

THE ATTITUDES AND PERSPECTIVES OF SMALL RURAL SCHOOL  
ADMINISTRATORS TOWARDS SECONDARY MATH INSTRUCTION

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A Thesis Presented to

The Faculty of Humboldt State University

In Partial Fulfillment of the Requirements for the Degree

Master of Arts in Education

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May 2021

## ABSTRACT

### THE ATTITUDES AND PERSPECTIVES OF SMALL RURAL SCHOOL ADMINISTRATORS TOWARDS SECONDARY MATH INSTRUCTION.

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Rural schools account for nearly 25% of the K-12 student population across the United States. With such a significant portion of the school system located in rural schools, the learning outcomes in these schools will inevitable impact the broader school system in the United States. This study looks to investigate a small selection of these rural schools in Colorado. This study investigates the broad question of, what is the school climate of math instruction in small, rural districts in Colorado. A survey of Administrators in rural schools across Colorado was conducted to assess what are the attitudes and perceptions towards mathematics in these rural schools. This survey collected a rather homogenous picture of the population of rural schools across Colorado and most students in these schools struggled to have positive attitudes and perceptions towards mathematics despite administrators and teachers having positive attitudes and perceptions towards mathematics instruction. This spread of how far staff and students are from each other's attitudes and perceptions could be a result of how much time administrative teams focus on school culture practices and goals on developing intrinsic potential.

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## INTRODUCTION

Effective social, emotional and academic growth becomes moot when the recipients of the learning do not feel safe in the learning environment (Cobb, 2014). Student safety is a concept that goes beyond physical violence and other crimes. School safety includes both overall school climate and perceptions, and academics (Jennings, 2009). Academic achievements impacting factors stretch far beyond the confines of the classroom and its teacher to include how students and families feel about being in school shapes their individual/group learning and development (National School Climate Center: School Climate, 2014). The National School Climate Center website (2014) defines school climate as “the quality and character of school life” based on “students’, parents, school personnel, and communities experience of school life”, with regards to the “norms, goals, values, interpersonal relationships, teaching learning practices and organizational structures” .

This study on small rural schools was born out of my own experiences in rural schools in both California and Colorado. In these schools I noticed similarities in nature to the demographics of the student population, how the community did or did not engage with the school, student’s negative perceptions and attitudes towards school, and how administrations seemingly lack of concern towards school climate can be detrimental to the overall learning experience. As a math teacher in rural schools in both states, I understand the demands placed on teachers in rural schools particularly on math teachers. Due to my current connection to Colorado the following study will look to gather a broad



picture to answer the following overarching question. What is the school climate of math instruction in small, rural districts in Colorado?

As a current administrator in an alternative school, albeit not in a rural school district, I have often conceded how an administrator can impact school climate. This study will combine my experiences as a math teacher with my current position as an administrator. This study will look to narrow down the very broad concept of school climate of math in small rural schools across Colorado into three sub questions about attitudes and perceptions towards math instruction from three different members of the school community.

This study asks administrators to speak from their own perspective with the intention of understanding the following. What are administrators' perceptions and attitudes towards math instruction in rural schools?

Schools do not exist without students, and teachers to guide the instruction. This study also asks administrators to speak from the perspective of students and math teachers at their school sites. Administrators will shed light on the following questions:

What are the students' perceptions and attitudes towards math instruction, as identified by the administrator, and what are the math teachers' perceptions and attitudes towards math instruction, as identified by the administrator?

The combination of the larger picture of school culture narrowed down to these three perspectives as viewed by the administrator will begin with an investigation into the literature behind school culture across rural school in the United States. Following the

literature review there will be chapters on the Methods, Results, and Discussion of this study conducted on small rural school administrators of Colorado.

## LITERATURE REVIEW

### Profile of small rural schools in the American education system

Many researchers would consider the rural American school a topic unworthy of spending time on. The rural American schools are rarely considered beneficially to anyone other than historians and rural sociologists. Rural schools have received a reputation of being disorderly, behind the times and obtaining unproductive results. (DeYoung 1995)

Despite their perceived lack of influence on public education, rural American education accounts for nearly 25 percent of the nation's kindergarten through 12th grade scholars (DeYoung 1995; Arnold, Newman, Gaddy & Dean 2005). Aside from accounting for an approximate quarter of American students, teaching characteristics seen in small rural schools are being taken to urban school systems in an attempt to revive struggling school systems (McKinney, Steglich and Stever-Zeitlin 2002). Such as the small school studies done in the Boston Public schools that created 11 small school environments with standalone staff, facilities, and students. This study has shown significant social and academic benefits in four of the 11 schools studied, the other seven showed improvement as well but not a notable amount (McKinney, Steglich, & Stever-Zeitlin 2002).

With the complexity of the rural American school system it is no wonder that beneficial educational research has been taken to benefit students elsewhere (DeYoung

1995; Nelson 2010). According to DeYoung (1995) and his research there are five types of rural schooling communities. Three of these communities are seen as sustainable and productive rural communities. “High-Growth” communities that are identified as being close to expanding metropolitan areas, “Reborn” rural communities that have become an escape for many former city dwellers looking for an escape from the city life, “Stable” rural communities are ones that have maintained a dependable economical market. These three communities have schools that provide meaningful engagement of the national economy and school system due to their stable local tax base. (DeYoung 1995; Gjelten 1982; Ulrich 2011)

The remaining two communities are the rural communities and schools that are struggling with the changing economic times. “Depressed” rural areas have a scarce local economy that has caused many residents to leave for more prosperous areas. Whereas “Isolated Communities” are rural areas characterized by their distance from major transportation and commerce centers. (DeYoung 1995; Gjelten 1982)

Having little to no major communication or consumer markets nearby, many isolated rural communities have created their own distinct subcultures that differ in views and opinions on schooling when compared to the nearest metropolitan neighbor. These differing views have created unique school systems that have placed different values on education and its importance. (DeYoung 1995)

Many of the five types of rural communities were founded by the agricultural and industrial demands that used the natural resources of some areas to benefit economical needs. The natural resources were located in these rural areas, but the settlements

themselves were founded around transportation routes. The need for the foundation around transportation routes was due to the difficulty that Mother Nature provided in getting the region's goods out in a timely and economically efficient manner. (DeYoung 1995; Sherman & Sage 2011)

For some of the “Isolated” or depressed communities that lost industrial jobs the population faded as well. Aside from lack of jobs and population these areas continue to exist due to its generational and poor economical influences. When money left these areas some families were and still are stuck due to lack of funds to leave. The out migration from rural communities has increased significantly over the past century. Individuals who choose to stay in struggling communities likely stay because of generational ties to the land. Either way many members of these communities purposefully isolate themselves due to suspicious feelings towards outside programs. Many of these suspicions come from a fear that these programs are out to change their complacent way of life. (DeYoung 1995)

This fear of change comes from a lack of central government support in many isolated and depressed rural communities due to limited populations, and the fear that many changes do not give voice to the community’s principles. Principles that often differ from the principles in the mainstream population. As a result many rural communities, especially isolated one, have turned to the one constant governmental office in the community to be the cultural bridge between the two worlds. More often than not this one constant governmental office is the community school. (DeYoung 1995; Sherman & Sage 2011)

Teachers who have not strayed far from home to receive their degrees and return to their home communities traditionally run the schools. These teachers are often willing to receive substandard pay and work around increased workloads due to staff reductions. As a result rural teachers are often seen as unpredictable in their teaching quality. This unpredictability is based around the teacher's lack of experience and knowledge outside of the enclosed rural community. (DeYoung 1995; Ulrich 2011)

Rural schools have differing characteristics from the metropolitan schools (DeYoung 1995). These differences are due to environmental, economical, and cultural traditions (DeYoung 1995). Rural schools have positive differences from their counterparts in education. Differences that provide rural staff more opportunities to connect with students and community members are; Teachers often work with smaller populations that come from extended family relations, the teachers and students in rural schools have more frequent social interactions with each other in and out of school, and the school is often seen as a historical link between generations (Achilles, Finn & Pannozzo 2003; DeYoung 1995; McKinney, Steglich & Stever-Zeitlin 2002).

The smaller school groups help to create a "sense of belonging" in the school (Achilles, Finn & Pannozzo 2003). This includes both sustainable, productive, isolated and depressed rural communities (DeYoung 1995; Achilles, Finn & Pannozzo 2003}. This "sense of belonging" is likely a result of the fact that a small classroom increases a student's visibility in the classroom (Achilles, Finn & Pannozzo 2003). Psychological theory explains how increased visibility is a clear indicator of motivation and active participation in a group setting (Achilles, Finn & Pannozzo 2003). The student belonging

is also represented by the added extracurricular opportunities small schools provide to students (McKinney, Steglich, & Stever-Zeitlin 2002). This statement should not be used to imply that more options are in smaller schools rather than the small school population allows for a wide variety of students to participate in afterschool programs (McKinney, Steglich, & Stever-Zeitlin 2002). Many activities that would eclipse students based on their perceived lack of ability in larger schools are available to a broader range of students in smaller schools (McKinney, Steglich, & Stever-Zeitlin 2002). The added interactions with adults provides for a small group that is united in their purposes and actions more so than those in larger groups (Achilles, Finn & Pannozzo 2003).

Making more meaningful connections with students is only part of the increased uses of interactive instructional strategies, and interdisciplinary practices that go on in small school environments (McKinney, Steglich, and Stever-Zeirlin 2002). Small learning environments have also been shown to drastically improve student behavior and align student behavior to that of the schools goals (Achilles, Finn & Pannozzo 2003; McKinney, Steglich, Stever-Zeitlin 2002).

