THE EFFECT OF HOMOGENEOUS ABILITY GROUPING IN MATH CLASS ON STUDENT ACHIEVEMENT AND ATTITUDES ABOUT MATH

by

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A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2012

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July 2012

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

In this investigation the students in fifth through eighth grades were placed in math classes based on their ability (homogenous grouping). MAP math test scores and teacher input were used to group the students by their ability. This treatment was implemented to see if there was a change in student achievement and to see if there were any student attitude changes about math. The post-treatment results indicated that students MAP test scores varied greatly for each individual but 82% of students increased their scores from the pre to post-treatment. The results indicated that the percent increase in MAP test scores were the highest during the pretreatment. The above grade level students had a 6.5% increase, at grade level had a 5.5% increase, and the below grade level had a 6.8% increase in their MAP test scores. During the post-treatment the group of students that were most affected by the ability grouping were the above grade level students. They had a 4.2% increase in their MAP test scores during the treatment year. The students that were at grade level had a 2.3% increase in their MAP test scores. The students that were negatively affected by the ability grouping were the below grade level students. They increased their scores by .3% in the treatment year. AIMSweb Concepts and Applications increased following the treatment from 8.1% to a 16% increase in the test scores. AIMSweb Computation scores decreased in overall percent gains from a 17.7% to an 11.1% following the treatment. Students' attitudes about math were more positive after the treatment but the students said that there was little benefit to their science class when they were in ability groped math class.

INTRODUCTION AND BACKGROUND

I teach at Potomac School in Potomac, Montana, which is a rural school located in western Montana. It is a kindergarten through eighth grade school, and there is a teacher for every grade level with the exception of a combined third and fourth grade and a combined seventh and eighth grade. The school is somewhat departmentalized in fifth, sixth, seventh and eighth grades. Potomac School has 94 students in the kindergarten through eighth grades with only three percent of the students being minorities (T. Johnson, personal communication, February 1, 2012). I teach the fifth through eighth grade science classes, the highest achieving math group and one elective class. Since it is such a small school, my class sizes are small, ranging from seven to eighteen students. With these small class sizes and working with the same kids from year to year, I feel like I have an advantage. I really get to know these kids and I know what I have taught them in previous years so we do not duplicate material. It also allows me to determine their strengths and weaknesses. The school has very little diversity and a low transient population. However, due to the economy, several students have left the school.

Administrators want to have the best school they possibly can and have high achieving students. Teachers want to increase student achievement scores and want to make sure their students have positive attitudes about school. The parents want to make sure that their child is getting the best education they can at the school they are placed in. Teaching in a small rural school can be a challenge but it can also be an effective way to reach each and every student. Making sure each student is being challenged in a small school can be hard due to the few classroom teachers (seven) in the district. Seeing that

this was an issue, our administrator decided to change the way math was taught in the second through eighth grades to make sure each student was challenged. The administrator arranged the students based on their math ability instead of by the grade that they were in.

This action research was completed during the 2010-2011 and the 2011-2012 school years. There was a change in the math classes at Potomac School during the 2011-2012 school year from traditional age leveled classes (during the 2010-2011 school year) to homogeneous ability groups (during the 2011-2012 school year). Once they were placed in the homogeneous ability groups, students had the opportunity to move into other math classes depending on their performance and ability to grasp the concepts. The teachers and curriculum remained the same for both years of the study, but the students may not have had the same teacher both years.

This study compared traditional age-based math classes with that of an ability grouped math class, with no regard to the ages of the students, in grades six through eight. Particular attention was paid to the low and high achieving students in these classes. The students were placed into homogeneous ability groups according to their Measures of Academic Progress (MAP) test scores as well as teacher recommendations in the 2011-2012 school year. The purpose of this action research project was to determine if the students in grades six through eight showed increased achievement on their MAP test scores and AIMSweb scores when placed in an ability grouped class compared to last school year's traditional age based classroom for math. Also, the study examined whether the students had any attitude changes toward math when placed in a

performance based class versus a traditional age based class. Lastly, it examined if the students thought that this ability grouping had any effect on their science class.

