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Solving the Achievement Gap in Mathematics: It's Not Just a Numbers Game

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Abstract

I conducted my research reflecting the opinions and thoughts of my colleagues and administrators. I exposed them to questions about their experience educating a diverse group of students, how they feel the impact of the achievement gap in mathematics has been exposed in their classrooms and what they are doing as educators to help close it. They discussed how difficult and challenging it can be to teach students who live in poverty and come from difficult home circumstances. They shed light on how to motivate students when many other social factors going on in their lives seem more important. Above all, they reacted to the impact of the Common Core and the rigorous standards, and spoke positively about their hopes for the future of educating students. All participants in phase one and phase two of the data collection all shared one common opinion - they educate for the children they teach and make decisions that will have a positive impact on their lives. They are hopeful that the gap will diminish in their teaching careers, and that they can create a positive learning environment

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Solving the Achievement Gap in Mathematics:
It's Not Just a Numbers Game

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Abstract

I conducted my research reflecting the opinions and thoughts of my colleagues and administrators. I exposed them to questions about their experience educating a diverse group of students, how they feel the impact of the achievement gap in mathematics has been exposed in their classrooms and what they are doing as educators to help close it. They discussed how difficult and challenging it can be to teach students who live in poverty and come from difficult home circumstances. They shed light on how to motivate students when many other social factors going on in their lives seem more important. Above all, they reacted to the impact of the Common Core and the rigorous standards, and spoke positively about their hopes for the future of educating students. All participants in phase one and phase two of the data collection all shared one common opinion - they educate for the children they teach and make decisions that will have a positive impact on their lives. They are hopeful that the gap will diminish in their teaching careers, and that they can create a positive learning environment.

Solving the Achievement Gap in Mathematics: It's Not Just a Numbers Game.

It is widely known that there is an achievement gap in mathematics performance in low performing schools. Closing the gap has been studied extensively with numerous methods, research and analysis with varying degrees of success. The impact of poverty, school funding, home environment and teacher resources have all been identified as causing factors of the gap. In this research, the literature review I conducted focused on three main research threads: classroom culture: the structure and positive strategies teachers are implementing in their classrooms. The second thread is home and family environment: the effect poverty and diversity plays on student performance. The third thread is teacher qualifications, experience, salary and resources. The purpose in the research was to determine what strategies and practices contributed the most in closing the achievement gap.

In my research, the first phase consisted of a questionnaire which I distributed to my colleagues at Tree Hill Middle School. The Middle School, grades six through eight, has a total of eight math teachers, two teachers in grade six, and three teachers in both seventh and eighth grade. In my second phase, I interviewed a representative from an urban district in Upstate New York about her perspective on the issue, and the steps the district has taken to proactively close the achievement gap.

The results of the study illustrated that teachers and administrators are doing the very best they can, working collaboratively and efficiently to come up with new techniques, creative activities and interesting ways to project the information to their students. Although many teachers feel the pressure of the Common Core standards and new State regulations, their students are still the main priority. Students are the motivating factor behind all of this work.

Researchers Stance

As the researcher, I developed the questionnaire, facilitated it to my colleagues, compiled the data and completed the necessary analysis. The questions in phase one focused on the practices and methods that the math teachers at Tree Hill Middle School grades six through eight are using to close the achievement gap in mathematics, and make math more engaging to what has been an underachieving subject to the student population. I took the questionnaires and constructed phase two, where I interviewed a representative from an urban district in Upstate New York. My focus of the interview was to learn what was being done on a broader scale in an urban district, and to determine how they achieve positive outcomes.

I am currently certified in Middle School Mathematics Education, grades five through nine. I am currently enrolled in a program working towards earning a Master's of Science in Special Education. While I am working towards this certification, this is my first year of teaching, as I am employed as a sixth grade math teacher in Upstate New York where I am conducting my study.

Literature Review

The critical question of the achievement gap being one of disparities in learning and opportunity is discussed in detail by Flores (2007). Flores uses survey data from six different urban school districts to show that the gap in mathematics performance, especially for African American and Latino students, has been slow to close. Flores (2007) argues "it important to analyze the practice and the structure of classrooms, schools, and districts to seek responses to two important questions: why do such disparities in school achievement exist? and what are the causes of these gaps?" (p.32). This is an unconventional idea. Flores does not rule out that there are conventional reasons, such as family structure and income that affect the gap, but rather

sheds light on the fact that white students often have more access to experienced, qualified teachers, higher expectations and fewer out-of-field teachers serving as their primary mathematics instructors. In low-performing schools, the “minority” students are often in the majority. Instructors teaching these students find it difficult to relate to their culture, experiences and struggles. In their classrooms, teachers sometimes feel helpless to understand their background, which results in lower expectations when teaching higher level mathematics. Another issue this article brings attention to is that lower expectations often result in less feedback from teachers and grade inflation for substandard work. Students in urban settings are often passed along to the next grade level without mastering the higher level mathematic skills of their white peers. Teachers essentially give up in this process when they see low work ethic, lack of goal setting and little or no academic support from home. Flores addresses equitable opportunities as another focus of his article, and portrays this idea by presenting actions within and beyond the classroom and school. A position taken by the National Council of Teachers of Mathematics (NCTM) that Flores quotes directly discusses the idea of classroom competence. According to Flores (2005), “all students need the opportunity to learn challenging mathematics from a well-qualified teacher who will make connections to the background, needs and cultures of all learners.” (p.37) His study shows strong data around assigning homework, resulting in a positive effect on achievement. Another factor: teachers need to push and expose students of all backgrounds to take more advanced courses. However, teachers need to be flexible as to when homework is due, but still hold the expectation accountable that it needs to be completed. Building a classroom community where teachers understand their student’s life style outside of the four walls of the classroom helps garner a sense of trust and support between the teacher and student. The educator can modify deadlines and differentiate instruction to support their students

and their social lives, but also set expectations that the students can meet. Flores's (2007) argument about reframing the opportunity gap can be summarized by his statement