Aside from their benefits small rural schools also have their perceived shortcomings. Many small schools due to their unique community based subcultures have blurred lines on what would normally be seen as cut and dry school laws, such as the separation between church and state. Some rural communities also have some less than appealing views of prioritizing education, because of experiences with manual labor and limited exposure to educational careers. In many rural communities a high school

diploma is the end of one's schooling career rather than what most would consider a more valuable college diploma. (DeYoung 1995; Sherman & Sage 2010; Ulrich 2011)

Despite difficulties and occasional cultural biases, small rural schools have consistently shown higher attendance and lower transfer rates in comparison to the average large school (DeYoung 1995; McKinney, Steglich, Stever-Zeirlin 2002). These two characteristics are likely due to the increased relationships that students can create with teachers and other staff members when in small group settings (Achilles, Finn & Pannozzo 2003). Attendance and transfer rates are two strong indicators of graduation and achievement rates, both of which are higher in small school settings (McKinney, Steglich, Stever-Zeitlin 2002). Research and evidence on the topic of small school settings not be confused with small classrooms. Research has shown that smaller high schools out shine their larger competitors in achievement based testing (McKinney, Steglich & Stever-Zeitlin 2002). Small settings have been shown to be especially beneficial academically to those who have been underperforming in school, with their behavior and academics, which leads to a lower likelihood of dropping out of school (McKinney, Steglich & Stever-Zeitlin 2002).

With a declining number of rural areas left in America what is in store for the rural American school (Arnold, Newman, Gaddy & Dean 2005; Bailey & Beesly 2007)? With the dwindling populations of rural areas many schools will have to use alternate instructional methods to prepare and offset the needs of the inevitable multi-grade classrooms (Smit & Humpert 2012). Small high school principals might want to consider providing smaller classes to further benefit the students over diversifying classes with



limited resources as rural schools continue to struggle (Deutsch 2003). Along with population concerns rural schools continue to be targets of governmental reform efforts, since their local tax source makes them dependent upon outside funding sources (DeYoung 1995). Despite these issues rural schools will likely be a part of the American school system for the foreseeable future as they continue to act as representatives for the national culture in less populated areas (DeYoung 1995).

#### The benefits associated with small high school environments

One of most common topics associated with how student education is positively impacted, is the smaller school/class size environment (Achilles, Finn and Bate-Bain 2002). Considering its popularity in educational research there have been many opposing arguments to this benefit. Many of these arguments stem from the lack of clear definitions and the difference between small schools defined by pupil-teacher ratio vs. the class size definition (Achilles 2001; Achilles, Finn and Bate-Bain 2002; Fergusson 1991). Pupil-teacher ratio is defined by the ratio of students to staff members in a building, this definition provides for a wide variance of teacher-student ratios in the actual classroom and therefore a lack of consistent positive educational impact (Achilles, Finn and Bate-Bain 2002). Whereas the less controversial definition of class size ratios provides for quality educational achievement. For the purpose of this literature and the research that informs it, class size is defined as the number of students regularly in a teacher's room (Achilles 2001; Achilles, Finn and Bate-Bain 2002). This definition of class size has a closer tie to educational achievement due to the fact that the ratio between teacher and

student is individual for each classroom rather than a school wide staff to student ratio simplified down to imply possible class size (Achilles 2001; Achilles, Finn and Bate-Bain 2002).

The smaller class sizes provide environments where students are more engaged with higher levels of participation, and enriched learning experiences in comparison to students in large class sizes (Deutsch 2003). Higher levels of student engagement have a strong positive correlation with overall academic success. (Finn 1998).

Along with increased engagement teachers in small schools report using a wider variety of instructional strategies and hands on activities to meet a larger range of learning styles (Pate-Bain et.al. 1992). This use of hands-on activities is a clear predictor of academic achievement in math and science classes for junior high and high school students (Deutsch 2003). Interactive activities work to create a community supportive of productive academic struggle and scientific inquiry, skills that are necessary for the analytical problem solving and situational analysis that is necessary for higher level learning, and academic progress, (Deutsch 2003).

The smaller environment also provides for increased positive student teacher interaction with increased quality feedback and increased strategies that promote productive struggle in the learning environment (Deutsch 2003). Smaller class sizes provide a learning environment where the teacher is more likely to frequently use probing questions and respond positively to a student allowing for more the personal interactions necessary to promote academic success (Deutsch 2003).

Higher levels of engagement, increased interactive activities, and increased amounts of positive teacher interaction are strong indicators of academic achievement (Deutsch 2003; Finn 1998; Pate-Bain et.al. 1992). The school is a complex setting where the school itself and its overall climate have nearly as much impact on the learning going on as the factors previously discussed that exist in a small class environment (Deutsch 2003; Frascon 2011). Larger class sizes have been shown to require an increased amount of time spent on management and other organizational tasks rather than on instruction (Holliday 1992). The increased time not spent having quality educational interactions with students leads to less pressure for teachers with small classes (Deutsch 2003). The decreased levels of pressure and anxiety on staff leads to an increase in job satisfaction and the ability to have more meaningful academic interactions with students due fewer management issues along with the opportunity to more effectively accommodate individual student needs (Deutsch 2003; Holliday 1992). Smaller class sizes provide for less anonymity between students, families and the school. Individuals in these environments are closely connected to school and its staff; as a result levels of theft, vandalism, and graffiti are less likely to occur (Klonsky 2002). The levels of connectivity that occur when classes are small leads to decreased dropout rates, absenteeism, and school related disciplinary issues (Deutsch 2003; Klonsky 2002).

Despite all of the benefits that can be provided in smaller schools composed of small classes, there are still inhibiting factors that can take away from the overall success of academic and school climate progress in the above environments (Deutsch 2003; DeYoung 1995). Small schools with small class sizes as those seen in rural America are

often seen as sheltered and lacking the cultural diversity benefits that can be observed in larger schools. Rural schools are often behind the educational curve in regards to technology uses in the classroom due to decreasing budgets associated with a limited number of students. This lack of diversity and technological uses in many rural schools leaves high school students at a disadvantage for college readiness. Aside from the academic concerns, small class sizes pose economic issues for many districts as well. The development of smaller class sizes calls for a need in more classroom space and an increased number of staff to run the classes with smaller numbers. Both of these factors are major issues where logistic concerns often out weight the possibility of increased academic achievement.

#### Definition of School Climate

Effective social, emotional and academic growth becomes mute when the recipients of the learning do not feel safe in the learning environment (Cobb 2014). Student safety is a concept that goes beyond physical violence and other crimes (Jennings 2009). Academic achievements impacting factors stretch far beyond the confines of the classroom and its teacher. How students and families feel about being in school shapes their individual/group learning and development (“National School Climate Center: School Climate” 2014). The National School Climate Center (2014) defines school climate as “the quality and character of school life” based on “students’, parents, school personnel, and communities experience of school life”, with regards to the “norms, goals,

values, interpersonal relationships, teaching learning practices and organizational structures”.

Effective school climates are ones that promote social, emotional and physical well-being through the respectful engagement and school vision of all stakeholders (Cobb 2014; MacNeil, Prater and Busch 2009; “National School Climate Center: School Climate” 2014). Safe and supportive schools are ones that encompass three primary categories; Positive engagement, Safety (Social, Emotional and Physical), and Environmental safety (Cobb 2014). Although much of a school climate is non-academic, the information collected from school climate observations gives school leaders clear data that can be used to recognize priority areas for attention and improvement (Cobb 2014). Identified improvement and attention areas should be highlighted and addressed collaboratively with all stakeholders to provide the best possible outcome for academic and non-academic objectives (Cobb 2014).

Ineffective schools lack effective leadership. Ineffective leadership produces an environment not conducive for staff and students to feel comfortable and happy about where they are. The lack of a quality environment that is inviting and welcoming tends to give way to a lack of student and staff motivation with regards to academic achievement. The emotional environment is only one piece of a school's overall school climate. Effective school climates must perpetuate a physically safe environment for all involved. (MacNeil, Prater and Busch 2009)

Abundant research has been done to show that substandard school buildings are associated with lower performing schools, and students within these schools score

between 5 and 11 percentile points lower than students with a quality physical environment (Blazer 2012). Within the physical school environment, air quality, temperature variances, and lighting are influencing factors in schools that play a role in academic achievement (Blazer 2012). A dilapidated poor environment also negatively affects the overall attitude of those involved, and students who leave a poor physical environment for a better physical environment have shown higher achievement in higher quality environments (Blazer 2012; Cobb 2014 MacNeil, Prater and Busch 2009). When the physical working conditions are good, higher levels of productivity, learning, and job satisfaction are attained. Lower teacher retention rates have a strong correlation with building quality in schools (Blazer 2012). Specific building concerns have a negative impact on students and teachers in the building and the academic achievement that would come from the learning environment (Blazer 2012).

According to a study looking at the effect of school climate on student achievement by MacNeil, Prater and Busch (2009) several key aspects of a school climate were negatively impacted in schools with poor climates. Their study compared 29 schools in southeast Texas on the following categories; Goal Focus, Communication, Power equalization, Resource utilization, Cohesiveness, Morale, Innovativeness, Autonomy, Adaptation, and Problem solving (MacNeil, Prater & Busch 2009). All of the schools that were seen to have poor school climates scored significantly lower ratings in each category in comparison to the schools that had high quality school climates (MacNeil, Prater & Busch 2009). Poor school climates affect an organization's ability to positively impact student achievements due to their inability to provide clear directives

toward academic achievement, bring the all-necessary stakeholders to the table to make influential decisions, and promote student and staff well-being measures (Blazer 2012; Cobb 2014; MacNeil, Prater & Busch 2009).

### Impact of School Climate on Small Communities

Small school communities are deeply affected by school climate due to the fact that the school is at the focal point in many rural communities (DeYoung 1995).

Schools in rural environments tend to set the stage for expectations of community collaboration and achievement, poor climates in these areas is a concern for academic achievement and the communities' quality of life (DeYoung 1995).

