survey contained a scale in which students would answer assessing their personal, parent's, and teacher's goals. They compared the data of a student's personal goal to their parent and teacher's goals. Friedel et al. found that students' personal goals are more closely related to their parent's goals than their teacher's goals; however, students still do, at some level, adopt the teacher's goals.

Similar to the previous study, Goldman and Booker (2009) investigated how family life impacts students' math. They worked with six middle school student families over four years, with three families being the main focus of this case study. They saw that families regularly engaged in math activities such as buying groceries, calculating discounts, estimating bus travel time, and looking at sports stats. However, the families did not recognize this as formal math and often separated these activities from math in school. They saw that once they worked with families and redefined these experiences as doing math similar to that done in school, parents often felt a boost of confidence in their math ability. This clarification made families want to be more involved in helping their students with their math work.

Moving outside the family, in the next research Yu et al. (2021) worked with an after school math program to find their best practices. Around 120 middle school students participated in the afterschool program where they had university students as mentors. Yu et al. highlighted the four main practices the afterschool program followed: promoting a safe environment, engaging in personal conversation, facilitating opportunities for mutual learning across cultures, and promoting math and social-emotional skills. In particular, practices involved check-ins with their students at the beginning of the program and brain breaks throughout the day. These practices helped students feel more connected to the program, their peers, and their mentors. In particular, they found that students preferred opportunities to relate rather than cultural similarities. Another finding was that these students were empowered to help family and their peers with math outside of the program.

Students' ability to socialize in the classroom and different settings relating to mathematics is important. When teachers can successfully put students in an environment that facilitates math learning amongst peers, students take ownership of their learning. They became active participants in math and were able to make meaningful connections. When parents and community members can provide extra guidance and support, students can find success and confidence in math.

Summary

Through my research of different practices and information of SEL, these are the different research articles I found in that field. I found four main themes of math identity, math emotions, critical math thinking, and social practices in math. In the next section, I will address how these different practices can be applied to my action site.

Action Plan

Social Emotional Learning can be implemented in schools in a wide array that develops the core competencies. CASEL's recommendation for SEL is that it should be dynamic by reflecting and evolving to fit the needs of its students. My investigation into SEL research is based on the focal questions:

- What SEL practices increase study math engagement and skill?
- What SEL practices prepare students to be citizens of society?
- What information can teachers use to improve SEL teaching methods and practices?

In the search for how SEL practices impact the math classroom, themes I have addressed are math identity, critical thinking, emotions toward mathematics, and socialization while doing math. Environment plays a key aspect in SEL, as it happens in the classroom, school, family, and community. I will base my action plan on these different environments where SEL can occur.

The action site I will utilize for my action plan is a high school in a large school district in the Pacific Northwest. The demographic is highly diverse, with almost 70% minority enrollment. 30% of the students are White, 30% are Asian, 15% are Hispanic, 10% are black, 1% are Pacific Islander, and 10% are mixed race. 33% of the students are identified as economically disadvantaged, and 65% of the school scored proficient in mathematics (US News, 2022). The math classes available at the school offer three core math classes which are Algebra 1-2, Geometry 1-2, and Algebra 3-4. Math Essentials, a math support elective, accompanies each core class. There is a Special Education math course that is offered. Other classes such as Precalculus, Calculus AB, Calculus BC, and AP statistics are offered for students identified as highly capable. Students can use alternative math classes for a math credit, such as business and robotics for 3rd-year mathematics.

Across the district, there are initiatives to implement SEL in the classrooms. At the beginning of the school year, we began with restorative justice programs to develop stronger relationships with our students. Advisory classes are held bi-weekly, and their purpose is to develop community across the school. SEL professional development workshops are scheduled at the school year's end. Within the math department, Math Studio is a monthly training for teachers to attend to develop and improve math teaching.