Reframing the problem in terms of opportunity gaps focuses attention on examining the lack of access to the very resources that contribute to the success of more privileged students. This focus clarifies what actions need to be taken to guarantee that all students do indeed have opportunities to receive a high quality education. (p. 40)

This piece of research highlights how complicated the achievement gap is and how viewing it as a question of opportunity provides a possible solution. There will always be more than one way or path teachers go down to build structure and promote positive learning for all students as a way to close the achievement gap.

The positive view to the previous article is viewed in a more pragmatic lens according to Jerome Taylor (2005), who points out that even though there has been success with closing the achievement gap in mathematics and science, there has also been pitfalls, pratfalls and evolving opportunities. Taylor conducted a study in the Pittsburgh schools that showed how growth and average test scores do not always indicate success, as he found gaps within sub-groups were widening. Taylor recommends that "Religious and community leaders and citizens must insist that (a) achievement data are disaggregated by subtrends within race and (b) instructional strategies be put in place to revise negative transitions and promote positive transitions for students, Black and White" (p. 263). Instructional strategies and transitions need to be evident in the classroom to avoid race bias and promote a sense of equality. Not only educators, but community leaders and citizens need to be less naive, and not fall into the trap of thinking that there is more success than there actually is. An alternate view, argued by Pedro Noguera (2012)

shows that we can create conditions of positive learning where race and class no longer predict student achievement, which could result in closing the gap. Noguera talks about the confusion among policy makers and educators across the country, when he correctly points out that there are other factors beyond race which often distorts the discussions around the achievement gap. Noguera's (2012) article states the following:

Consider the fact that not all White students are high achievers. Indeed, in the Appalachian regions of Pennsylvania and Southern Ohio, African American students often achieve at higher levels than White Students. In states like Maine, Vermont and West Virginia where there are relatively few minority students, there are large numbers of White students who drop out of school, perform poorly on standardized tests and do not enroll in college. Yet, because the policy discourse about the achievement gap has framed the issue largely in racial terms, policy makers and many educators have overlooked the fact that many students across the country are not receiving an education that would adequately prepare them for college or adulthood. (p. 3)

This perspective helps us frame the achievement gap and realize the broader view of *who* is closing the achievement gap and *how* the achievement is actually being closed. Noguera makes a passionate argument for changing the national strategy by putting less emphasis on race.

The notion of reframing the gap is further researched and developed by Robert Evans. He argues that putting the achievement gap focus solely on schools ignores outside factors. When researchers and policy makers focus only on schools, they ignore fundamental changes in society that are needed to eliminate the achievement gap. Evans provides numerous examples about the impact of race before and beyond school, in addition to the limits of what schools can do. He

argues (2005) that often “Low income kindergarteners, (a group that includes large numbers of black and Hispanic children) typically start school often a year behind others in reading and with a vocabulary of 5,000 words (as opposed to 20,000 for their middle-class peers)” (p. 585). These students have less exposure to a rich vocabulary of words. The importance of vocabulary and reading extends to mathematics, as Common Core requires higher standards and the ability to explain reasoning using words. Evans goes on to other effects the achievement gap has on black and Hispanic students. For instance, changing schools more often, watching more television, having lower levels of parent involvement, higher rates of low birth weight, lead poisoning and peer cultures that appear to exert a negative influence on performance (Evans, 2005, p.586).

Evans (2005) closes this section of his research with a reflection on the source of these factors:

This last nonschool factor brings us back to the question of racism and its chicken-and-egg intricacies. Do minority students perform and behave as they do because of the ways they are treated and taught in school, or they are treated and taught as they are because of the ways they perform and behave? (p. 586)

Evans poses a strong question that many schools and teachers struggle with. He makes it clear that there is more than one blame for the achievement gap widening, but recognizes that there are limits to what schools can do, and argues that schools should not be alone in fixing the problem.

The focus of the achievement gap in mathematics education is strongly addressed by Rochelle Gutiérrez. Gutiérrez (2008) encourages developing a more balanced approach in mathematics. She reframes the achievement gap as a problem of unequal opportunities and recognizes the symptoms of the achievement gap are not enough. Educators and policy makers need to understand and address the underlying causes and realize that the gap is slow to close.

The opportunity gap as discussed by Gutiérrez can be addressed by teachers who emphasize reasoning and use more advanced technology in classrooms, which can promote higher level thinking. Additionally, not using out of field teachers to teach mathematics, who would pass along sub-standard work, will help close the achievement gap. Teachers who have a degree in mathematics are stronger candidates and are well suited for teaching the higher level math that all students need to know.

Gutiérrez (2008) makes a passionate point for mathematics educators when she states, “If we are serious about addressing equity in mathematics education, we must develop a more balanced approach for the future. A focus on advancement and the context of learning can serve as a humanizing tool in mathematics education research” (p. 362). She builds hope for mathematics education teachers that there can be success in the face of the achievement gap. Advancing students in the right direction by bringing context shown at a higher level in math classrooms can serve as a method to address the achievement gap.