Many rural communities in America are struggling from economic collapse due to the decline of once prominent industries that have died off due to increased government regulations and dwindling of skilled labor jobs (DeYoung 1995; Ulrich 2011). One of these communities in rural northern California as studied by Jennifer Sherman and Rayna Sage (2011) of Washington State University clearly depicts the issues created in rural environments and how it affects schools in the area where economic and environmental collapse has struck. When rural economies shut down the school became the primary employer and resource for community members (DeYoung 1995; Sherman & Sage 2011). As the school environment becomes the major source for change it can also be seen as perpetuating the issue of the community's dilapidation due to what is referred to as "Brain-Drain" (Sherman & Sage 2011). In the communities prime rural education was primarily focused on agriculture and forestry, as the requirements for education shifted

towards higher education, schools disconnected from the education that parents in the community achieved in years past (Ulrich 2011). Public schools are under federal pressure to produce college-trained citizens rather than the skilled labors that many rural communities need. As a result the schools are training students to get a higher education and career by leaving the rural community (Sherman & Sage 2011; Ulrich 2011). For depressed and isolated rural towns the school becomes the change agent that determines the deciding factor in how the community reacts and changes for the better or continues to diminish (Sherman & Sage 2011). Rural communities affected by "Brain-Drain " have a population where nearly 70% of the residents have no higher than a high school level education, this disparity in education provides an environmental backdrop that has lower values for education (Sherman & Sage 2011; Ulrich 2011). As a result of environmental and economic pressures rural schools are falling behind their counterparts when it comes to academic growth and achievement (Ulrich 2011).

The social climate of rural communities and their involvement and support of the local school has seen a decline as rural communities begin to lose labor based jobs (DeYoung 1995; Sherman & Sage 2011). In struggling rural populations only twenty seven percent of the population perceives school quality to be an issue for the community, this low level of concern for high quality education is a result of educational disinvestment in rural school communities (Ulrich 2011). The impact of the apathy towards high quality education could be the end of many rural communities and their schools (Ulrich, 2011). The end of some of the rural communities that have a lack of educational concern would likely come from the changing workforce trends. A good



work ethic does not always lead to a decent job that can pay the bills like it did a decade or two ago and companies are now looking for a higher education in addition to good work ethic (Ulrich 2011). A lack of concern for the quality of education has led to higher dropout rates, which in combination with the limited number of labor intensive employment opportunities guides the way to increased poverty and limited economic resources for school based improvement even if support for the school system was present (Ulrich 2011). The struggling school and its community surroundings is passed down from generation to generation where underinvestment in the local school system perpetuates seamlessly never-ending poverty in rural communities (Ulrich 2011).

With the issue of disinvestment in educational systems among rural communities what can schools do to create positive school and community climates that provide for a revitalized interest in the value of education? The task of turning this mentality around relies on the educational leaders in the given communities, like the school administrative team (Ulrich 2011; Wood, Finch & Mirecki 2013). A school administrator's primary objective should be to cultivate and promote a positive school climate conducive to learning (Frascon 2011). Students learn many of the benefits of a quality school climate from the structures and relationships that they observe and experience in school (Cobb 2014). Knowing that school climate starts in the administrator's office and works its way down to the instructional staff and students (Cobb 2014; Frascon 2011). Administrators should take time to focus on some key aspects of the school climate to increase engagement and interest the educational system (Cobb 2014; Frascon 2011).

“The press can be a principal’s worst enemy”, poor public relations can destroy a school and the administrator in charge (Newby & Hayden 2004). The school administrator is the primary marketing and communications director of the school environment, they have the responsibility of building a collaborative network with all stakeholders to implement and develop positive perceptions of the school (Frascon 2011; Newby & Hayden2004). The school administrator is the face of the building, but the teachers are the primary veins to the community and administrators must work with staff in providing superior connections with parents to become a part of the school and share in the decision making process (Cobb 2014; Frascon 2011).

Administrators that have attained high levels of school climate and student achievement along with effective public relations work to engage other site leaders to acquire and implement new procedures to improve the schools improvement plans. After plans have been made identifying what processes are needed to improve public image, school administrators need to identify individuals who are interested in change and capable of implementing positive change. With identified areas for improvement and a collection of focused individuals and reasons why public relations are poor, the administrator and his improvement team collaborate with all stakeholders to create a shared voice. With a shared collaborative effort a plan that is measurable and achievable needs to be set in place to achieve the necessary change. Positive public relations can only be achieved through collaboration, so that every member of the organization feels valued and equally important. (Newby & Hayden 2004)

Work with public relations helps to develop a higher level of building trust. The building trust allows for a more engaged and motivated staff. When staff trusts their administration team they are more willing to take suggestions and advice to heart. Trust in the administration team leads to the “open door” communication that is necessary for collaboration and the acceptance of community voice. Autonomy tends to fade when staff and community members feel that their opinions are valued and taken into consideration. Imbedded into the public relations of a school site administrators must consider the internal relations of the site. With consistent collaboration and recognition, staff administrators can create a strong team of instructional staff that is connected to the progress of the school site. The self-connectivity of the school site increases the impact and spread of the quality instruction that the school site is doing to benefit the students and surrounding community members. (Frascon 2011; Newby & Hayden 2004)

The work in decreasing educational disinvestment is focused around the implementation of procedures and practices that work to improve community and school wide climates (Cobb 2014; Frascon 2011; Newby & Hayden 2004; Wood, Finch & Mirecki 2013). Community wide climate is a large operational task that needs to be started by the administration, but carried out as a collaborative effort between a variety of staff, students, and community members (Frascon 2011; Newby & Hayden 2004). Disinvestment can only be countered through the engagement of a variety of voices that work in unison to transform school site autonomy into the collective environment it is intended to be (Frascon 2011).

Using school climate to increase academic performance in rural schools.

The exemplar model for school improvement and academic growth in rural schools looks different than that in urban and suburban schools (Nelson 2010). Rural schools are different from their urban counterparts due to the availability of resources, and the limited number of specialized personnel that are used in larger schools to implement school improvement plans (DeYoung 1995; Nelson 2010). Due to limited resources and specified personnel, improvement plan tasks are often disseminated and added to already busy school staff members. The added tasks are done less formally and often less effectively due to a lack of staffing options in rural community settings (Nelson 2010). As a result of the limited staff options it is imperative that parents in rural communities play a larger role in the educational practices and planning of school wide improvement plans (Nelson 2010). Rural schools and their choices have a heavy impact on the outcomes and values of the community it resides in due to the close-knit nature of rural communities (DeYoung 1995).

The most successful rural schools use the close interpersonal connections present in their communities to leverage engagement and collaboration between students, staff, parents, and community members (DeYoung 1995; Nelson 2010). Centralized objectives have been shown to increase student achievement and to use the benefits of small class sizes in rural schools to their fullest potential (Nelson 2010; Ulrich 2011). According to John Hattie (2012) and his research, micro-reaching, teacher-student feedback, effective classroom management, student-teacher relationships, and the use of teaching strategies

to involve individualized learning are some of the influences that affect student academic growth the most. Many of the listed influences can be correlated and used in rural schools due to the smaller environments that rural schools work with (Arnold, Newman, Gaddy & Dean 2005; Nelson 2010). The rural schools that have been collaborative working to leverage their strengths to meet the needs of the students and surrounding community have successfully brought all stakeholders to the table to identify weaknesses (Nelson 2010). Together their collaborative work for solutions has shown success in raising academic achievement with a high level of organizational confidence from all individuals involved (Nelson 2010).

Rural schools are unique entities with their own host of organizational and individual based issues, aside from the broad sense of the aforementioned climate focuses there are student based programs that can be used to target problem areas in rural school. Substance use and abuse is one of the target problems that are a significant health concern in rural areas with at-risk students and families (Williams, Barnes, Holman & Hunt 2014). Students that are at-risk for substance use and abuse are at higher risk of dropping out and not achieving efficient academic growth (DeYoung 1995; Williams, Barnes, Holman & Hunt 2014). Williams, Barnes, Holman and Hunt's (2014) studied the effects of a mentoring program on students who were identified to likely have substance abuse problems. The study showed that mentoring programs for substance abuse in rural communities does increase student interest in higher education and peer development skills (Williams, Barnes, Holman and Hunt 2014). Uses of mentoring programs can create interpersonal connections that will help alleviate disengagement in quality

education (Williams, Barnes, Holman & Hunt 2014). Mentoring programs are cost effective ways for rural schools to use community members to engage students and families in the educational progress (Williams, Barnes, Holman & Hunt 2014).

There are many in and out of school programs that promote higher-level education and achievement such as Science, Technology, Engineering, and Mathematics (STEM) programs (Goodpaster, Adedokun, & Weaver 2012). Many programs such as STEM require resources that rural schools struggle with finding, such as retaining qualified teachers, and funding for additional materials (Sherman & Sage 2011). STEM programs allow students to connect their learning to higher educational goals and show interest in academic achievement (Goodpaster, Adedokun, & Weaver 2012). Teachers of these programs in rural schools have noted that the interpersonal connections that they can make due to the close connectedness between community and school in rural areas allows them to draw in higher levels of engagement from students families and the surrounding community (Goodpaster, Adedokun, & Weaver 2012).

Rural communities need leaders who can reach across the many socioeconomic, and unique challenges that present themselves in rural communities to strengthen the quality of life through improved access to resources and quality community partnerships (Goodman 2014). Rural leaders need to leverage community partner's assets to the benefit of student academic growth with effective communication based on mutual respect (Newby & Hayden 2004).

Rural school leaders should look to the resources that local institutions of higher learning offer, having a joint partner to assist improving the educational engagement in

rural communities can be vital to the success of the communities' educational experience. Higher educational institutes have the unique opportunity to increase community leadership that collectively strengthens the surrounding community. These institutes can draw students and other community members in through a specific set of resources that play to an individual's interest, something local public schools are limited by due to standards and expectations. Local secondary school leaders need to make connections with these resources to provide opportunities that have a higher likelihood of developing globally prepared civically invested citizens. (Goodman 2014)

The leveraging of community resources have also proven successful in gathering resources and interest in academics through tutoring opportunities with local community partners. Engaging local partners in the academic success of all students draws in a closely connected community that has a shared value for quality education. Aside from the personal connections made from drawing in community businesses and other parties, schools can benefit from donations of supplies and materials to benefit the academic growth of students in the community. Through these connections students who otherwise would not speak up or show interest in academics are more willing to voice their thoughts to the community partners who can in-turn work with the schools to ensure that every student's social, emotional and academic needs are being met. (Alleman & Holly 2013).