Class Environment

Class environment is a key aspect of SEL and how the environment facilitates strong learning for its students. In the classroom, the teacher has many decisions to make in order to implement SEL to meet the needs of their students.

Table 1

Classroom environment

Research	Practice	Recommendation
A classroom environment where teachers encourage students to learn from their mistakes and errors leads to higher math achievement. (Garland, 2022; Steuer, 2013)	Students are quizzed weekly with no opportunity for corrections outside of students in Math Essentials. Students are allowed retakes up to a certain percentage. Students in Math Essentials improve their quiz scores when given the opportunity to make corrections	Teachers to attend training on facilitating error-correcting and reflection classroom environment.

Student collaboration helps students make meaning of their learning. Students that defend their learning and strategies strengthen their math understanding. (Staples, 2007; Inoue, 2010; Kotsopoulos, 2012; Kennedy & Smolinsky, 2015)	Summative assessments are solely based on testing. Math Studio encourages teachers to promote justifying and generalizing. Math Studio encourages teachers to make use of partner and group work. There is an explicit focus on the use of sentence stems to help students focus on sharing their ideas.	Teachers to use math studio training to develop summative assessments based on students justifying and generalizing their thoughts.
Students that use emotion-based strategies during test-taking show increased emotional regulation and math ability. (Kamour and Altakhayneh, 2021; Peltier et al., 2022)	Bi-weekly advisory classes are used to help develop 'school citizenship' and organizational strategies.	Teachers to attend workshops on emotion regulation and test-taking strategies. Teachers and counselors teach students emotional regulation and test-taking skills during advisory classes.
Teachers who implement check-ins for students create an opportunity for meaningful relationship building. (Griggs et al., 2013; Yu et al., 2021)	During advisory class, students are asked check-in questions. Video announcements are made once a week during 3rd period	Use video announcements as an opportunity to build relationships with students.
Positive math discourse encourages students to find success. (Horn, 2007; Heyd-Metzuyanim, 2015)	Administrators held a restorative justice workshop that facilitates positive contact with students.	Workshops during professional development time to help teachers develop encouragement practices.

School Environment

Effective SEL implementation takes school-wide involvement (CASEL). The school environment extends out of the classroom into the hallway, cafeteria, outdoor areas, and so forth. A strong school environment gives students a sense of belonging.

Table 2

School Environment

Research	Practice	Recommendation
Culturally relevant education and classes promote engagement and critical thinking (Chittum et al. 2017)	Algebra 1-2, Geometry 1-2, and Algebra 3-4 are required math classes for students to graduate. Robotics, financial algebra, statistics, and other math alternative math	Math department to offer culturally responsive math classes at all levels.
Alternative programs outside of the classrooms help develop math identity, understanding, a sense of belonging, and social-emotional support. (Kamour & Altakhayaneh, 2021; Yu et al. 2021; Simpson & Kastberg, 2022)	Math club and tutoring are available programs students can use to seek help in math.	Math club to develop a mentorship program to build relationships with students.
	Math lab, an afterschool math support program run by teachers, is available to students once a week for Geometry 1-2 and Algebra 3-4.	Math teachers to take training on math circle talk and make use of math circle in the math lab.

Family and Community

Family and community play an important role in implementing SEL. They are partners that reinforce students' social and emotional development (CASEL About Us 2023). Schools need to involve family and community members in the decision-making process, as families and communities are a rich resource of history, culture, and experiences.

Table 3

Family and Community

Research	Practice	Recommendation
Family and community members influence their student's identity and goals (Goldman & Booker, 2009; Friedel et al. 2007)	Parent Teacher Student Association (PTSA) holds meetings, fundraisers, and events for the school. The open house and parent-teacher conference are available to parents and the community to meet and learn about the school.	School to hold training on lines of communication available for teachers and parents. PTSA and school administration to host town halls to voice concerns and recommendations.
Family and community involvement in the learning process help students engage in mathematics. (Landers, 2013; Yu et al., 2021)	There is no program for parent involvement in the learning process.	School to host workshops for parents to be involved in the learning process and how lessons taught in school are related to activities at home. Teachers to take training in relating school lessons to home to make them more culturally relevant.