CONCEPTUAL FRAMEWORK

"For as long as instruction has been delivered, students, teachers, administrators, and researchers have debated the question of how classes should be organized" and this will continue for as long as teachers are teaching (Slavin, 1987, p.109). Ability grouping in schools has been going on since the mid 19th century and has become ingrained in the U.S. school system and will continue to be debated (Chiu et al., 2008). Ability grouping relates to the homogeneous re-grouping of students for the purpose of providing curriculum aimed at a common instructional level (Fiedler, Lange, & Winebrenner, 2002). In order for ability grouping to work, the students must not be permanently locked into place but must be allowed to move up or down in classes based on what is appropriately challenging for them (Fiedler et al., 2002).

There are opposing views when it comes to ability grouping of students. Some say that there are negative effects and others say there are benefits for the students. In the past, minorities and economically disadvantaged students were underrepresented in the gifted classes but now educators have refined their identification methods so this is no longer the case (Fiedler et al., 2002). There are several ways schools can group students by ability. Schools can group all the average achieving students, the low achieving students and the gifted and talented students. The gifted and talented students, from this study had very clear effects of grouping and showed significant to moderate achievement gains (Kulik & Kulik, 1984). A meta-analysis of studies by Kulik and Kulik (1984)

suggested that students gained somewhat more academically from grouped classes than they did from ungrouped ones. It has also been said that achievement is based more on the nature and quality of instruction than the class makeup (Hattie, 2002).

Another concern that schools have is that there might be a widening gap between high achievers and low achievers. Students in remedial classes performed especially poor compared to ungrouped students with similar family backgrounds and initial achievement (Gamoran, 1992). It has been found that the high achieving grouped students often gained more than students in low ability groups (Oakes, Gamoran, & Page, 1992). One question that schools have to ask themselves, if they are thinking about ability grouping their students, is will they be holding their high achievers back if they are not allowed to be in a group that is homogeneous in ability. Ability grouping has different effects depending on where and how they are implemented (Gamoran, 1992). The high ability group, often referred to as the gifted and talented group, can either be educated in a heterogeneous or homogenous class setting. This may depend on the school that they are in and the availability of separate programs for the gifted and talented. Some educators claim that if the gifted students are placed in a heterogeneous classroom that they may become underachievers, may have behavior problems, and may not be able to develop their talents to the fullest extent (Goldring, 1990).

Ability grouping and its effects on learning outcomes is another item that needs to be considered when a school is considering grouping their students. In Hong Kong, all schools are given the same curriculum and the students are grouped based on their ability. In this scenario it was discovered that ability grouped students appeared to have higher

achievement in math and science compared to those that were not in an ability group (Cheung & Rudowicz, 2003). Students differ in knowledge, skills, developmental stage, and learning rates. A teacher who is teaching a lesson to a heterogeneous group of students would be teaching to a level that they think is optimal for all students, but it may not be optimal for all learners involved (Slavin, 1987). Teachers or the schools may want to group certain subject areas into homogeneous ability classes or maybe they can look at the teachers' expectations that they have for the class of students. Teacher expectations can have an impact on the achievement level of their students. Rubie-Davies (2010) found that students in a classroom that had a teacher who had high expectations, and who displayed a positive attitude about students abilities and social relationships larger gains in learning compared to students who were in a class that had a teacher with low expectations of the students and who viewed student achievement negatively.

The school that may be considering ability grouping for students in math or science needs to consider if they are leaving behind or holding back the talented students if they do not put them in the most challenging program that they have. Choosing the way in which students should be grouped is dependent on the school, administrator, teachers, the numbers of students, and the flexibility of the schedule of the school. Feedback received by educators, parents, and students is that schools have sacrificed the learning potential of highly motivated students especially in math and science, beyond grade level expectations by forcing them to stay in an aged based class instead of being able to advance at their own pace (Phillips, 2008). "The truly equitable way to group students is by individual ability across age levels" (Phillips, 2008, p.54). Grouping by age level is not the most effective way to divide children in a classroom or school

(Colangelo, Assouline, & Gross, 2004). Students have the right to be challenged and if not challenged they may drop out of school or become underachievers (McAllister & Plourde, 2008).