Outreaching to community partners can provide avenues for students and families to build a network of educationally minded individuals. As a team the school and its partners can provide families a wider variety of academic, career based, and interpersonal

resources that would be severely limited otherwise. (Alleman & Holly 2013; Goodman 2014).

### Conclusion

This literature review has gone over many factors of rural schools and their influence on students and the public education system as a whole. Rural American schools are a viable resource for developing an engaged and mathematically focused workforce. As mentioned, 25% of America's school age children are in rural schools. Due to the environment and teacher resources many American students continue to fall behind in math, leaving many students and adults with limited resources and skills in mathematics. The literature observed in this literature review displayed some key characteristics of the impact that school climate has on student performance. School and community climate in rural schools has a lot to do with developing educationally minded and civically involved individuals as shown in this review of the literature. Despite having a variety of articles on the impact of school climate, mathematics, and internal factors done separately, there is limited research and review that combines these three areas of rural schools.

The intent of this review of the literature was to identify some key positive and negative characteristics of rural schools, and to recognize the impact of school climate on rural areas. There is a need for further investigation into rural high schools and how they are effectively using school climate to their advantage to further develop mathematically minded citizens.



The lack of research in rural high schools focusing on the use of school climate to improve math proficiency has led to the need for a deeper look into the following question. How can small isolated public high schools effectively use school climate factors specific to mathematics to limit math prejudices and improve academic performance?

## METHODS

Rural American education accounts for nearly 25 percent of the Nation's kindergarten through 12th grade students (Arnold, Newman, Gaddy & Dean, 2005; DeYoung 1995). Despite beneficial student based characteristics, such as low student teacher ratios, more individualized support and consistency in learning some of the studied rural high schools fall short in their state proficiency rates for mathematics. The methods to follow are directed towards better understanding attitudes and perceptions of mathematics in rural schools. This study draws upon the knowledge of administrators of rural schools in Colorado as defined by the Colorado Department of Education to inform the findings. School administrators were the foundation of this study due to their knowledge of the entire school system, ease of access based on IRB requirements, and my own interest as a fellow administrator. In order to begin investigating this phenomenon, this study starts by exploring rural school climate and attitudes towards math instruction. The purpose of this study is to investigate the following research questions:

Overarching question:

What is the school climate of math instruction in small, rural districts in Colorado?

Sub-questions:

1. What are administrators' perceptions and attitudes towards math instruction in rural schools?
2. What are the students' perceptions and attitudes towards math instruction, as identified by the administrator?
3. What are the math teachers' perceptions and attitudes towards math instruction, as identified by the administrator?

The researcher was in direct contact with current rural Colorado Administrators. Throughout this study, the use of quantitative data provided the analytical perspective needed to understand the factors within a given school that may affect mathematics performance at the middle school and/or high school level.

Quantitative data alone is not enough to capture factors of school culture and academic prejudice towards mathematics. Adopting prejudices themselves comes in three phases; first one associates attributing characteristic to the prejudice, secondly one puts ideas into certain classes with other concepts, and lastly concepts in each class are assigned the attributing characteristics in phase one without justifiable knowledge of if those characteristics actually apply to the targeted concept (Thomas, 1999). Prejudices are social constructions that do not fit straight analytical patterns but rather vary widely among social groups (Thomas, 1999). Qualitative components were also built into the research methods.

## Participant Population

The goal of this study was to survey a total of 20 rural/small rural Colorado school administrators. Schools were randomly selected from the CDE (Colorado Department of Education) list of 109 rural/small schools. By use of a random number generator 40 schools were initially chosen to request participation from Administrative staff at the school site. Administrators were chosen as the target population due to the challenges posed with conducting a student study that needs additional IRB and school site approval. While the study would benefit from surveying students, it was not possible to obtain IRB approval to survey this vulnerable population. In addition as a school administrator myself, I wanted to see the perceptions and attitudes towards mathematics from the lens of my fellow administrators.

Each of the 40 initially selected schools had administrators emails collected from school district websites. These school names and administrator emails were tracked to determine when emails had been sent or replied to. In this initial collection of participants, 48 messages were sent through email to invite administrators to partake in the survey. Two weeks following the initial round of request for participation all schools who did not complete the survey were emailed the same email a second time. This process produced six participants.

Two weeks following the completion of six surveys, a new round of 23 schools were selected and each school was sent at least one email to a website identified administrator. After two weeks of this second round of participants' first email, the email

was sent again to request participants. This second round produced two additional participants.

During the span of two months 86 possible participants were emailed twice. Due to extenuating circumstances as described below in the limitations section requests for participants were stopped after each round had been emailed twice. At the conclusion of the participant collection phase eight surveys were completed. The small participation size is a limitation of this study. However, the study still provides a starting point for further research.

### Survey Instrument

The instrument used to collect the quantitative and qualitative data used in this student was a digital survey. The survey contains different modalities of questions. The survey consists of multiple choice, Open Response, and Likert Scale based questions.

The survey that was created and used for this study was intended to gather three categories of information from participants; “Demographics”, “Attitudes and Perceptions towards Mathematics”, and “School Culture”. The categories of “Demographics”, and “Attitudes and Perceptions towards Mathematics” were broken into two subcategories; “Individual (the Participants) experiences or thoughts” and “The participants perceived thoughts of the Students, Staff, and Communities experiences or thoughts”.

The survey questions used in the “Demographics” sections were created based on the combination of questions typically utilized in demographic questionnaires and individual experience in rural schools. The demographic questions were designed to

provide a greater context of the research participants' school sites and communities. The questions were developed to gather information about rural school graphics, community connection and the influence on educational practices.

The questions used in the “Attitudes and Perceptions towards Mathematics” sections were modeled from “The Mathematics Attitudes and Perceptions Survey” (MAPS) from the International Journal of Mathematical Education in Science and Technology (Code, Merchant, Maciejewski, Thomas, & Lo, 2016). This model was chosen because it provided practical, research based questions with a validated evaluation system that identified perceptions and attitudes towards mathematics.

The questions used in the “School Culture” category were developed by the researchers and modeled after the MAPS survey (Code, Merchant, Maciejewski, Thomas, & Lo, 2016).

### Procedure

The survey was created and distributed to participants digitally through district provided emails the survey was in a Google Form and all materials, including the consent, were sent and collected through the survey link that was embedded into the email that was sent to participants. In the email invitation to participate, participants were provided with a brief overview of the study. In the survey, participants gave themselves a pseudonym in order to de-identify the data. All location specific information was removed prior to data analysis.

## Data Analysis

The quantitative survey questions were analyzed with either single quantity-based statistics or the rubric associated with MAPS. Single quantity-based statistics, rubric categorization and scoring provided a conceptual look into what “Demographics”, “Attitudes and Perceptions”, and aspects of “School Culture” are commonplace in rural and small rural schools across Colorado.

All questions related to “Demographics” of the school and surrounding community were analyzed with single variable statistics via pivot tables and averages. The use of these statistics provided an overarching picture of the characteristics between schools who participated in the survey.

All Likert scale questions were categorized based on what the questions intended target of math attitudes and perspectives. These categories were modeled from the MAPS survey instrument (Code, Merchant, Maciejewski, Thomas, & Lo, 2016) and the categories assigned in that study. The categories were as follows; “Sense Making”, “Growth Mindset”, Nature of (Math) Answers”, “Interest in Mathematics”, “Persistence (as related to math learning)”, “Real World relationships”, and “Cross curricular Math approach”.

As explained in the Survey Instrument section above the survey asked school administrators to answer questions based on their own attitude and perceptions, the attitude and perceptions of their Math staff, and the attitude and perceptions of their students. To accurately analyze data from each of these perspectives the categories the

Likert scale questions were split into were separated based on which perspective the questions was answered from/for. Some categories had questions that were asked of to all perspectives, and others were only asked towards a particular perspective.

Each question was assigned to the side of the Likert scale that best represented a positive attitude or perspective towards mathematics. The questions were then scored in accordance with the MAPS survey guidance.

The participant receives 1 point for a question if their answer is in the same direction – that is, in the disagree or agree direction – as the expert consensus. If the participant responds in the opposite direction of the consensus, or a neutral response is given, they receive 0 for that question (Code, Merchant, Maciejewski, Thomas, & Lo, 2016, p. #936).

Following the assigning of values for each question each participant's scores were totaled and compared to an ideal response that would have scored 1 on all questions. The use of these final scores were then used to identify what common characteristics might exist among the participants.

In addition to the “Demographic”, “Attitude and Perspective”, and “School Culture” questions there were to 4 additional short response questions that related to the “School Culture” and community engagement of each participant's school. These questions were more qualitative in nature and therefore were analyzed differently than the previously described questions. The data collected from these questions was used to gather a better-rounded picture of the school and where school priorities lie. Responses



helped to develop a deeper understanding of how participants may have scored in given Likert scale categories.

### Limitations

The intention of this study as previously stated was to gather a minimum of 20 participants to better understand trends in school culture. The efforts to gather 20 participants was stunted by the busy nature of the duties of a school administrator. These time constraints of the intended participants' responsibilities were significantly impacted due to the global COVID-19 pandemic that drastically altered the course of schooling in the year this survey was conducted.).

If you worked with vertebrate animals, your Institutional Animal Care and Use Committee (IACUC) approval number and date must be included in your methods. If you worked with Human Subjects in your research, your Institutional Review Board (IRB) approval number and date must be included in your methods.

Your methods may require a detailed description of the study site. The study site section can be a sub-section within your methods or it can be a stand-alone section just before the methods section. It is always a good idea to provide a site map of where you conducted your study.