Summary

This action plan details my recommendation to apply SEL practices throughout the school to increase math engagement and skill, reduce anxiety towards mathematics, increase community involvement, and develop citizenship within the school community. In the next session, I will discuss the implications and challenges of applying SEL practices to school and classroom settings.

Discussion

Collaborative for Academic, Social, and Emotional Learning (CASEL) states that research into Social Emotional Learning (SEL) has proven that it leads to "beneficial outcomes related to social and emotional skills, academic performance, mental wellness, healthy behaviors,

school climate and safety, and lifetime outcomes" (CASEL 2023). If it benefits the school community, why haven't SEL practices been rolled out to different schools? At my school community, SEL has been defined as a goal our district wants to achieve but has yet to be done. In my research, I attempt to find SEL research on practices in secondary math classrooms. On a search through academic journals, only a handful of SEL practices in secondary math classrooms had popped up. I used this research and their references as my starting point. Once I gathered those sources, I used the core components of SEL to broaden my search: self-awareness, self-management, responsible decision-making, social awareness, and relationship-building. Through these search methods, I was able to expand my findings.

Discussion of Findings

My guiding questions in my research into SEL research were: What SEL practices increase math engagement and skill? What SEL practices prepare students to be citizens of society? What information can teachers use to improve SEL teaching methods and practices? Research into SEL application to secondary mathematics was sparse. Some research discussed the emotions students felt while doing math, practices to improve student thinking, how students develop their math identity, and relationship-building between school community members. Most of the research did not specify that this was an explicit aspect of SEL, so I had to use my best judgment on how each research article relates to each SEL component.

Math Engagement and Skill

During my research, engagement and skill are often developed in unison. The following are the practices I found that increase math engagement and skill.

SEL practices that increased students' math engagement and skills involved creating an environment where students can thrive either by encouraging students to make mistakes as part

of their learning process (Gartland, 2022) or by making a social space that encourages work and learning (Landers, 2013; Lopez, 2001; Horn, 2007). Students who developed positive math identities increased their math engagement and skills.

I noticed multiple times in my classroom that it just takes one student to encourage their peers to get to work. Often I would hear one say, "Let us get studious," and they would put whatever they are being distracted away and start working together to finish classwork. These students created an environment where they and their peers could engage in math and develop their skills.

Another instance I have of students' developing an environment to engage in math and increase their skills involves two students. Both students have moved to America from Arab countries with limited English skills. At different times during the year, the students have either strongly disengaged or engaged in math. In times of strong engagement, I noticed it all depended on the environment they were placed in. When members of their group engaged in work together, these students with limited English skills strongly engaged in math work, increasing their skills. However, when they were moved into different groups who struggled to work together socially, their math skills suffered, and they often disengaged from the lesson. Once I noticed this trend, I found peers that influenced their group to succeed, and they soon developed their math skills.

Students' emotions during mathematics play a pivotal role in their engagement in the classroom. The thinking strategies promoted by Peltier et al. (2022) are simple and effective. Peltier et al. noted that the main drawback is that when students stop using their thinking strategies, they fall back to their old ways. I have a poster on the back wall of my classroom with questions students can ask themselves if they are stuck on a question. These questions provide

students with a strategy to help them when they are stuck on a problem. Peltier et al. noticed that these strategies are especially effective when students learn new skills.

Community plays an important role in what students see as a priority. A student's goal is often more associated with their parents than their teacher's. (Friedel et al., 2007). Students also understand where math is used when brought into the personal and family context (Goldman & Booker, 2009). When it comes to doing math, students can also look to mentors as a place to find inspiration to do mathematics (Yu et al., 2021). Parents are generally the greatest motivators for my students to do work. I have spoken with parents about what their child needs to do to succeed in my class, and many times students come to understand what responsibilities they have to fulfill after speaking with their parents. One parent, in particular, spoke to me during Open House and asked that I give extra math work to their child. Afterward, their child came to me at the end of every class, asking for extra assignments they could do. When the community is involved, there is greater engagement in math and more development of their skills.