The high school subject areas of mathematics, English and science is where ability grouping classes, like advanced placement classes, tend to take place (Hallam, Lister, Chaudhury, & Davies, 2003). Also, there tends to be more in-class ability grouping in science and math as well (Hallam et al., 2003). In a study of seventh grade math students, the results showed that the students' actual math level or track has no significant effect on their self-esteem (Chiu et al., 2008). These findings contradict previous studies that have found that track level affects self-esteem. For example, one study by Oakes (1985) found that students in higher tracks had higher levels of self-esteem than did students in lower tracks. Not only does self-esteem matter, but so does the interest level of the students. If high ability students are not challenged or presented with appropriate lessons for their abilities, they are more likely to lose motivation and interest over time. Brain research suggests that the brain will not continue to develop if a student is not challenged (McAllister & Plourde, 2008). One study shows that mathematically gifted students learn at a faster rate and perform at a higher level than their same age peers which indicates that a different curriculum would be better suited for them and would challenge them (McAllister & Plourde, 2008). If there is not individualized curriculum and instruction for these students, they may quickly become bored or frustrated and may eventually become underachievers. Mathematically gifted students have been shown to be significantly more likely to retain science and mathematics content accurately when taught two to three times faster than normal class

pace (Rogers, 2002). High school students scored higher on several math and science sections of the ACT when they were in a program for gifted education in math and science than those that were not in the gifted program. This gifted program used higher level thinking skills and more real life laboratory experiences. The students that were enrolled in the program maintained superior performance difference as they exited high school (Tyler-Wood, 2000).

Gifted science students also need curriculum that is challenging to keep them engaged and to continue their interest in the subject matter. The nationwide Science, Technology, Engineering, and Mathematics (STEM) disciplines are helping students on their critical thinking skills at the high school level. There are schools that specialize in these areas for high school students. Students are also able to apply their interests and excel with the aid of school programs, contests, advanced placement classes, competitions, mentorships, internships, and distance education programs. Specialized STEM schools provide an advanced curriculum, ability to work in the field to learn real world applications and have faculty that have expertise in the field of study. With the expertise of the teachers providing real world applications in science and math it will make the work that the students do more relevant to their lives and the challenges that the classes offer will motivate them and keep them from getting bored by material they already know. These STEM schools may be most appropriate for students who have a solid background in math and science and have a single minded focus in math or science careers. These schools will have a less heterogeneous student body, in terms of math and science interests, and may not have many options for extracurricular activities (Olszewski-Kubilius, 2010). By having both homogeneous and heterogeneous classes in

a school, all students would benefit and be challenged and it would help to eliminate boredom and frustration. High ability grouping should be open to all students no matter their IQ. By providing challenging classes and exceptional teachers the students have everything that may lead to an increase in student achievement. The data from these articles are coming from schools with a large population; there is very little data on homogeneous ability grouping in math in small rural schools.

METHODOLOGY

The treatment for this study consisted of sixth through eighth grade students being placed into homogenous ability math groups in the fall of 2011 based on their spring 2011 MAP (Measures of Academic Progress) test scores and teacher recommendations. All students in sixth, seventh, and eighth grade were selected for treatment. These groups included students working below, at, or above their grade level. Potomac School does not have a gifted and talented program so the students that are working above grade level were placed in math classes higher than the current grade they are in. These varying student academic levels allowed the treatments' effectiveness to be analyzed in a general education math setting. The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained.

The Measures of Academic Progress (MAP) mathematics test scores from the spring of the 2010-2011 school year and the 2011-2012 school year were used to determine if there was a change in achievement with ability grouped math classes as

compared to age based math classes. The MAP math test is not timed so the students may take as long as they would like to complete the test. All students were observed in order to analyze the results of the intervention but special attention was paid to the below grade level and above grade level students to see if they benefited from the ability grouped math classes. The overall change in test scores was compared from the spring of 2011 to the spring of 2012. To account for the variability of test scores this study looked at a one value that took into account the fact that students gain a different amount of points at every grade level. For example, the status norm for a sixth grade student is six points. So if a particular student in the sixth grade earned seven points they would have a value greater than one that means that they gained more than the status norm.