## RESULTS

### Purpose of Study

In this chapter the results are intended to provide a picture of what the school climate of math instruction in small, rural districts in Colorado looks like based on Administrators perceptions in addition to the overarching school climate, these results also provide insight into the perceptions and attitudes towards mathematics for Administrators, Teachers and Students within each school as seen from the perspective of the school Administrators who participated in the study.

The survey results have been categorized into eight sections. The first section “Demographics” will provide a description of the participants themselves, the math staff within their school site and the surrounding community’s impact and engagement with the school. The next seven sections display the Attitudes and Perceptions of Mathematics Education in each participant's school site. These seven sections are categorized as “Sense Making”, “Growth Mindset”, “Nature of Answers”, Interest in Mathematics”, “Persistence”, “Real World Learning”, and “School Culture - As related to Math integration”.

### Demographics

Understanding the participants in this study is a necessary component of recognizing the attitudes and perceptions towards mathematics of the schools in this study. As the participants and representatives of their individual school and community

populations, the administrators represented in this study needed to have a quality understanding of their communities. As reported by the administrators, seventy five percent of them had been living and working in their surrounding communities for ten or more years. Although the distribution of the administrators varied, over sixty percent of the participants were over the age of 46. Age was not a determining factor for years lived in the community. Of the three participants who identified themselves as between the ages of 36-45, two of the three have lived in their communities for 10+ years.

Aside from information on the administrators themselves, each participant also identified demographic characteristics for the community and school environment they worked for. Considering that the majority of the administrators had lived in their communities for 10+ years and were above the age of 46, it may not be surprising that 75% of the school staff were identified in the range of 36-45, which is ten years younger than what most of the administrators identified as.

The ethnic makeup of the administrators, school staff, and student body was not anything outside of what would be expected from small rural communities in Colorado. All eight administrators self-identified as Caucasian. Eighty percent of the school staff was identified as Caucasian, while the remaining twenty percent were identified as Hispanic or Latino. As seen in the majority of rural schools across Colorado, the student population was more diverse than the staff population, but still predominantly identified as Caucasian. The Eight school participants all identified Caucasian as one of the majority ethnic student population, where two of the eight also identified Hispanic or

Latino as an additional ethnic majority, and one of the eight listed Asian as an ethnic majority in addition to Caucasian and Hispanic or Latino.

Seven of the eight schools in the study had K-12 student populations of less than 250 students and overall community populations under 500. The eighth community in the study was still categorized as a small rural school district by the Colorado Department of Education despite having a student population twice as large as the largest of the other 7 schools and up 6 times the size of the school district with the smallest student population. This 7th larger school district also had a community population of between 1,000-2,000 people as represented by the administrator. As would be expected with school districts as small as the ones in this study, the student teacher ratio in the math classrooms was quite small. The student to teacher ratio ranged from 8:1 up to 23:1, with a median ratio of 9.5:1. The larger ratio of 23:1 was associated with the largest school district as previously described. A smaller student to teacher ratio is a common factor in small rural schools. Unsurprisingly, this small ratio is often coupled with a significant number of preps for any given math teacher. As represented by this study seven of the eight districts reported 7-12th grade math teachers have 4 or more daily preps. The eighth participant reported 1 prep while only having one teacher for 7-12th grade students, this may have been a reporting error on the part of the participant due that it is unlikely that one teacher can teach all 7-12th grade math courses and have only one prep.

The economic driver of small rural schools can vary widely based on the location of each community. Three of the eight communities used tourism as an economic driver for the community. Half of the 8 communities studied, listed

Farming/Ranching/Agriculture was one of the primary economic providers. As would be expected these four schools who provided Agriculture were located in the Eastern plains of Colorado. Although these four schools varied in how far north or south in Colorado they were located, each community was located in what is commonly considered as the Eastern Plains where Agriculture is the primary economic driver.

Gender and gender non-conforming distributions across the eight participants varied but ultimately showed that as an overall average, student who represented as female made up 55% of school populations, 45% for male, and less than 1% as gender non-conforming. Five of the eight schools represented either a 50/50 split in student gender or within 4% difference between the male and female population interestingly enough what swayed the percentages in the direction of the female majority is that three of the eight schools represented 60% of their student population as female. Two of these three schools were school districts in the eastern plains of Colorado, the other two eastern plains schools represented a 50/50 split in student population. In regards to schools who reported a portion of their student population identifying as gender non-conforming, only 3 schools had gender non-conforming students. Each of these three showed 1% or less of the students as gender non-conforming. All three schools with this group of students were the three schools that used tourism as one of their economic indicators.

Generally speaking, community engagement is often a challenge for rural schools. Student buy in is often best supported by parents or the surrounding communities buy in to the school. All seven schools that provided input on community engagement with the school mentioned that the community often or only comes from school extra-curricular

activities, such as sports. Only one of the seven schools listed examples of community sponsored activities hosted at the school. The other six schools represented school sponsored activities for community engagement.

### Sense Making

The sense making questions in this study are Likert scaled questions that asked administrators to represent the options of themselves, their math teachers, and their math students. This category intended to evaluate the participants' perspectives on the nature of the personal mathematical knowledge of themselves, their math teachers and their students. Individuals tend to structure and apply their mathematical knowledge in two ways: concrete applications, or the ability to apply that concrete knowledge to abstract situations (Code, Merchant, Maciejewski, Thomas, & Lo, 2016). Those who perceive math as a set of concrete applications use math as certain tools to solve learned problem types. Whereas those who perceive math skills as a set of applicable skills, use math as a coherent body of knowledge that can be interpreted and applied equally to known and unknown problems.(Code, Merchant, Maciejewski, Thomas, & Lo, 2016).

Sense making questions asked to administrators (Table 1) either explicitly stated words that implied math was a set of concrete “formulas”, or asked questions about abstract problem solving behind concrete understanding without using words like “formulas”. When administrators were asked questions that did not explicitly mention “formulas” they were more than 85% in agreement with the ideal response, leading towards quality attitude and perceptions towards mathematics. Conversely if the

questions directly stated concrete mathematical thinking by using the word “formulas”, they were much less likely to answer with an ideal response. In these concrete questions as much as 63% of the participants answered outside of the ideal.

Table 1. Sense Making for Administrators (Green = “Ideal Response”)

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
In my opinion I do not expect formulas to help my understanding of mathematical ideas, they are just for doing calculations.	12.5%	50%	37.5%	0%	0%
In my opinion I think it is unfair to expect students to solve a math problem that is not similar to any example given in class, even if the topic has been covered in the course.	25%	62.5%	12.5%	0%	0%
In my opinion there is only one correct approach to solving a math problem.	50%	50%	0%	0%	0%
When I am solving a math problem, if I can see a formula that applies then I don't worry about the underlying concepts.	12.5%	25%	50%	12.5%	0%

In addition to the individualized questions, administrators responded to sense making questions that asked them to generalize responses focused on practices of students and teachers in their school. The data (Table 2) suggests that despite the efforts of the majority of teachers in this study to provide skills and practices to effectively make sense of mathematical processes, the vast majority of students struggle to value sense making practices. When examining the teacher and student sense making data, it is notable that zero respondents answered of the far opposite end of the ideal. Having most

of the non-ideal responses near neutral can provide opportunities for investigating what efforts by teachers have the biggest impact on bringing students closer to the ideal.

Table 2. Sense Making for Students and Teaching (Green = “Ideal Response”)

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Students at my school believe it is a waste of time to understand where math formulas come from.	0%	12.5%	25%	62.5%	0%
Math teachers at my school are satisfied if students can do the exercises for a math topic, even if students don't understand how everything works.	25%	62.5%	0%	12.5%	0%
Math teachers at my school believe that it is important to teach students how to make sense out of formulas and procedures before using them.	0%	0%	12.5%	62.5%	25%
When learning something new in math, math teachers at my school teach students to relate it to what students already know rather than just memorizing it the way it is presented.	0%	0%	25%	62.5%	12.5%

Growth Mindset

Growth mindset questions in this study are Likert scaled questions that were directed solely to the administrator’s personal perspective. These questions accessed administrators' belief about whether mathematical ability is innate (fixed mindset) or can be developed (growth mindset). Those with a fixed mindset believe that academic ability cannot be developed, but is rather a product of the person. The antithesis of a fixed mindset is a growth mindset. Growth mindset recognizes that abilities can be developed through continued learning (Code, Merchant, Maciejewski, Thomas, & Lo, 2016).



In this study growth mindset questions were directed solely towards administrators' individual perspective. Between the two questions asked (Table 3) the administrators were mostly in agreement towards a growth mindset. When asked directly about the near definition of a fixed mindset, "In my opinion being good at math requires natural (i.e. you're born with it) intelligence in math.", all eight administrators disagreed or strongly disagreed with the statement. Despite this consensus on the less direct question around fixed mindset 25% of the respondents answered outside of the ideal. In addition to the individualized questions, administrators responded to sense making questions that asked them to generalize responses focused on practices of students and teachers in their school. The data (Table 2) suggests that despite the efforts of the majority of teachers in this study to provide skills and practices to effectively make sense of mathematical processes, the vast majority of students struggle to value sense making practices. When examining the teacher and student sense making data, it is notable that zero respondents answered of the far opposite end of the ideal. Having most of the non-ideal responses near neutral can provide opportunities for investigating what efforts by teachers have the biggest impact on bringing students closer to the ideal.

Table 3. Administrators Growth Mindset (Green = “Ideal Response”)

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
In my opinion everyone is capable of understanding math if they work at it.	0%	12.5%	12.5%	50%	25%
In my opinion being good at math requires natural (i.e. you're born with it) intelligence in math.	50%	50%	0%	0%	0%

Nature of Answers

Nature of Answers questions in this study are Likert scaled questions that were directed towards the administrator’s personal perspective, and teaching math at their school is guided. These questions address the administrator’s views on the nature of solutions to mathematics problems. Individuals who have air on the non-ideal side of responses often view answers in mathematics as having a singular output and the solutions supporting these answers as having one correct process (Code, Merchant, Maciejewski, Thomas & Lo, 2016).