Family and home environment can have an effect on the widening achievement gap in mathematics education. School districts have worked to improve student success in mathematics by implementing strategies to improve curriculum, standards and best practices. However, the real struggle has been how to incorporate families, especially those living in poverty, into higher level mathematics. These families need to be offered support for their children, mathematical strategies to investigate and tools to work with on how to understand the higher level mathematics, instead of the mathematics they learned years ago. Sheldon, Epstein and Galindo (2010) conducted a study by using data from 39 schools to assess the effects of family and community involvement activities on school levels of math achievement. Indeed, they claim that a child’s home environment and family involvement does have a direct association with

mathematics performance. However, it is not the location of the school that determines this, whether an urban or suburban setting, it is more focused on how each individual student lives. According to Sheldon et al (2010) “parents socialize their children in ways that significantly affect their children’s self-perceptions of ability and achievement in math” (p. 28). The way students perceive mathematics can be affected by family perceptions about mathematics, whether that be in a positive or negative light. Sheldon (2010) argues that, “In addition to helping teachers improve students’ self-perceptions of their math abilities, schools may need to help parents increase their understanding of expectations for students’ math achievement and progress” (p.29). A majority of parents do not have the ability to support their child in helping them understand mathematics. Practices have evolved and changed with different strategies and methods in how to solve a problem from what they were taught. Curriculum has also adapted to inquiry based, leaving open-ended questions for students to investigate further instead of traditional methods of memorizing formulas and solving for exact solutions. “...family involvement is less common in math than in other subjects such as reading or language arts” (Sheldon et al., 2010, p.29). Contributing factors are due to the present way mathematics is being taught, compared to the past - two very different approaches. Common Core has not allowed any time for parents to catch up and learn the new ways to understanding mathematics, nor has it given teachers the opportunity to sit down with parents and help guide them through these difficult standards.

Some argue that family environment is the sole element that contributes to student achievement. Others claim that schools are the sole contributors to setting their students up for success. Sheldon also provides evidence through a study that states, “In addition to using family and community involvement activities to increase support at home for students math learning,

implementing effective partnership practices may also affect the school atmosphere and climate” (p.31). Teachers have limited to zero training in how to incorporate parents or guardians into math lesson plans or math homework. Schools need to work together with their teachers to provide resources on how to help parents and invest the time and energy. Shelton (2010) discuss how schools can implement specific strategies in their study.

This study draws upon Epstein’s (2001) framework of six types of involvement to characterize math involvement activities: (1) parenting — helping all families establish supportive home environments for children; (2) communicating — establishing two-way exchanges about school programs and children’s progress, (3) volunteering — recruiting and organizing parent help at school, home and other locations, (4) learning at home — providing information and ideas to families about how to help students with homework and other curriculum-related materials, (5) decision making — having parents from all backgrounds serve as representatives on school committees, and (6) collaborating with the community—integrating resources and services from the community into students’ experiences to strengthen school programs. (p. 30)

In a second article by the same authors, Sheldon and Epstein’s (2005) research found that home activities can have an impact on improving math achievement. Schools that effectively encourage parents to participate with their children at home saw some improved proficiency at math (p.204). The writers warn that,

Schools must advance beyond a belief that any parent involvement

activity will produce important results. We found that rather than use of an activity, the reported *quality of implementation* was strongly and consistently associated with changes in levels in student mathematics achievement. (p.204)

These two authors simply argue that encouraging the development of mathematics skills has many important components. Family, support from educators, encouragement in home based activities and support for understanding the math curriculum, in conjunction with other learning activities, helps encourage and develop skills, which in the end leads to improved results in closing the achievement gap in mathematics.

Additional insight offered by Noguera (2012) states that “it becomes clear that in many ways the achievement gap is first and foremost an educational manifestation of social inequality” (p.3). He believes that these factors greatly contribute to student performance, and how students and the broader society compete for resources. Donlevy (2002) argues that closing the gap involves “issues of power” (p.146).

“Young people need to learn that school success gives them power and access to greater opportunities for further education and employment” asserts Donlevy (2002, p.146). The idea that success is possible needs to be reinforced by home and community. Donlevy (2002) also points out that the achievement gap is affected by “the broader needs of children and family” (p.147). A student’s personal background, where factors like poverty, homelessness and family involvement all affect their ability to learn and succeed, especially in a difficult subject like math where students have home and community based perceptions that math is not important.

Even in our own community, recent data indicates that poverty does make a difference, however it is not just an urban problem, as per pupil spending has been shown not always to be indicative of performance. Murphy (2014) briefly reports that in our area, better schools

generally pay teachers more, but the effect of teacher experience is not clear. Indicative of the power of climate, culture and tradition is “West Irondequoit has the second-most teachers with less than 10 years of experience, 41 percent, but was ranked sixth in the area overall” (p. 1A). This justifies that communities with strong home school connections can be successful.

The authors Parke and Kanyongo (2012) conducted a study of 53 different schools to determine if non-attendance and mobility affected math scores. Parke’s (2012) findings revealed that “each day that a student does not attend school is a day of missed knowledge through a lack of contact with his or her teachers” (2012, p.161).

Their study found that lack of attendance does affect math achievement, and it is similar between both blacks and whites. Numerous studies beyond theirs which they cited, found multiple reasons for not attending, such as weather, vacations, peer group pressure and family responsibilities sometimes resulting from poverty. The implications for schools are important; they need to target the areas that cause absenteeism. Schools collect a considerable amount of data about students who are mobile, or non-attendees. School districts need to be systematic, comprehensive and thoughtful about how they can use data to affect instruction.