Collaboration practices are important, and certain strategies are necessary to encourage math engagement. A math circle develops a strong culture of discussing and discussing math (Kennedy & Smolinsky, 2015). Social and academic support from teachers led to higher efficacy by students (Jansen et al., 2019). I have seen groups develop throughout the year, where they develop strong bonds. These groups usually work together on a problem and discuss their thinking, and when they come to a roadblock, they ask for teacher support and can move past their roadblock into more learning.

These are the practices I highlighted that promote math engagement and skill. Most engagement is developed by building confidence and connections and using tools. From there, maths skill is developed through students' engagement.

Citizens of Society

I will define students being prepared to be members of society as developing a sense of responsibility, respect, compassion, and leadership. In the classroom, assessing when citizenship is being developed can be difficult. We can see the growth occurring in discussions and how they interact with others. While developing citizenship is not an explicit practice in SEL and mathematics; critical thinking, culturally relevant education, and social leadership practice contribute to its development. The following are research practices I found.

Arisoy and Aybek's (2021) research on critical thinking and its effects on students ties critical thinking to SEL. Arisoy and Aybek's critical thinking practice is based on teaching students to view ideas by their components and how they fit together. This research found that students with higher levels of critical thinking led to higher levels of intellectual perseverance, empathy, and courage. By developing critical math thinkers, we prepare students to become citizens of society.

In my classroom, these practices help develop students who can think critically. During my first year of teaching, I have fallen into the pattern of teaching procedure-based math. Students need help seeing how they can apply their everyday learning to their lives outside my classroom. By engaging in these practices, students can develop critical math thinking practices that will better help them as citizens of society.

Regarding critical math thinking, Chittum et al. (2012) noted that culturally relevant education increased interest and a sense of responsibility. In this research, the students were given problems that affected them or a theme they cared about. As students learned about the world around them in a STEM framework, they saw how subjects learned in school could be useful outside of school. Through this education, students developed a sense of responsibility.

Many students frequently ask when they will use the math skills learned in my class when they grow up. A culturally relevant math education is absent from my school's curriculum. I have spoken with other teachers about developing a culturally relevant curriculum instead of theoretical mathematics that seem abstract to many students. We are currently limited in curriculum that the school district allows us, and the math department limits the summative assessment we can use. This limitation is because of the school district's contracts with companies providing us textbooks or teachers focusing on preparing students for standardized testing. Students can develop citizenship inside the math classroom by updating the curriculum to be more relevant to students.

Students developed leadership and compassion in the next set of practices I found in my research. Compliments help encourage students in their learning process, especially coming from their peers (Ackerman, 2020). Allowing students to take the lead in the discussion gives students decision-making power (Staples, 2007). Through these social practices, students build autonomy, allowing for a stronger student voice.

This is a gap in the current practice at school. Our current Algebra 1-2 curriculum is strict and does not allow students to lead the discussion. However, our current practice allows for group work, and many students have developed into group leaders. I encourage students and give them compliments, especially when struggling students find success. For many of my classes, however, there is no culture of complimenting peers on their work.

Finding sources connecting math teaching practices to developing citizenship was difficult. While I did find a few sources, there were cases where I had to interpret practices and develop skills to fit aspects of citizenship. A common theme in the research is the development

of citizenship through social practices and understanding the world through mathematics. Through understanding bits of the world, often research saw a sense of responsibility develop.

Information for SEL Practices

Much of the research I encountered is useful information teachers can use to improve their SEL practices. The specific information from research I am using to improve SEL is how students think and feel and what trends students might follow. I will cover four pieces of information that I believe will be useful for teachers to use to adjust SEL practices.