The four questions Nature of Answers questions (Table 4) can be separated into two sets, with the set having an administrator's individual perspective and the administrator answering from the perspective of instruction at their school site. There was more disparity between responses when the questions were directed towards the concept that mathematics is a set of memorized skills, these questions are highlighted in gray in Table 4. Although teaching from the perspective of the administrator showed higher consistency with 75% of teaching not focusing on memorized skills, only 37.5% of the

administrators personal perspective thought that understanding math meant a set of memorized skills.

Teaching from the administrator's perspective was significantly closer to their own individual perspective with the two questions that focused on math answers as a process and not just a formula or answer. All eight administrators were in agreement or neutral towards the concept the students need more than a concrete formula to understand mathematics. From the perspective of teaching at the school all teaching was heavily in the ideal for the need that students need to understand the process and steps rather than just a final result.

Table 4. Leading and Teaching towards Nature of Answers (Green="Ideal Response")

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
In my opinion understanding math means being able to recall something you've read or been shown.	25%	12.5%	25%	37.5%	0%
In my opinion the only thing a student needs to solve a math problem is a formula.	50%	37.5%	12.5%	0%	0%
When students at my school are taught, to learn math, math teachers at my school believe the best approach is to memorize solutions to sample problems.	12.5%	62.5%	25%	0%	0%
Math teachers at my school believe that showing intermediate steps for a math problem is not important as long as students can find the correct answer.	37.5%	62.5%	0%	0%	0%

### Interest in Mathematics

Interest in Mathematics questions in this study are Likert scaled questions that asked administrators to respond from their perspective of the student population at their school site. The questions answered that related to student interest in mathematics looked for a student's active willingness to engage in mathematical situations from the administrator's opinion of the students (Code, Merchant, Maciejewski, Thomas & Lo, 2016).

The three interest questions asked (Table 5) all produced responses that went heavily against the ideal responses. Each question showed that 75%-87.5% of the study participants felt that students in their school had a negative or neutral attitude towards engaging with mathematics. The question that the lowest percentage (12.5%) of agreement "Students at my school enjoy solving math problems", was the question which received the highest percentage of neutral responses (37.5%). This question was also the only question not to receive any percentage of responses in the scale furthest from the ideal.

Table 5. Students Interest in Mathematics (Green = “Ideal Response”)

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Students at my school enjoy solving math problems.	0%	50%	37.5%	12.5%	0%
Students at my school enjoy solving math problems.	0%	25%	12.5%	50%	12.5%
Students at my school only learn math when it is required.	0%	25%	12.5%	37.5%	25%

## Persistence

Persistence in Mathematics questions in this study are Likert scaled questions that asked administrators to respond from their perspective of the student population at their school site. Persistence as represented by the questions in this study were built to understand how students approach solving a non-routine mathematical problem that can lead to students struggling. For this study problem perseverance is a student’s willingness to use a set of strategies to continue attempting a problem until they make progress, and lack of persistence in no way is a bi-product of anxiety or laziness (Code, Merchant, Maciejewski, Thomas & Lo, 2016).

The administrator’s responses (Table 6) from the student perspective on persistence were neutral and responses that were on the same side as the ideal response. These neutral and ideal responses accounted for 50% (12.5% neutral and 37.5% in ideal) of the participants in both questions. Half of the students in participating schools got upset and gave up easily when presented with a challenging math problem. Administrators in the study showed that, in the small rural schools across Colorado who

participated in the study, students struggle with “sticking with it” when it comes to struggling with a math concept.

Table 6. Students Persistence in Mathematics (Green = “Ideal Response”)

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Students at my school get upset easily when they are stuck on a math problem.	0%	37.5%	12.5%	50%	0%
If students in my school are stuck on a math problem for more than a few minutes, they give up.	0%	37.5%	12.5%	37.5%	12.5%

#### Relationships with Mathematics and the Real World

Relationships with Mathematics and the Real World questions in this study are Likert scaled questions that asked administrators to respond from their perspective of the student population, and teaching occurring at their school site. These questions are directed to identify the student population’s ability to recognize connections between mathematics and other contexts, as well as if teaching is done to develop these connections (Code, Merchant, Maciejewski, Thomas & Lo, 2016).

Seventy five percent of teaching in the studied school districts incorporated learning that was intended to develop students’ ability to connect mathematics to real world contexts (Table 7). The remaining 25% of the respondents were neutral about whether teaching at their school is done in a way that changes students' ideas about how the world interacts with mathematics.

Despite teaching efforts to connect mathematics to the real world administrators who spoke from the perspectives of their schools students represented that 75% of the

student population did not believe there was a connection between school mathematics and the real world or that reasoning skills helped them in their everyday lives. Despite this disconnect between what was being taught and student perspectives 75% of the respondents felt neutral about students at their school believing that reasoning skills in math were helpful in everyday life.

Table 7. Student perception and Teaching toward Real world relationships (Green = “Ideal Response”)

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Students at my school feel that school mathematics has little to do with what they experience in the real world.	12.5%	12.5%	25%	37.5%	12.5%
Students at my school believe that reasoning skills used to understand math can be helpful to them in their everyday life.	0%	0%	75%	25%	0%
Math teachers at my school teach in way that learning math changes students ideas about how the world works	0%	0%	25%	62.5%	12.5%

### School Culture towards Math Culture

Due to the often individualized nature of school culture the questions in this study are a combination of quantitative Likert scale questions and qualitative open ended responses questions. These quantitative questions asked administrators to respond from their perspective on how integrated math curriculum and the non-math teachers comfortability towards math. The qualitative questions asked administrators to respond

from their perspective on what was the schools overarching school culture goal and what challenges they currently are having or foresee having in obtaining that goal. Effective school cultures are ones that promote social, emotional and physical well-being through the respectful engagement and school vision of all stakeholders (Cobb 2014; MacNeil, Prater and Busch 2009; “National School Climate Center: School Climate” 2014).

According to the administrators at the participating schools only three of the eight participating schools (37.5%) regulatory integrated math across contents in their school (Table 8). The remaining five schools all felt that their school did little to integrate math skills across content areas. These responses towards math integration followed closely along lines of what percentage of the non-math teachers felt comfortable supporting students with basic Algebra skills. Despite having the same number of schools who integrate math as the schools whose non-math teachers feel comfortable with basic Algebra skills, those who answered in the ideal for both questions were not entirely the same. Two of the three schools who integrated math skills across content areas also had non-math staff who felt comfortable with basic algebra skills. The third school who had integrated math across contents identified their non-math teachers as neutral towards comfortability with basic Algebra Skills. It is surprising that these two questions did not have the same results from participants in regards to where responses matched with the ideal.

Table 8. School Culture towards Math Culture (Green = “Ideal Response”)



	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Math skills are integrated regularly across contents.	0%	62.5%	0%	37.5%	0%
The non-math teachers at my school are comfortable with supporting students with basic Algebra skills.	0%	32.5%	25%	25%	12.5%

School culture goals are often a reflection on the community and what ails the community surrounding small rural schools often ails the school (DeYoung 1995). Based on the seven of the eight participants who responded to the open ended question, “What are your goal/s related to school culture?” participants used similar language to identify only two different types of goals. Participants identified school goals that were either focused on students identifying their own intrinsic potential, and/or students’ appropriate behavior and actions to others. Based on the results there is an implied synergy between schools who integrate math and whose goals focus on intrinsic potential, according to this study the three schools who identified math integration as occurring in their school also mentioned school goals around intrinsic potential of students. Six of the seven participants who responded to the open-ended questions identified challenges towards achieving school culture goals as related to a lack of student and family/community buy-in towards the school goals.

## DISCUSSION

This chapter of the study on the attitude and perceptions towards mathematics education in small rural schools across Colorado is intended to discuss the results collected from the survey completed by school administrators serving in these schools. The administrators were asked to answer questions on the attitudes and perceptions of themselves, teachers at their school site and students at their school site. The survey questions and corresponding results were separated into the following eight sections “Demographics”, “Sense Making”, “Growth Mindset”, “Nature of Answers”, Interest in Mathematics”, “Persistence”, “Real World Learning”, and “School Culture - As related to Math integration”. Each of these sections and their overall context is explained in more detail in the previous results section of this study.

Throughout the eight sections, questions were asked directly towards the administrator’s individual perspective, the perspective of teachers from the guise of the administrator, or the perspective of the students from the guise of the administrator. In many categories the administrator was asked to answer questions from more than one of these perspectives.

The discussions to follow are set around the categories listed above and how this study connects to already existing research done for this study. The literature that preceded this study helped to inform discussion on “The Demographics of Small Rural Schools”, and “The Climate of Rural Schools”. Considering this studies focus on how school climate impacts attitudes and perceptions of mathematics “The Climate of Rural

Schools” section is broken down into the following discussions: Attitudes and perceptions of mathematics towards “Sense Making”, “The Growth Mindset and how it Relates to other Perceptions”, and “Real World Connection”. Due to the limited scope of this study many of the sections contain recommendations for further research. This chapter of the study is drawn to a conclusion with a summation of how school climate goals may tie back to math attitudes and perceptions.

### Demographics of Small Rural Schools

Rural communities across the United States of America were traditionally founded in areas where natural resource production or extraction was the primary way of life. These communities often developed along transportation routes that allowed them to deliver their goods to larger communities. Rural communities often are significantly different from urban schools due environmental, economical, and cultural traditions. Many rural communities in the United States have a largely homogeneous population. This population is often tied to the community due to generational characteristics (DeYoung 1995; Sherman & Sage 2011). Aside from common demographic characteristics in rural areas across the United States, the schools in rural areas share similar instructional characteristics as well. One of topics informed by literature and covered in this research is with how student education is positively impacted, is the smaller school/class size environment (Achilles, Finn and Bate-Bain 2002).

The eight schools in this study shared similar characteristics to those described by researchers who study rural schools across the United States. All eight schools in this

study showed a homogeneous population of students and staff. Each school represented a largely Caucasian population of staff and students. These schools were located in primarily agriculture or natural resource dependent communities, those schools that were located in non-agricultural communities identified tourism as a primary industry. These communities that identified tourism as a primary industry were communities that were originally founded on the extraction of natural resources, but evolved based on changing situations.