Specific to math achievement results, Parke et al. (2012) discusses the negative impact non-attendance and mobility can have.

Disaggregating mathematics scores within each ethnicity showed that Black and White students had similar patterns of results. Regardless of ethnicity, the two highest mean mathematics scores occurred for the two attendance categories and the two lowest mean mathematics scores occurred for the two nonattendance categories. Similarly, the stable categories showed higher average mathematics scores than the mobile categories. In short, when

Black and White student miss class or are mobile, they learn less. (p. 174)

The point is to be in the classroom to receive the full instruction, regardless of ethnicity and race. Being there is important, and attendance is a concern in many school districts. Having strong home and community support in school, and the willingness to attend classes has a documented positive effect on student success in mathematics. The review of the literature shows that family and home environment have a lasting impact on student achievement.

In this final section of the literature review, the impacts of school, culture and climate play a crucial role. In a broader context, teaching practices and school reform are contributing factors in closing the achievement gap. A curricular case study, conducted by Superintendent Allan Alson (2006) focused on closing the achievement gap in his district. His findings were that closing the achievement gap takes a long time, it does not just happen overnight. Alson (2006) stated that,

Substantive reform simply takes a long time. In order for change to be sustainable, the culture has to evolve, first, by people becoming receptive to entertaining the conversation about the achievement gap; second, by their committing to doing something about it; and finally, by their resolving to do something about it as a community. (p.74-75)

These broad challenges help establish an agenda, which focuses on leadership and change. Alson argues that to create that change, it must be done through staff development and the community, where members and educators need to build trust, eventually resulting in capacity and structure reform. Research by Bodovski and Nahum-Shani and Walsh (2013) presents that school reform in closing the achievement gap takes a long time. However, school reform is not enough to battle the inequality in student achievement. The authors noted the important characteristics to close

the gap, such as school climate, academic and disciplinary culture and teaching with best practices:

Strong climate does not happen overnight. The literature on academic press and academic climate shows that these changes require profound dedication from all faculty and staff, as well as from parents and students, to commit to an academic mission for the school and to create an environment that is conducive to learning. (Bodovski et al., 2013)

A problem as complex as the achievement gap, yields various factors, as noted in the previous article are discussed by Rothman (2001-2002). Some approaches are getting results through collaboration with other schools, changing instructional practices and recognizing that framing the achievement gap and only talking about race is not altogether accurate, as Rothman states.

The broader issue of resource disparity is noted as follows:

Although there is some dispute about the precise nature of the relationship between spending and achievement, there is ample evidence that, on many dimensions, schools that serve large numbers of poor children and children of color lack many of the resources available to schools serving more advantaged populations. (Rothman, 2001-2002, p.22)

Not being able to provide enough resources hurts the effort to close the achievement gap.

Additional insight from Holloway (2004) notes the importance of a teacher's presence in the classroom. The combination of increased teacher sensitivity, quality interactions and focusing on the cognitive level of teacher's students can increase math performance levels (Holloway, 2004, p. 85).

Holloway (2004) recognizes in his article that:

Research has shown that we can improve the chances of success for achievement in mathematics for all students. But this can only occur when schools provide students with a rich standards-based curriculum, aligned and articulated across grade level, that supports high expectations for all students. This curriculum, combined with greater teacher sensitivity to the needs of minority students, can become a powerful force in closing the mathematics achievement gap. (p. 85)

The role of the teacher is the glue that holds student success in place. How they lay the foundation to provide the best education and future for their students can then help build the success of the student.

Georges and Pallas (2010) did a very complex study with a considerable amount of research about measuring achievement, teacher practices and the effects of socio-economic status on math achievement. They also factored race, ethnicity and the effect of summer vacations. They did this across all grade levels, K-12. Some of the important findings from looking at minority students is that justification for supplementary summer school programs will help stem the loss during summer months. They also note that in elementary grades in particular “...general content knowledge of the subject does not necessarily imply pedagogical knowledge of how to teach mathematics in ways that promote knowledge retention and ongoing learning” (Georges et al., 2010, p.287). They argue that there is a relationship between teaching practices and scores, especially after elementary school when math content specialists are doing the teaching.

A longitudinal study done by Mac Iver and Mac Iver (2009) show that there are positive results related to the number of years schools implemented school reform. They found that there is a correlation between a comprehensive school reform program and urban middle grade student

mathematics achievement growth (p.223). Teacher resistance to reform can affect outcomes, however more focus on professional development is needed.

Researcher Kara S. Finnigan, from the University of Rochester and her collaborator Alan J. Daly (2012) discuss organizational learning and improvement in under-performing urban systems. Their study is unique in that it examines both the internal conditions of failing schools and the larger context of district practices. Their study used a sophisticated mathematical model of plotting the effects of teacher support, administration support and instructional support. Their findings suggest that “the structure and quality of social relationships within schools and district wide play a crucial role in the schools’ capacities for organizational learning and improvement” (Finnigan et al., 2012, p. 65). Further, “at the school and district level, greater attention should be paid to developing the formal structures within schools that allow for collaboration and the greater exchange of ideas” (Finnigan et al., 2012, p. 66). Finnigan and Daly place emphasis on how a system has to work. The exchange of teacher ideas and best practices needs to have a positive school culture built on trust and support with open lines of communication and support from principals. They stress that districts need to shift the emphasis from central office direction to the building level. The result could help close the achievement gap in under-performing schools.