First I will cover how math identity impacts group dynamics. A part of math identity that can be used to improve SEL practices is from Langer-Osuna (2016). Langer-Osuna highlighted a possible issue with having a strong math identity. In their research, they noted that within a group dynamic, students with stronger math identities tend to dominate the group's decision-making and conversation. This does not allow students with negative math identities to develop positive ones.

In this practice with heterogeneous grouping, they found that student engagement decreased. While this is a case against heterogeneous grouping, homogenous groups of math skills can allow students to develop strong math skills and thinking. In my experience with grouping, my school district mentor encouraged me to try homogeneous grouping after I noticed that students in heterogeneous groups depend on highly skilled students to do most of the work. After I changed to homogeneous groups, I saw students split the work evenly, and whole-group participation was common.

Second, I will review the trends found in identity and how they impact math engagement. This set of research into math identities showed how a student's other identities could predict a student's math skills (Otgonbaatar, 2012; Collie et al., 2018). Both found that students of

marginalized identities generally struggled in mathematics. Otgonbaatar noticed girls of rural communities had negative views of their math skills, and Collie et al. recognized that students who struggled with English disengaged in their math classrooms. Their research is meant to help predict math identities based on trends in marginalized communities.

This information can be helpful to teachers as it serves as a reminder of which identities most need our support. The school I work in is very diverse, and we have a variety of students of different backgrounds. By understanding the students' backgrounds, teachers would be better able to adapt our SEL practices to fit the needs of our students.

Third, I will cover how negative math emotions impact students' math engagement. Di Leo (2019). Heyd-Metzuuanim (2015) and Tulis and Fulmer (2013) examined how negative emotions led to disengagement and a cyclical path to failure. Students who experience failure may spiral into a mindset of failure. This information is important to teachers as they can adjust their SEL practices to target these individuals' needs, especially knowing that students with negative emotions toward math tend to disengage in the classroom. In response to this, Horn (2008) suggested that encouraging students can play a vital role in students turning around their failure into success.

I have had a long discussion with my district mentor on this issue; she noticed a trend that students who fail in middle school are stuck in the mindset that they are failures and have a hard time recovering from it. While I have students stuck in the mindset of failure, I also have students who once identified as "never liked math" to finding success in their work once they develop a positive attitude towards math.

Finally, I will cover predictors for critical math thinking. Two predictors for strong mathematical thinking skills are spatial awareness (Skagerlund, 2016) and spontaneous problem-

solving (Headrick, 2020). Spatial awareness is an ability I have yet to figure out how to wield in the classroom, but within a STEM class, there would be many activities available for students to strengthen that skill. Spontaneous problem-solving was described as a moment where high-level thinking occurs. It is not something teachers can prompt, but students can do it independently. By understanding the moments when students are and are not critical thinking, teachers can adjust their lessons to facilitate critical thinking.

I found a variety of research important for improving SEL practices. There was no particular theme found for information useful to improving SEL practices. Some information spoke about student background, some information spoke about the power dynamic between students, and others spoke about what other skills contribute to math achievement.

Professional Experience Gaps Between Findings and Practices

I will examine three experiences I have had that relate to the research I found. The first is an experience I have had with veteran teachers towards implementing new practices such as SEL and restorative justice programs. This experience details a gap between new teaching methods and practice in the classroom. The next experience I will discuss is my visit to math classrooms across the district, where I saw a classroom that enforced some of the practices I have found in my research. The last experience details a yearly program at my school where we discuss improvements to our teaching practices, which enforces increase math engagement and skill.