The AIMSweb Mathematics Concepts and Applications and AIMSweb Mathematics Computation test scores were used from the 2010-2011 school year and then compared to the 2011-2012 school year. The students took the two AIMSweb tests, which are eight minutes, in the fall, winter and spring during both school years. This two-year data set was collected and then compared to see if there were any differences between pre and post-treatment. The average percent change in the group of students scores were examined between the two years of the study.

A Math and Science Attitude Survey was given to the students in September of 2011 to determine the students' attitudes toward their traditional age based math class during the 2010-2011 school year (Appendix A). Students responded by selecting *strongly agree*, *agree*, *undecided*, *disagree*, or *strongly disagree*. This survey was given to the students on the first day they started in their homogenous ability group math

classes and was used as baseline data to compare it to their attitudes during the 2011-2012 school year. The identical survey was given to the students in February and May of 2012 to obtain post-treatment data. In addition, there were individual student interviews to determine the attitudes of the students towards the new ability based math classes to see if it affected the way they thought about their math class (Appendix B). These interviews took place the beginning of April so there was ample time for the students to be exposed to the new ability grouped math classes. The implemented data collection techniques addressed above are generalized in the Data Triangulation Matrix in Table 1.

Table 1
Data Triangulation Matrix

Research Questions	Data Collection 1	Data Collection 2
1. Is achievement affected by homogeneous ability grouping in middle school math class?	MAP test scores from fall 2010 and spring 2011, MAP test scores from fall 2011 and spring 2012	AIMSweb computations and AIMSweb concepts and application test scores from 2010-2011 school year and 2011-2012 school year
2. How do students attitudes about math compare from a traditional age grouped math class to a homogeneous grouped math class?	A Math and Science Attitude Survey taken September 2011, February 2012, and May 2012	Interviews with students taken during the 2011-2012 school year
3. Do students perceive a benefit to ability grouping in math on their science learning?	Interviews with students taken during the 2011-2012 school year	A Math and Science Attitude Survey taken September 2011, February 2012, and May 2012

DATA AND ANALYSIS

This action research project resulted in an abundance of quantitative and qualitative data that was analyzed to answer the three focus questions dealing with achievement and attitude changes pre and post-treatment, and if the students felt that they

benefited in science from the ability grouped math class. The math MAP (Measures of Academic Progress) scores, AIMSweb Computation scores, AIMSweb Concepts and Application scores, surveys, and student interviews led to a variety of conclusions and patterns. The MAP test is a test in which the student can spend as much time as they think is necessary on the test. The AIMSweb Math Computation test is an eight-minute test that deals with basic computation skills. The AIMSweb Math Concepts and Application for sixth and seventh grade is an eight-minute test but the eighth graders have ten minutes. This test uses the math facts and applies them to math problems. Some students perform different on timed tests versus untimed test.

The MAP mathematics test scores from the 2010-2011 school year compared to the 2011-2012 school year showed that 81% of the students (N=27) had an increase in their score from the spring of 2011 to the spring of 2012. The percentages at which the scores increased varied greatly. The range in growth for the two school years was from one percent to an 11.6% increase. The pretreatment scores were about the same as the status norm for that school year. The post-treatment data showed a higher gain of points than the status norm group for that school year. The data also shows that there was an increase in the overall average of the MAP test scores from the 2010-2011 school year compared to the 2011-2012 school year (Figure 1).