Palumbo and Kramer-Vida’s (2012) findings are aligned with Finnigan and Daly’s ideas. They find that schools that succeed embrace a culture of success. They have curriculum that includes school wide programs, literacy training (not just in mathematics) and the mastery of basic skills, emotional support and recognition of the restorative power of learning (p. 119). This approach stresses the unity of a whole curriculum leading to student success. Palumbo et al., makes a passionate argument that,

We know that education can do for students what society has failed to do. Education can change the lives of these students for the better. Some commentators believe that schools cannot succeed until society reforms itself. The view is shortsighted, it denies the restorative power of learning. Educate students to the best the culture has to offer, and let them reform society. (Palumbo et al., 2012, p.120) There can be success if schools embrace a culture of success. Students need to step-up and fight for their future and embrace learning.

Methodology

Context

I reviewed a district in Upstate New York using 2012-2013 state math scores in grade six. The findings from the 2013 sixth grade mathematics test are shown below.

Results by Student Group	2013					
	Total Tested	Percent Scoring at Level(s)				% Proficient (Levels 3 and 4)
		1	2	3	4	
All Students	210	40	52	8	0	8
General Education	191	35	57	8	1	9
Students with Disabilities	19	89	11	0	0	0
Asian or Native Hawaiian/Other Pacific Islander	5	20	80	0	0	0
Black or African American	40	63	35	3	0	3
Hispanic or Latino	27	33	56	11	0	11
White	131	34	56	9	1	10
Multiracial	7	57	43	0	0	0

After reflecting on the data above and recognizing how it was similar to the district I teach in and how it played a role in my research and teaching, I sent out a questionnaire to eight math teachers at Tree Hill Middle School.

Participants

In phase one, eight teachers were given the questionnaire. Out of the eight teachers, all are certified math teachers, six of them have been at the middle school five plus years, one is a first year teacher, and the other is a long term substitute. In phase two, I interviewed a representative from an urban district in Upstate New York who has been a teacher for over 15 years in a suburban district, then advanced to become an assistant principal, who now works for an urban district collecting data and implementing best practices to help strengthen gaps in the curriculum of math and science.

Method

Phase one of this study was designed to capture first hand experiences and opinions of mathematics teachers, and how they engaged underprivileged students when teaching middle school mathematics. They discussed the challenges of teaching math, and share the rewarding experiences that they have created in their own classrooms. The purpose of sending out this questionnaire was to gain insight into what math teachers felt was their biggest teaching challenge, as well as what strategies they feel have worked and what have not. They discussed their trials and tribulations, whether it be lack of parent support or the rigorous responsibilities of implementing common core. This study, based on the results from the questionnaire, will share results and opinions first hand from highly qualified teachers who teach in a low performing district.

Phase two of this study was designed to have a conversation with a representative from an urban district in Upstate New York, delve into the achievement gap in mathematics and discuss the hope for teachers across the country of overcoming it. The representative discussed the gap and the positive steps that need to be taken to have a chance at closing it. She talked

about teacher resources, strategies, and how not only her district, but other districts can work together to make math an engaging subject for those who are underprivileged.

Informed consent and protecting the rights of the participants

In phase one, a conversation was held with the eight math teachers that discussed what the questionnaire would be about. Those who agreed to participate were informed of all of the methods and intentions of the study. This was followed by an email of the questionnaire that was simple to follow and complete at their convenience. In phase two, a formal letter was sent to the representative, explaining the intent of the study and the different methods that had taken place in phase one. A conversation was conducted by phone with the representative.

Data collection

Data was collected via email or paper copy in phase one. Out of the twelve participants who were sent the questionnaire, eight responded. The tables below show the specific questions that I asked all participants, as well as the questions are broken into topics and clustered on how participants responded. Data on phase two was collected from the representative from an urban school district through a recorded phone interview.

In the data collection, P1 = participant one

Phase one data:

1. How can we as teachers create a level of enthusiasm for math to those who are underprivileged, but must have essential math skills to survive in the modern world?

Make real-world connections	Use manipulative's & multiple representations	Use of technology
P1	P1	P2
P3	P6	P5
P4		
P5		
P6		
P7		
P8		

2. How do the attitudes of your disadvantaged students differ from those who are not? What are some of those differences?

Lack of motivation & attitude	Breaking classroom conduct	Little family support	Being prepared to learn	Little mastery of material
P1	P7	P4	P2	P1
P4		P5		
P5		P6		
P6				
P8				

3. If you could ask a math expert with extensive experience any question about how to close the achievement gap, what would it be?

How to strengthen number sense	How to keep students engaged	What are best practices and how are they implemented?	How to tailor curriculum to meet specific needs	How do standardized tests impact the curriculum?
P1	P2	P5	P5	P8
P4			P6	

4. How does teaching students who are underprivileged affect your classroom routine and instruction?

Common Core content & implementation	Gaps in skills	Developmentally inappropriate	Changing plans to meet student needs	Implementing behavior plans
P1	P1	P1	P1	P8
P2			P3	
			P4	
			P5	
			P7	

5. What is the most challenging part of teaching a diverse group of student's mathematics?

Motivation	Range of ability	Covering the Common Core	Meeting academic needs	Home environment
P1	P2	P2	P3	P3
P4			P5	P4
P7			P6	
P8				

6. What is the most rewarding part of teaching a diverse group of student’s mathematics?

Seeing success through student’s struggle	Giving extra help to students who ask
P1	P4
P2	
P3	
P5	
P6	
P7	
P8	

7. How do you as an educator try to close the “so called achievement gap” in mathematics? Do you think it is a bigger issue than just teaching?