During my first professional development, I was thrown into a discussion group with a pod of veteran teachers with over a decade of teaching experience. A new group of admins had been hired over the summer, and they were talking about the particular expertise they bring to the community. The previous administration had been notoriously authoritarian, and the new administration came to implement restorative justice practices in the school. Now, this pod of

veteran teachers did not react kindly to the idea of restorative justice practices. They had little experience in it, didn't believe it would work, thought it was a silly practice the district was implementing to look good, and didn't think it was a realistic practice. It seemed like a ridiculous amount of hate thrown at an idea they had just heard of without trying it. It seemed like teachers hated new ideas and practices that changed their current practice. In my mind, SEL and restorative justice programs are in the same vein of new teaching practices trying to be implemented. Teachers' willingness to implement new ideas didn't seem apparent, so this may hinder the school from using SEL practices. But the district also wants to implement SEL practices in the school, and we've had one professional development workshop on it along with optional training provided by the school. The district's provided access to SEL training is very limited.

A district initiative is for new teachers to have a field day to visit other teachers across the district and watch different classroom practices. Most classrooms followed the standard teaching paradigm, but one classroom transcended SEL practices. This classroom was a pseudo-charter school within a traditional public high school. When I walked in, the students were laughing and talking, with six to eight students huddled around a desk only meant for four students. At the front were two students leading the class's lesson, and in the back was the teacher observing the classroom. The students moved the discussion forward, had great relationships, and no student was quietly working but conversing with another student. It was controlled chaos, but the high level of learning was apparent. The teacher would occasionally ask a question to help elevate the learning. I spoke with the teacher about how the classroom works. Every lesson is student taught; each student prepares to lead it when it is their turn. For this class's summative work, they take an approach akin to 'Math Congress' (Kotsopoulos, 2012).

Students are given a set of problems to solve. They are allowed to use any resource to solve the questions, but they must be able to defend their answer in debate with the classroom. When I discussed with the teacher how he created the classroom, he spoke about how getting the class to this point every year was challenging. They spend the first month of school developing practices, cultivating relationships, and building student confidence and rigor. In my observation of one school period, this is what I thought the pinnacle of an SEL classroom could be.

A practice at my school community is a math program teachers engage in called Math Studio, where we analyze our teaching methods twice a quarter. This program focuses on the critical thinking aspect of SEL, similar to Inoue (2011) and Arisoy and Aybek (2021). We observe other math teachers' classrooms but focus on the student to student interaction. We label each piece of evidence we find from lower-order level thinking to higher-order level thinking. We then discuss what specific practices we can implement to achieve higher-order level thinking across all levels. This practice helps our teaching routines as we reflect on our growth as teachers throughout the year. This practice is not necessarily rooted in SEL practices; however, with a few changes, this practice can help guide critical thinking and decision-making for our students. A trend emerged from this practice: most evidence is taken from the higher-skilled students as the lower-skilled students rarely engage in math, which allows us to gather evidence. There should be a greater focus on practices that get all students involved, build their math identity, develop strong relationships in the community, and develop their math thinking.

Much of the current practice I experience in school is related to critical thinking. There needs to be a greater push for relationship building, fostering math identity, and addressing negative emotions toward mathematics. Our district union has been pushing for social-emotional support for our students, but the district has yet to implement any practices to help our students.

Building a math identity is critical. Many of my students have fallen into a cycle of failure and disengagement in the classroom due to their negative math identities. My math support class students have succeeded in math because they've been given the extra support needed, and I've developed a strong relationship with them. However, many more students fall through the cracks.

Our current society is driven by profit, production of goods, and cheap labor. And systematic issues exist in our education system, because of the driving forces of society. Education is a long term investment that does not provide any direct profit to any companies or businesses. Therefore education, like other social services, is often underfunded and undervalued. I have seen valuable program coordinators of social services in schools lose their jobs due to a lack of funding. Coming from a neoliberal education system, I have experienced privatization of education. Through this, funding for programs that better the education system such as SEL are often only available to the elites, thus helping them gain capital to get ahead in life.