The results of this study also seemed to suggest that individuals in the community were tied to the community in a way that kept them there for an extended period of time, likely creating generational ties. This is represented by the data that shows that seventy five percent of the respondents have lived in their given community for ten or more years. Seven of the eight schools in this study had student populations of under 250 students. These small rural schools followed the trend that literature suggests about the benefits and possible down sides from small populations (Deutsch 2003; DeYoung 1995). Between the eight schools in the study the median student to teacher ratio in a math classroom was 9.5:1. As suggested by the literature these schools also followed a similar pattern of small student to teacher ratios often paired with a high number of preps. As represented by this study seven of the eight districts reported 7-12th grade math teachers have 4 or more daily preps.

The results of this study conclude that previous data on rural schools across the United States is accurate in stating that rural communities are often homogeneous populations of individuals who live in the communities for generations. Although much

of the literature reviewed in this study is nearly twenty years old at this point, this study albeit small in scope seems to point to data that corresponds with this depiction of small rural communities.

The eight schools in this study are obviously a small portion of the overall picture of rural schools across Colorado and an even small portion of those across the whole United States. Any conclusions based on this study would need to be expanded to a larger set of schools to provide validity to any conclusions beyond what is observed in this study.

### School Climate of Rural Schools

Effective school climates are ones that promote social, emotional and physical well-being through the respectful engagement and school vision of all stakeholders (Cobb 2014; MacNeil, Prater and Busch 2009; “National School Climate Center: School Climate” 2014). A school administrator’s primary objective should be to cultivate and promote a positive school climate conducive to learning (Frascon, 2011). Students learn many of the benefits of a quality school climate from the structures and relationships that they observe and experience in school (Cobb, 2014). Knowing that school climate starts in the administrator’s office and works its way down to the instructional staff and students (Cobb, 2014; Frascon, 2011). Administrators should take time to focus on some key aspects of the school climate to increase engagement and interest the educational system (Cobb 2014; Frascon, 2011).

### Attitudes and perceptions of mathematics towards “Sense Making”

In this study school culture was examined as it relates to math instruction in small rural schools across Colorado. The eight school administrators often respond from a perspective outside their own and in the lens of students and staff at their school site. Some of the more compelling discussions can arise when all three perspectives are asked questions with the same underlying concept of “Sense Making” in mathematics. These “Sense Making” questions investigated how individuals tend to structure and apply their mathematical knowledge in two ways: concrete applications, or if they use their ability to apply that concrete knowledge to abstract situations.

Administrators themselves seemed to represent a desire to think abstractly with 85% of them in agreement with ideal responses when the questions used language that did not explicitly lend itself to concrete mathematical thinking. When questions contained concrete words like “formulas”, administrators were less in sync with the ideal responses. This disconnect may likely be due to administrators' lack of mathematical experience. Further research on the administrator's educational background or an adjustment to survey questions away from familiarly concrete language could provide valuable data on if this truly a trend towards concrete thinking or rather just a set of responses that give implied answers based on word choice.

From the perspective of administrators, math teaching at their schools was done to create mathematical thinkers who saw math abstractly as an applicable set of skills rather than a concrete set of steps and outcomes. Despite the thinking and teaching that occurred at each school site around creating abstract mathematicians, most students at the school

leaned towards an interest in concrete thinking over the abstract application of mathematics. Although only one of the eight schools answered in the ideal side of the Likert scale for students “Sense Making”, the remaining 7 schools represented students as being neutral or within one from neutral on the Likert scale.

Considering that each school site had similar responses to administrator and staff attitudes and perspectives towards “Sense Making” in mathematics, it is worth a broader study to evaluate what effect this thinking has on standardized test scores. A broader study could provide insights to the following questions: “Is this Administration and teacher perspective common across Colorado?” and “Do these perspectives affect students' standardized test scores?”.

This study is just a snapshot of the perspective of mathematical thinking at this point in time. Further study could possibly provide clarity on how this administrative thinking and common teaching perspective affects the students “Sense Making” perspective. A long term study going back to the same schools might be able to answer if this type of teaching moves students any closer to the ideal of applicable abstract thinking.

#### The Growth Mindset and how it relates to other Perceptions

As referenced in the literature schools climate is a true reflection of the efforts of those in charge of the school. The belief that all students are capable of learning and developing academically, also known as a growth mindset (Code, Merchant, Maciejewski, Thomas, & Lo, 2016), certainly has a trickle-down effect in the school climate. The results of this study asked administrators to speak on their own individual

attitudes of the learning capabilities of their student population. Although responses in this study on growth mindset varied based on the question asked of the administrators, the overall consensus is that school administrators in this study have a growth mindset towards their student populations' ability to learn math.

Despite the administrators' similar feelings towards math being a learned skill and not associated with inherent ability, other learned math skills seemed to be missing in the student populations of this study. Administrators were not asked growth mindset questions from the perspective of teaching at the school, but they were asked questions about students' perspectives on “Persistence”, and “Interest” in school based mathematics. This study showed in addition to administrators' focus on a growth mindset, teachers at the participating schools work with students to identify and work with math as an abstract set of skills that can be applied to concrete and abstract situations. From the administrators perspective students at all eight schools teach students to show intermediate steps for math problems and seven of the eight teach students to process behind mathematical steps and not just memorization of the steps. In addition to the steps teachers in these schools take to help students make sense out of problems, seven of the eight administrators identified that teachers in their school take the time to establish “Sense Making” procedures and do not teach math as a memorization of facts.

Students in the eight schools studied generally had negative attitudes and perceptions towards mathematics education, from the perspective of the administrators. It is worth noting that of the student perspective questions, “Persistence” was the category that scored the highest number of student responses in the ideal with additional



responses with students feeling neutral. Considering the efforts of teachers to work with students, in the study schools, on developing academic knowledge that views mathematics as a set of applicable steps to abstract situations, do these teaching strategies positively affect a student's persistence with mathematics since they don't view a problem from a concrete view? A further study that would look deeper into teaching strategies and how they impact students' persistence in mathematics could possibly answer the question.

### Real World Connection

In mathematics, real world connection often plays a role in student engagement with school based mathematics. School based mathematics is often theoretical in practice due to the fact that much of the applied mathematics requires individuals to have a strong base set of skills. In this study administrators were asked to answer questions from the perspective of the students, and if their teachers teach in a way that changes a student's ideas about how the world works.

Student perspective and teaching practice were exact opposites of each other in this study. Seventy five percent of the administrators felt their students did not feel that mathematics was connected to their real world or that the learning would be helpful to them in the real world. In contrast seventy five percent of the administrators perceived that their teachers taught in a way that changed students' ideas about how the world works.

Despite this discrepancy it is worth noting that seventh five percent of the responses from the student perspective on whether mathematics is useful in their

everyday lives and feel into the neutral responses. This does imply that teachers' efforts to teach in a way that changes students' ideas about how the world works might have a positive impact on how useful the students perceive mathematics is in their everyday life.

## CONCLUSIONS

The results of this study have validated many common conceptions about mathematics in small rural schools that is noted in the literature. As previously mentioned the eight schools in this study are a largely homogeneous population that seems to have little variation from the literature that was written on rural schools, even if the literature is not recent. In addition mathematics engagement and buy in is always a challenge, many schools struggle with overcoming this barrier. The schools in this study showed that despite their close knit communities and small student populations, mathematics engagement is still a struggle for teachers and administrators in these schools.

Students' interest and engagement in mathematics was low across nearly all of the eight participants. Teachers and administrators seemed to counterbalance this lack of interest and engagement with their own teaching strategies and attitudes towards mathematics. At the conclusion of the survey, participants were asked to identify their individual school culture goals. Participants identified school goals that were either focused on students identifying their own intrinsic potential, and/or student's appropriate behavior and actions to others. Based on the results there is an implied synergy between schools who integrate math and whose goals focus on intrinsic potential, according to this study the three schools who identified math integration as occurring in their school also mentioned school goals around intrinsic potential of students.

Further research with a broader scope may be able to investigate how long the schools who are working towards intrinsic potential have been doing so, and does this

school wide focus correlate to more positive attitudes and perceptions towards math and other learning. It is entirely possible that those schools who have set school goals based on intrinsic potential may be the same schools who develop more students who have a positive outlook on school based mathematics. Research that is directed toward comparing the long term effects of these two different goals may lead to impactful conclusions.

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## APPENDICES

### Appendix A. Problem statement and Definitions

#### Problem Statement and Definitions

Ideal: Students attending isolated rural schools have small student to teacher ratios and therefore benefit from more quality teacher interaction. The high quality of student and teacher interactions leads to a positive increase in school and community climate, driving increased performance on state and university based standardized testing.

Real: Many isolated rural schools have differing programs that provide character education, increased community involvement, after-school programs, increased student involvement, and limit students and families from being sheltered. These opportunities severely impact the school climate and overall performance of each individual student. These issues may have a stronger negative impact on isolated rural schools than on larger surrounding schools.

Consequence: The poor school climate, and surrounding communities differing cultural views weight down performance based testing scores in isolated rural schools.



Research: I propose to examine the impact of community opportunities such as character education, community involvement, and after-school programs in isolated rural schools and how they affect individual math prejudices that impact performance on standardized testing. Throughout my research I will research isolated small schools' strategies for establishing and maintaining an effective overall climate that positively impacts mathematics performance. I will be taking in-depth looks at specific isolated small schools and why they have or have not seen academic success in mathematics.

## Definitions

Isolated rural schools: Kindergarten through 12th grade schools that have less than 250 total students and are located one or more hours away from a city of 80,000 or more.

Small student to teacher ratios: Schools with a maximum student to teacher ratio of 1:15.

Teacher interactions: Student to teacher interactions in small groups of 10 or less.

Community Climate: The community values, concerns, tone, ideology, and atmosphere of the surrounding community and how it impacts schools.