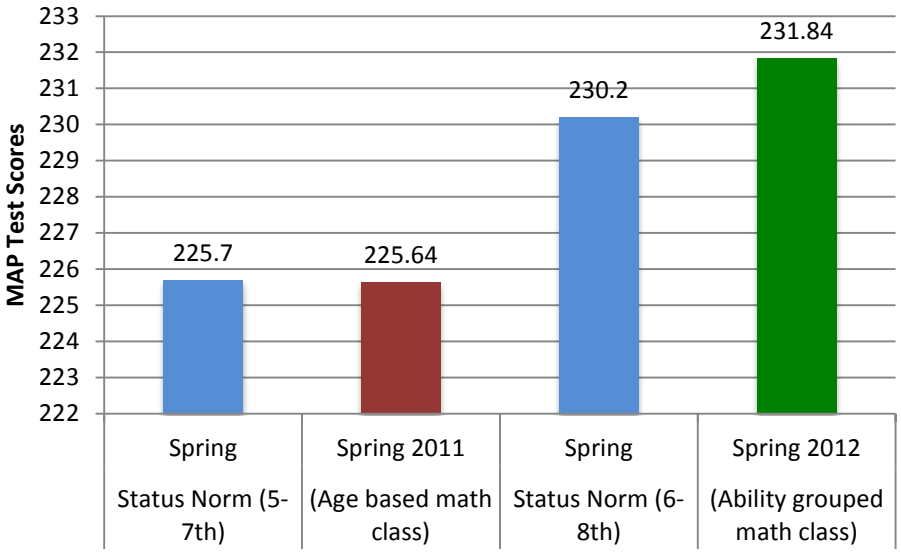

Figure 1. Average MAP Scores During the Spring of Pre and Post-Treatment, (*N*=27).

When looking at individual student scores it was noted that there were noticeable changes in the scores (Figure 2). Nineteen percent of the students' scores decreased from the spring of 2011 compared to the spring of 2012. Eighty-one percent of the students' scores increased when observing the pre and post-treatment. Some students whose points decreased only decreased by one point whereas others decreased by 17 points. Similar results were seen when the increase in scores was observed. Some students increased their scores by one point while others increased it by 19 points. The average points gained for the sixth, seventh and eighth grades in a school year for the status norm group was 5.1 points. Seventy-four percent of the students increased their scores by 5 points or more during this study.

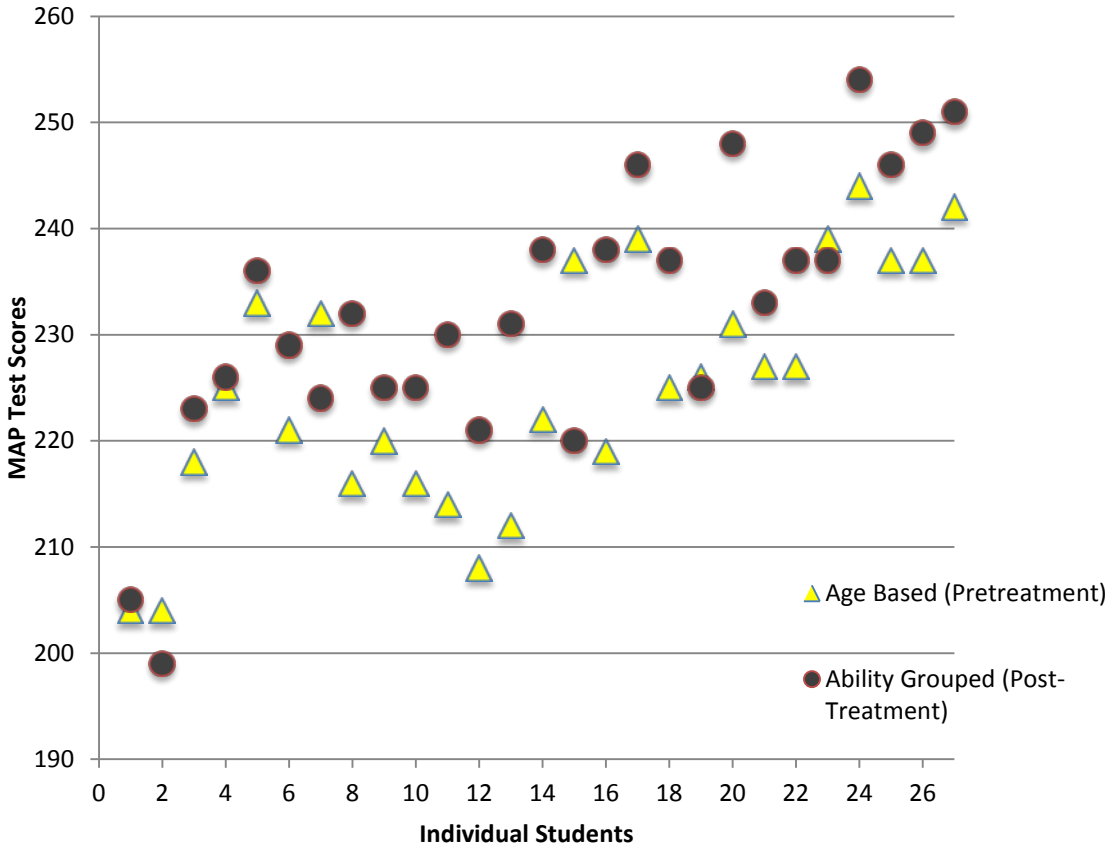

Figure 2. Individual Student MAP Scores Pretreatment and Post-Treatment, (*N*=27).