Implications for Teachers, Students, and Schools

My research has several implications for current practices in the school and classroom. I will discuss the impacts of the themes of developing math identity, emotions towards mathematics, critical math thinking, and socializing mathematics in the classroom, school, family, and community. There is a need to implement SEL practices in schools across the country. Students often dread math class once they get to secondary school. Often I have heard my students speak about the love the used to have for math before they got to Algebra. SEL offers and opportunity to rekindle that love they have for math class.

Many of my recommendations consist of training and workshops offered to teachers and parents. The current schedule for staff meetings is building updates, with occasional workshops,

followed by professional learning community time. School districts often dictates workshops; I recommend shifting workshops to themes that help teachers implement SEL in the classrooms. Outside of that, teachers across different grade levels could receive clock-hour training to facilitate SEL practices in the classroom. Family and community must also be involved as SEL practices develop. Workshop and training can be coordinated with the Parent Teacher Student Association to help develop SEL practices. Schools must be creative for families and communities to commit to developing SEL practices. I encourage school districts to work with their community to develop these joint practices.

Classroom

Implementation of SEL starts in the classroom. The following practices are what I recommend for teachers in the classroom to begin SEL implementation.

I recommended that teachers train in facilitating error-correcting and reflection processes to help the classroom. Through this process students develop SEL skills in terms of reflection and find motivation to complete their work. This recommendation allows students to show their growth and reflect on their mistakes. This practice promotes critical math thinking and engagement. Schools must reexamine how they evaluate formative assessments, including state and national standardized testing.

Research says students strengthen their math understanding through collaboration and defending math strategies. In this practice, student develop social skills by problem solving and collaborating with others. I recommend that teachers shift to using summative assessments of math understanding, such as generalizing and justifying. Currently, most schools use tests and quizzes to assess procedural knowledge; teachers will need training in different ways to assess

students, generalizing and justifying their thoughts and ideas. This practice promotes critical thinking and reduces math anxiety.

Research suggests that teachers should use emotion-based strategies during summative assessments to assist students with test-taking anxiety. I recommend that teachers and counselors take workshops on different strategies students can use. Teachers and counselors would then teach students these strategies. Students learning these strategies would better regulate emotions during difficult situations. It would help develop citizenship in students and help teachers gauge students' math skills.

Research suggests that check-ins help in building meaningful relationships with students. A student's connection with their teacher helps build trust and comfort. When students experience social and academic support from their teachers, their math efficacy improves. I recommend that teachers start using check-ins with their students to develop relationships. This would facilitate stronger relationships between students and teachers.

Research suggests positive math discourse, such as compliments and encouragement, helps develop narratives that build student identity. I recommend that these workshops continue throughout the year to help teachers develop good practices. In order to achieve this, teachers and administrators must buy into the process and understand the importance of developing stronger student identities as learners.

School

A single classroom in a school implementing SEL practices is not enough. The school community needs to adopt SEL practices so teachers can collaborate with each other and improve SEL practices and so that students feel supported by the school.

Research suggests that culturally relevant education increases math engagement and critical thinking. Many schools have a traditional math track that students are stuck in with not option for culturally relevant classes. I recommend readjusting the courses available to respond to the needs of our students. There needs to be a survey of the class students would be interested in. The district would need a team of curriculum specialists to develop resources for teachers for culturally relevant education.

Research suggests that alternative programs increase math engagement and strengthen math identity. I recommend that mentorship programs be implemented in math clubs to foster relationships and that math teachers take training on the implementation of math circles. Clock hour trainings should be made available for teachers to develop SEL practices such as reading groups. These groups can adopt learning about math circles to help the department implement them in the classroom. Math club can offer a mentorship program that can count towards volunteer hours which are graduation requirements. It helps students build math identity and skills while helping them fulfill requirements for graduation.

Family and Community

To fully implement and take full advantage of SEL practices, family and community must be involved in its implementation and practice.