Yes	Developing number sense to build computational skills	Accessibility outside of school	Support social life	Have understanding & patience
P1	P1	P3	P5	P8
P2	P5	P5	P6	
P3	P6		P7	
P4	P8		P8	
P5				
P6				
P7				
P8				

8. Do you think the implementation of common core and learning standards has affected the achievement gap?

Developmentally inappropriate	Not accommodating from grade level to grade level	Widened the gap	Rigorous curriculum	Will help teachers be consistent & provide a better framework
P1	P1	P2	P3	P5
P6	P3		P8	P6
	P4			
	P5			
	P8			

9. In your experience does parent support help close the mathematics achievement gap? How so?

Yes	Provide additional help & support	Districts need to educate parents on the “new” math
P1	P1	P3
P2	P5	
P3	P6	
P4		
P5		
P6		
P7		
P8		

10. Is classroom technology helping close the achievement gap?

Yes- it plays a positive effect on student practice, motivation, collaboration, inquiry & hands on learning	No- it is a distraction to learning	Too early to be sure	No effect
P1	P2	P1	P7
P4	P3	P3	
P5	P5	P4	
P8	P6		
	P8		

Reporting data from phase one:

From the results of the eight math teachers who responded to the questionnaire, all seemed to agree that having the role of parent involvement in their child’s education will close the achievement gap. By having the extra support from parents needed to motivate their students and provide structure and stability at home, strengthens their ability in the classroom. All participants believe that the Common Core rigorous standards are only hurting the students and their teaching practices. The participants feel strongly that they are developmentally inappropriate, above the understanding and knowledge that their students can perform and are not accommodating from grade level to grade level. Although, participant five and participant six do feel that the Common Core provides framework and expectations for teachers to follow. All participants agree that closing the achievement gap is a challenge that is bigger than just teaching. Those who are working to engage students in their classrooms are using strategies such as building number sense and stronger mathematical computational skills, according to participant one, five, six and eight. Participants three, five, six, seven and eight agree that by just supporting their student’s social lives, making themselves accessible outside of school and

having a positive presence will build a level of trust with their students and a level of understanding and patience. Participant six stated that the most rewarding part of teaching a diverse group of student's mathematics was that "the challenge is the reward! When you can teach a successful lesson to a group of diverse learners, you know you have created a learning environment that is inspiring!" A majority of participants all agreed that the most rewarding part of teaching is being able to experience that "aha" moment in their classrooms when their students finally understand the challenges that students face with math. They all agree that creating a level of enthusiasm for math to those who are underprivileged begins with making real-world connections that students can relate to.

According to the participants, teaching a disadvantaged group of students comes with a challenge. Five out of the eight participants responded that they see lack of motivation and attitude coupled with little mastery of material, resulting in lack of a positive attitude towards school and mathematics in particular. Coping with these attitude issues on a day to day basis clearly affects the routine and instructional practices. Five out of the eight participants responded that they are constantly re-constructing and modifying their lesson plans, assignments and instructional practices to meet the needs of a diverse group of learners. The data from the participants in my study reinforces the need for flexibility and adaptability in curriculum. The results show that if they could ask an expert how to improve results in their instruction, two said they would want to focus on improving number sense and two others responded with the desire to tailor curriculum to meet the needs of their ever changing students. The participants were nearly split equally on the impact of technology in the math classroom. (The participants in this survey are in a school district which has recently implemented a pilot program that allows every student to have a district supplied iPad.) Four out of eight said that technology increases hands-

on learning, collaboration with peers, motivation to complete homework and organizational skills that carry over into all classes. However, out of those four, one participant noted it was a complete distraction in the classroom in addition to four other participants, making a total of five who felt the use of technology was yet to be providing benefits in math instruction they could see.

Phase two data:

1. How did your career start? Why were you interested in math?

I was a teacher for 17 years before I became an assistant principal. I taught in a suburban, low income district. I built success in that school because I had the mentality of telling my students everyday as I taught them, “100% of you are going to pass.” It was all about a positive mindset. The kids believed everything I said. Now working on data and technology in an urban district, I still carry that good mindset with me daily.

2. In that role as curriculum supervisor, how did you specifically contribute to closing the achievement gap? What was effective?

Professional development and curriculum is the basis to having effective results. Having teachers experience trainings and developments that they can go back and use in their classrooms to better their students is the most effective aspect to helping increase positivity, knowledge and confidence.

3. What kinds of professional development do you think are the most beneficial to mathematics teachers?

Any development that focuses on the actual standards is what teachers need. By taking a look at math concepts and asking yourself, “how does this fit into the continuum of learning?” “what do these standards mean?” “what do these standards look like?” Teachers need to spend time breaking down the standards and answering these types of questions. Administrators need to give the teachers time to learn the math. It will only better math teachers to be more successful in the classroom and be that much more engaged in what they are teaching.

4. You were interviewed about the districts graduation rate and how summer school has impacted the achievement gap. In my literature review, I discussed the importance of summer school. How important do you think that is?

Summer school has many gains. There has always been that negative stereotyped that summer school is for students who don't do well all year. We are trying to change that. Our programs are for students to get the school year started earlier. Students come to kick off the start of advanced placement courses to receive online credit. Students are engaged in the summer experiences that we offer that reduce learning loss. For those students who already come to Kindergarten behind, summer school is an opportunity to strengthen skills and go into the next grade level with the background knowledge many students will need.