Due to the fact that all the students have varying MAP test scores to begin with, this study also looked at the average percent increase in points that students gained on the MAP test. What was found was that the percent change was larger in the pretreatment, 2010-2011 school year than the post-treatment (Figure 3).

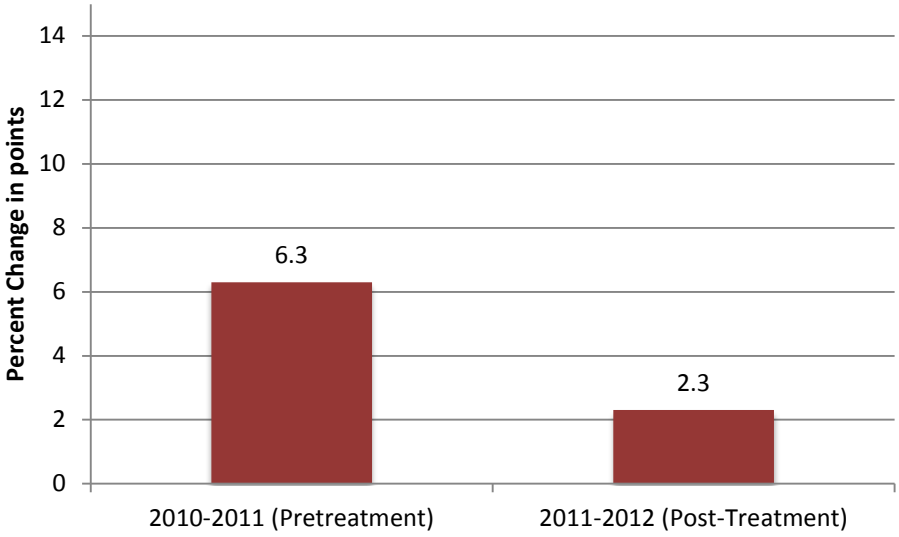

Figure 3. Average Percent Increase in Points on the MAP Test From 2010-2011 (pretreatment) School Year Compared to the 2011-2012 School Year, (*N*=27).

By taking a closer look at the students MAP test scores (Figure 4) it was found that the pretreatment scores were similar for all varying degrees of student ability but the post-treatment scores varied more. For example, the students who were working below grade level showed an increase of 13.8 points during the pretreatment and a .4 increase in points when put in an ability grouped math class otherwise identified as, post-treatment. The students working at their grade level went from an 11.5 increase in points to a 7.9 increase in points on their scores. The students working above their grade level went from a 14.0 increase in points to a 9.7 increase in points on their scores.

No matter which way math was taught at Potomac School, these last two years, the average increase in points are still higher than the status norm in all groups except for the below average ability grouped class. It also shows that the age based math class led to a greater increase in MAP test scores as compared to the ability grouped math class.

The data in figure 4 shows that the above grade level students were able to increase their points on the MAP test scores no matter which math class they were placed in. The below average students did not gain as many points on the MAP test scores when placed in an ability based math group. The students at grade level were able to increase their points more than the standard norm group as well.