Research suggest that family and community influence a student's priorities. In many schools, parent engagement is limited to Open Houses, parent-teacher conferences, phone call homes, and emails. I recommend that schools hold community training on communication lines available to parents and teachers. Currently, teachers have access to parent phone and emails. Likewise, parents have access to teachers' phones and emails. However, knowing when communication is necessary for both parents and teachers is a grey zone. I recommend that

parents and teachers set boundaries and "need-to-know" moments for their students. Another opportunity for community support is Town Halls. Town halls allow parents to voice their concerns and recommendations for the school. Parents could join in person, virtually, or write in any concerns at the town hall.

Research suggests that family and community involvement in a student's learning helps students stay engaged in mathematics. Schools can host workshops for parents on how they can get involved in student learning. Teachers can also train to relate their lessons to home life for cultural relevancy. In my experience, my students do not wish to work with their parents on schoolwork because of the pressure they get from their parents. Workshops on how parents can engage in school work with their students without adding pressure to their students' lives would be beneficial.

Implications for Future Research

Experimental research should examine how different communities are faring after changing to SEL. From my experience, I found that most classrooms still teach students like we are still in the Cold War or putting students into factories. SEL looks to change the educational system to meet the needs of our society. Especially from many of my peer's experiences of COVID, they noticed they are losing many students to "drill and kill" methods they have employed for years. My students will not do any homework if there are more than ten problems to do for homework. If I listened to my students, is there a way through SEL where students can learn what the curriculum tells me to teach them? This is where research should move towards next as we modernize our education system to a post-COVID world.

Research on SEL should look into its socio-economic impacts on the community. This is a longitudinal study that can help better frame the practice for any future investors. In our

capitalist society, one of the reasons new practices slowly come to fruition is the lack of funding. If any research can be done and SEL can be proven to increase the community economically, more funding might be put into counseling and education.

Research on how different communities and cultures respond to SEL is another question. In my research, I have found practices from all over the world ranging from the US to Japan to Jordan and down to Australia. Many cultures learn communally, and SEL practices might even be normal everyday practices already in place. Conversely, some cultures might be highly individualistic and students and families may respond poorly to SEL.

Limitations of the Project

Since CASEL first posted about SEL in the 1990s, all 30 of the research articles I have found has come after 2000 with 25 of the 30 research articles being done between 2010-2022. Originally, my search begin with “SEL math practics in secondary school”. This led me to my first article about SEL practices in math classrooms. From there, I evaluated the SEL framework and search for math identity, emotions, decision making, and relationship building. Another limitation in my research is SEL practices done in secondary schools in America. I have found many SEL practices done, mostly in elementary schools and some in middle schools. Most SEL research done in secondary schools was conducted mainly outside of America. Because of this, I decided to include research done in primary schools in America and secondary schools in other countries. I did limit myself to SEL practices done in math classrooms; however, there were some cases where STEM classrooms contributed to my topic. SEL is a broad topic and dynamic in the ways it is practiced, so I had to use my judgment on whether this research article was an actual SEL practice or not. I also included articles that were not SEL practices but researched into students' thinking, as that is a vital piece of information.

I used the University of Washington Library database to find these articles. After exhausting the database, I looked at the references of my found articles to identity their sources. There were a few articles I was not able to access as the databases they were on were not support by University of Washington.

Conclusion

This literature review showed that Social Emotional Learning application in high school mathematics is limited even though SEL practices have been practiced since the 90s. SEL covers self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Strong SEL practices have the ability to reignite student's love for math and improve math skills. A strong math identity and positive emotions towards math allow students to engage deeper with mathematics. These aspects are developed by students, teachers, and the community. Much research has also shown that identity and emotions toward math most strongly affect students in middle school and are strong indicators of future math experiences.

I have gathered research on practices that promote social emotional learning. After identifying specific themes and practices, I made recommendations on how my action site can implement these SEL practices. CASEL recommends experimenting and exploring different practices that promote the development of core competencies; thus, practices are constantly changing and improving.

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