5. How often are you in math classrooms, and if so, what are some of the best practices that you have observed?

Any time I go into the classrooms, I am always looking for teachers who use different ways to engage students. Teachers who use manipulative's and create opportunities for all learners have the most successful and engaging lesson plans. Teachers who really provide the mathematical

knowledge to their students as to what the math really means, and how does it make sense, are creating a level of knowledge for students that go above and beyond the role of a teacher. It is not always about the “tricks” to being a strong math teacher. They need to build reasoning for their students so they can understand on a more rigorous level. Language is a crucial part of teaching mathematics successfully. Teachers need to believe that ALL of their students can do it. There are fundamentals to teaching math that needs to be consistent across all grade levels. Asking the universal question of “how do I take the math concepts apart and how do I put them back together?, is what every math teacher needs to incorporate into their classrooms on a daily basis”

6. In my literature review, there is a lot of data collection on home and family environment and socioeconomic status. In your experience, what impact does that have on the achievement gap? And in what ways?

Home and family support presents a challenge when it is absent. Family support and help will always play a positive role on a child. Because students come from backgrounds that are out of our control, you have to “really treat them like this is the only time to learn. Create love in those six to eight hours, bank on it, engage them as best you can, and say the rest of it is out of your control.”

7. To any first year teacher, what advice would you give?

I would say as much as you can, observe all of your colleagues. Go to the lower grade levels in your district and observe those teachers. It is one of the only way you will get a good sense of what is going on, gain some understanding, find some great strategies, and really understand

what you have to do to teach those same students in the future years. Because you teach math, use mathematical thinking and inquiry as much as you can. Spend weeks investigating just one problem with your students, it will make you a better teacher, and make them stronger thinkers.

8. What is your district doing specifically to make math more engaging to students?

Focusing on the kids. It's all about the kids.

9. Where do you think the future of math instruction is heading?

I support the Common Core. It tests what is good learning for the kids. It is very clear based on what we know, and what we want to know. The down side is that it gets caught in the political arena. I think if teachers can take a step back and not get involved in the politics, and do what is best for the students, it can only get better.

Reporting data from phase two:

The representative from the urban district in Upstate New York remained positive throughout the entire phone interview. As she deals with struggles in her district to raise test scores, attendance and attempts to strengthen the achievement gap, her focus always returns to the betterment and achievement of the students. "Really treat them like this is the only time to learn. Create love in those six to eight hours, bank on it, engage them as best you can, and say the rest of it is out of your control." Her words give me a new perspective that I always knew I had in me, but had trouble giving up outcomes that are simply out my hands. The representative highlighted that family involvement and support will always be out of a teacher's hands, however there is a

window of opportunity during the school day where the teacher can make a lasting impact on a student's education. The representative discussed in our interview that being a successful mathematics teacher really delves into understanding the mathematical concepts and reason behind it. If math teachers can successfully dissect and have a clear understanding of the standards that they are teaching, it will make teaching the math easier and more relatable to their students. Teachers who work consistently on breaking down the math, creating manipulative's and engaging their students to the "why" of math instead of just teaching "how" to do it are successful educators. They end our conversation with keeping the focus on the students, and making sure that moving forward, any decisions or impacts in closing the achievement gap in mathematics remains making the push for the student's futures.

Data Analysis:

What does it mean to have good number sense? I throw the phrase 'number sense' around in my classroom on a daily basis. I try to instill in my student's minds that number sense is so important. What will happen when my young students need to balance their own checkbook? When they need to pay a mortgage? Or set a budget? I throw this word around so loosely, yet do my students even understand what number sense is? The basic number sense that some interacted with before they even entered Kindergarten. What does it mean to have number sense? Does it mean building a foundation of working with numbers, being able to identify them and solve for them? How can I teach my students good number sense when they are fearful of failure to comprehend and carry out number tasks? Questions from my students arise such as, why do we have to know what a variable is? What difference does it make between an obtuse or acute triangle? How will I use this in my everyday life? When I picked my topic for my literature review, I chose from what I was seeing in my own classroom. Being a first year teacher, a

majority of my students did not enter with the prior background and knowledge they needed to be successful in my math classes. As I dove into the standards and started planning my curriculum for the entire year, it became more challenging. My students entered into the grade level not being up to date with the math skills from lower grade levels. In particular, I found their language skills lacking. As my expert stated in our interview, “language is a crucial part of teaching mathematics successfully.” I started playing the blame game. Why did they not know the units and topics they were expected to? Were they not paying close attention? Did the teachers below me not cover it? I learned in the end of my research that so many different factors contribute to these so called “gaps” that the students carry with them from grade level to grade level. It’s not just one person’s fault, its many faults. A student’s home, family environment and poverty level all combine to make a significant impact on support, motivation and the guidance a student needs after they leave school. Classroom culture and strategies, or lack of, which the teacher builds also plays its own role. New teachers bring new ideas, yet veteran teachers bring experience. How a teacher commits to their classroom by bringing a fresh perspective, while building a classroom that is safe and inviting, and a space where students want to do well is a challenge, yet has a substantial reward. Budget constraints, limited resources and teacher’s strengths and weaknesses all play an important part in determining the variance of the gap.