School Climate: The school values, concerns, tone, ideology, and atmosphere of the school and how it impacts school performance on standardized testing.

State Standardized Testing: Testing used by states to measure how schools are performing based on NCLB all schools should be at a 100% proficiency rating. Until common core is finalized tests differ from state to state.

University Standardized Testing: Tests used by higher education to determine how well students are prepared for further education. Commonly used tests would be the ACT and SAT.

## Appendix B. Recruitment Email

Hello,

I am a current Colorado administrator, former rural school teacher and a graduate student at Humboldt State University. I am requesting your support with the collection of my thesis data. My methods of research contains a brief 15-20 minute survey of school administrators in schools that are identified by CDE data as small rural schools.

I would like to request your participation to share your experience and understanding of the needs of your community's approach to mathematics education. Participation is completely voluntary, and you can decline or remove yourself from the research process at any time. If you choose to participate, your identity as a research participant will remain anonymous as well as the identity of your school site.

The digital survey process can be completed at a time that is convenient for you and will take approximately 15-20 minutes.

If you are interested and available, please access the survey at this link. Below is some background information about me and my research, should you like to know more.

I am a Humboldt State University student, but live in Littleton, Colorado. I have been a math teacher/Assistant Principal at McLain Community High School in Lakewood for the past 5 years and have taught in the Denver metro area for 2 years prior to my time at McLain. Before teaching in the Denver area I was the sole math teacher in the small rural district of Weldona, Colorado for 1 year and the sole math/PE teacher in a small rural district in northern California for 3.5 years. As part of my studies for a Master's in

Education, I am conducting a research study about what defining characteristics can be used to measure mathematics proficiencies for small rural schools.

Thank you for your time. If you have any questions you may reach me by email at [tje105@humboldt.edu](mailto:tje105@humboldt.edu) or by phone at 313-952-0995.

## Appendix C. Informed Consent

### Online Informed Consent

You are invited to participate in a research study, which will involve a survey to measure your background and preferences to school and mathematics in general. Following the completion of the study a few teachers, parents and students will be randomly selected to be a part of a brief interview to further investigate mathematics and school preferences. My name is Timothy Ebendick and I am a Master's in Education Candidate at Humboldt State University School of Education. The purpose of this research is to identify trends in school culture that impact student development in mathematics.

If you decide to participate, you will be asked to complete a survey. Your participation in this study will last 30 minutes for the survey. All names and descriptive information will be removed from quotations to protect the participant's anonymity. There are limited possible risks involved for participants. These risks involve the use of individual perceptions to guide research. Benefits of this research are the identification of key characteristics that guide performance in mathematics to better benefit your school.

Your participation in this project is voluntary. You have the right not to participate at all or to leave the study at any time without penalty or loss of benefits to which you may otherwise be entitled. If at any time you wish to withdraw from the study data collected that has identifiable characters to you will be removed.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Measures to ensure your confidentiality individual survey respondents will provide pseudonym names upon consent these pseudonyms will be used to complete the survey.

The data obtained will be maintained in a safe, digital secured format and will be destroyed after a period of within 3 year after the study is completed. This consent form will be maintained in a safe, password protected location and will be destroyed after a period of three years after the study is completed.

If you have any questions about this research at any time, please call or email me at [tje105@humboldt.edu](mailto:tje105@humboldt.edu) or by phone at 313-952-0995, or Libbi Miller at [Elizabeth.Miller@humboldt.edu](mailto:Elizabeth.Miller@humboldt.edu) or by phone at (707) 826-3734.

If you have any concerns with this study or questions about your rights as a participant, contact the Institutional Review Board for the Protection of Human Subjects at [irb@humboldt.edu](mailto:irb@humboldt.edu) or (707) 826-5165. Your signature below indicates that you are at least 18 years old and have read and understand the information provided above, that you willingly agree to participate, and that you understand that your participation is voluntary and you may stop at any time.

\* Required

1. Do you consent to participate? *Mark only one oval.*

☐

Yes

☐

No *Skip to question 47*

☐

Other:

## Appendix D. Research Survey

Demographic Information (Individual)

2. Name of school you work for?

School name requested for follow up purposes and to compare final data to state identified math performance. This data will be de-identified.

3. Pseudonym name \*

Please provide a pseudonym for yourself that will be used to maintain anonymity throughout the research process.

4. What is your age?

*Mark only one oval.*

☐ 25 - 35

☐ 36 - 45

☐ 46 - 55

☐ 56 - 66

☐ 66 +

☐ Prefer not to answer



5. Please specify your race/ethnicity (select all that apply to you)

*Check all that apply.*

- ☐ Caucasian
- ☐ African-American
- ☐ Latino or Hispanic
- ☐ Asian
- ☐ Native American
- ☐ Native Hawaiian or Pacific Islander
- ☐ Two or more
- ☐ Prefer not to say

Other: ☐ \_\_\_\_\_

6. How long have you lived in the community in which your school is located?

*Mark only one oval.*

- ☐ 0 years (live outside of community)
- ☐ 0 - 5 years
- ☐ 5 - 10 years
- ☐ 10 + years

Demographic Information (School)

7. Please specify the majority race/ethnic identities of students in your school (select all that apply to your school).

*Check all that apply.*

- ☐ Caucasian
- ☐ African-American
- ☐ Latino or Hispanic
- ☐ Asian
- ☐ Native American
- ☐ Native Hawaiian or Pacific Islander
- ☐ Two or more
- ☐ Prefer not to say

Other: ☐ \_\_\_\_\_

8. What percentage of your student population identifies as female?

9. What percentage of your student population identifies as male?

10. What percentage of your student population identifies as Gender non-specific/non-conforming?

11. Please specify the majority ethnicity of teachers in your school (select all that apply to your school).

*Check all that apply.*

- ☐ Caucasian
- ☐ African-American
- ☐ Latino or Hispanic
- ☐ Asian
- ☐ Native American
- ☐ Native Hawaiian or Pacific Islander
- ☐ Two or more
- ☐ Prefer not to say

Other: ☐ \_\_\_\_\_

12. What is the average age of your staff?

*Mark only one oval.*

- ☐ 20 - 35
- ☐ 36 - 45
- ☐ 46 - 55
- ☐ 56 - 66
- ☐ 66 +
- ☐ Prefer not to answer

13. What is your school proximity drive time to a Major Metropolitan Center?

*Mark only one oval.*

- ☐ 0 - 1 hour
- ☐ 1 - 2 hours
- ☐ 2 - 3 hours
- ☐ 3 - 4 hours
- ☐ 4 + hours

14. What best describes the population size of the community your school is located in?

*Mark only one oval.*

- ☐ 0 - 500 people
- ☐ 500-1000 people
- ☐ 1000-2000 people
- ☐ 2000-3000 people
- ☐ 4000-5000 people
- ☐ 5000+ people

15. How many math teachers serve your 7-12th grade teachers?

*Check all that apply.*

- ☐ 1  
☐ 2  
☐ 3  
☐ 4+

16. How many preps does your average math teacher cover in a day? (Ex. If a teacher only teaches Algebra, Geometry, and an English class, but teaches each of those classes twice that is 3 preps.)

*Check all that apply.*

- ☐ 1  
☐ 2  
☐ 3  
☐ 4  
☐ 5  
☐ 6+

17. On average what is the student to teacher ratio for math classes at your school?

18. What/Who is the primary economic driver or industry for the families who attend your school?



1            2            3            4            5

Strongly Disagree   ☐   ☐   ☐   ☐   ☐   Strongly Agree

- Mark only one oval.*

1            2            3            4            5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

- Mark only one oval.*

1            2            3            4            5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

26. When I am solving a math problem, if I can see a formula that applies then I don't worry about the underlying concepts.

*Mark only one oval.*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

27. In my option the only thing a student needs to solve a math problem is a formula.

*Mark only one oval.*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

## Students Attitudes and Perceptions toward Mathematics

This is a survey of your students attitudes and perceptions about mathematics; these statements all have scaled responses from 1-5. 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree. Please choose the response that matches the students at your school.

28. Students at my school enjoy solving math problems.

*Mark only one oval.*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree



29. Students at my school avoid solving math problems when possible.

*Mark only one oval.*

	1	2	3	4	5	
<b>Strongly Disagree</b>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<b>Strongly Agree</b>

30. Students at my school only learn math when it is required.

*Mark only one oval.*

	1	2	3	4	5	
<hr/>						
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

31. Students at my school get upset easily when they are stuck on a math problem.

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

32. If students in my school are stuck on a math problem for more than a few minutes, they give up.

*Mark only one oval.*

1                  2                  3                  4                  5

---

Strongly Disagree    ☐        ☐        ☐        ☐        ☐        Strongly Agree

33. Students at my school believe it is a waste of time to understand where math formulas come from.

Mark only one oval.

	1	2	3	4	5	
<hr/>						
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

34. Students at my school feel that school mathematics has little to do with what they experience in the real world.

Mark only one oval.

	1	2	3	4	5	
<hr/>						
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

35. Students at my school believe that reasoning skills used to understand math can be helpful to them in their everyday life.

*Mark only one oval.*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

36. In my opinion I think it is unfair to expect students to solve a math problem that is not similar to any example given in class, even if the topic has been covered in the course.

*Mark only one oval.*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

### Students Attitudes and Perceptions toward Mathematics

This is a survey of your teachers attitudes and perceptions about mathematics; these statements all have scaled responses from 1-5. 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree. Please choose the response that matches the teachers at your school.

37. Math teachers at my school are satisfied if students can do the exercises for a math topic, even if students don't understand how everything works.

*Mark only one oval.*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

38. Math teachers at my school believe that it is important to teach students how to make sense out of formulas and procedures before using them.

*Mark only one oval.*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

39. Math teachers at my school teach in way that learning math changes students ideas about how the world works

*Mark only one oval.*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

1            2            3            4            5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

- Mark only one oval.*

1            2            3            4            5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

- Mark only one oval.*

1            2            3            4            5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