On a personal level after conducting this research, I have realized that although the achievement gap in mathematics exists and will continue to exist, there is no set course that should be followed that will make a noticeable impact on the gap. Just as there are many factors as to why the achievement gap in mathematics exists, there are many productive ways and strategies to go about fixing it. It starts with good teaching. An effective teacher, who loves their students, cares about them and will vow to try new things every day in their classroom can get

positive results. According to Flores (2005), “all students need the opportunity to learn challenging mathematics from a well-qualified teacher who will make connections to the background, needs and cultures of all learners.” (p.37) I think Flores makes a valid point, because even though the math may be difficult for a lower level diverse group of students, they deserve and are given the same rights as any other student; that is to receive a public education and opportunities that are taking place in the top schools. How that material is being taught to them has an influential gain on their learning and understanding. Teachers have to make the material and topics they teach worthwhile. They have to make their lessons entertaining, enjoyable and interesting enough that they can engage their students for the entire class. Trying and failing at strategies is all part of being a great teacher. You find what strategies work, which ones fail, and come up with new ideas and activities that can not only stump your students, but ones where they will go home at the end of the day and talk about those activities done in your class.

Math content is challenging in and of itself. When people hear the word math, they instantly think they cannot do it. Math content has changed in the last twenty to thirty years that makes math difficult to adults who now have children in the system. Teaching to the common core and the “new math” as many call it, widens the achievement gap even more. Students who live in low poverty districts come home and do not receive the support or help from parents or guardians because these adults either do not comprehend the math, or there may not be an authority figure around to help their child with their homework. Fixing the gap means offering parents support, teachers reaching out to parents and providing help, whether that is staying after school for review sessions, or sending out information to parents about where they can receive

help and support. Social media and technology has made this much easier in recent years to try to contact parents and keep open lines of communication. Alson (2006) stated that,

Substantive reform simply takes a long time. In order for change to be sustainable, the culture has to evolve, first, by people becoming receptive to entertaining the conversation about the achievement gap; second, by their committing to doing something about it; and finally, by their resolving to do something about it as a community. (p.74-75)

I agree with Alson, when he states that as much as teachers can take a role in reaching out to parents, the community needs to be involved, everyone needs to step up. In my district, there is often very little parent support. Many students go home to the role of being moms and dads to their little siblings; the result is they cannot focus on math homework. The community needs to come together and offer help and structure to households who need the help, but never ask for it. The achievement gap only gets larger when we push these students to their potential during the entire school day, which often is lost when they leave school. It is like taking one step forward and two steps back. As these students move to higher grade levels, the gap only widens.

In my own practice, I have made a commitment to my students and myself to go deeper with the math content and really explain to my students the reasoning behind it. Many of them do not have that foundational knowledge and background, so I struggle on a daily basis to either get them caught up from previous grade levels, or keep pushing them along on current grade level material. What's more effective? Teaching grade level content or re-teaching previous grade level content? Isn't this why there are gaps? I think this is an area that not only math classes, but all classes are dealing with. I am not quite certain there is an exact answer or right way. I incorporate lower level topics as daily warm-ups or review, and build upon them. Many of my

students have the attitude and predisposition that math is boring, not fun, or dry. I try to bring learning through hands-on, inventive, engaging activities. It may be relating their shoe size to statistics, or teaching the distributive property through Big Mac's and fries. I've pushed my students to create geometric nets from scratch on the floor using painters tape, or by making human plots of the number of jumping jacks they can do in 120 seconds. I push my students to reach individual goals and have them understand the meaning to be an inquirer. I ask them about their future and relate it to the cost of college, I create problems where they are my main topics. I read an article in the fall of last year upon starting my first year of teaching that I saved. It discussed how to keep attendance rates at higher levels in urban districts, and what teachers are collaboratively doing with their colleagues and their students to keep these rates as high as possible. The principal of the urban district mentioned in this article was asked how they doubled their proficiency rates, and encouraged students to attend school. Her reply was simple, "...we just covered all the (material), we looked at the data and we worked together...we love the kids." (Murphy, 2014, pp.1A, 16A)

In thinking about my future as an educator and what changes I might make in my own classroom, I have several ideas. In striving to make the math that so many of my students are in fear of, I will use an abundance of strategies, methods and ways to cover the math standards. I work hard to re-explain different concepts and material in different ways to all of my students, because one way of presenting the material might not make sense to every student in my classroom. A teacher once told me that a good educator needs to sell the subject to the kids. Meaning, how a teacher projects and delivers the material is what makes the students want and willing to learn it. My seventh grade math teacher covered himself in tin foil to teach the "foil method" and although that method is long gone in the books, I will never forget how that

inspired me at the age of twelve. Teaching the content is a simple task, how to teach it is one of the most frustrating yet rewarding experiences of being a teacher. My number one priority with every lesson I teach is that does it make sense to the kids? Do my kids understand the content and seem excited about the content? A participant that filled out one of my questionnaires talked about how the most rewarding part of teaching a diverse group of students is when “*the light bulb goes on,*” when they seem to grasp the material and make sense of it. Seeing students who did not have confidence or were up against obstacles comprehend the material makes the job no longer a job, it becomes an honor to make a difference and have that much of an impact on a child’s life. If I can keep students excited and interested in math, while filling in learning gaps that seem to be out of everyone’s control, students will be more successful which in turn, helps close the achievement gap. Factors that are pulling the achievement gap in mathematics will always be out of my control, and I do not think that the gap will shrink overnight. I truly believe that it will take years of work and commitment to close an individual’s achievement gap. I do not feel that the gap exists because of one reason, and I do not feel it will end because of one reason. I have the hope that the teachers, adults, administrators, community members and actual students will find the ways to move forward and realize how important an education is our changing society.

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