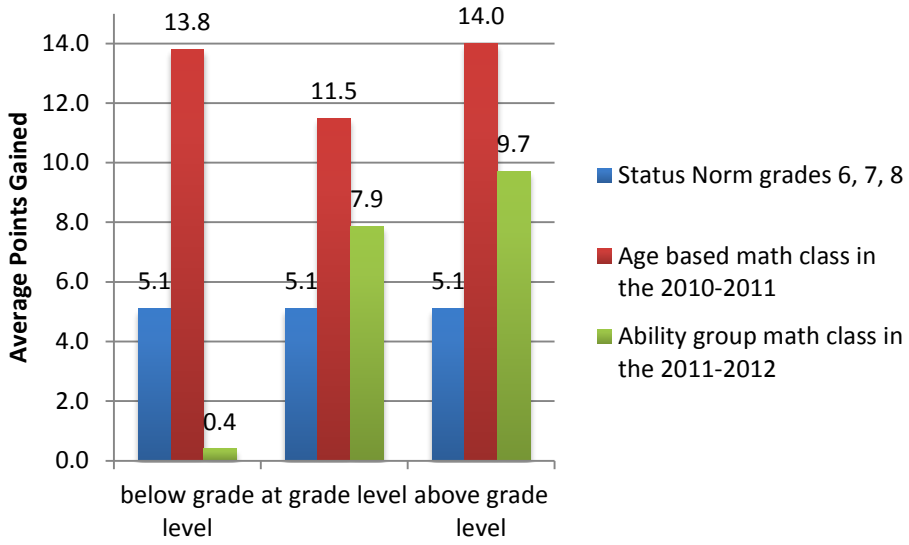

Figure 4. Average Points Gained on the MAP Test, (*N*=27).

Students in the different grades are expected to earn different amounts of points. The fifth graders are expected to gain 8.1 points, sixth graders six points, seventh graders 4.9 points and eighth graders 4.3 points from the fall to the spring of the school year that they are currently in. To account for the variability in the amount of points that the students were projected to gain a one value was used. This value was obtained by comparing what the students earned and compared it to the amount of points they were expected to gain. For example, if a sixth grader earned seven points they would get a value of 1.7 which is greater than the one value. The data in figure 5 shows that the

below grade level students showed the highest value, 3.0, when placed in an age based math class but did not perform well, a value of .1, when they were placed in an ability grouped math class. The students that were at grade level did better when they were in an age based math class receiving a 2.3 compared to the ability grouped receiving a 1.5. The above grade level students were about the same in the age based math class, 1.9 and the same students in the ability grouped math class were at a 1.8. Overall, whichever way the math class was arranged all the students were higher than the needed one value except the below grade level students that were placed in the ability grouped math class.

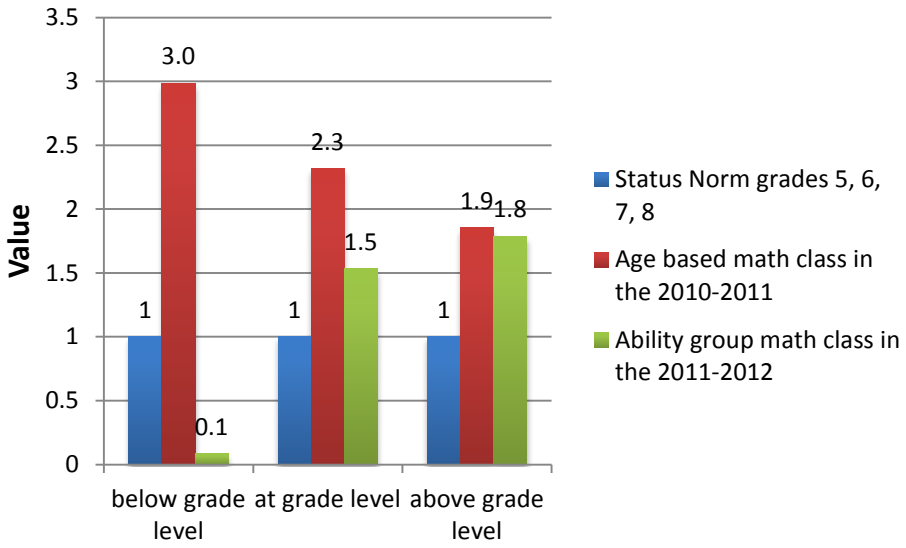

Figure 5. Students Scores Compared To Expected Growth On MAP Test, (*N*=27).

The percent increase in the AIMSweb Concepts and Application scores from fall of 2010 to the spring of 2011 was compared to the data from fall 2011 to the spring of 2012 to see if there was growth in their scores. The AIMSweb Concepts and Application showed that the overall percent increase in scores went from 8.1% to 16%.

This is a gain of 49% in their percent increase of scores from pretreatment to post-treatment (Figure 6).

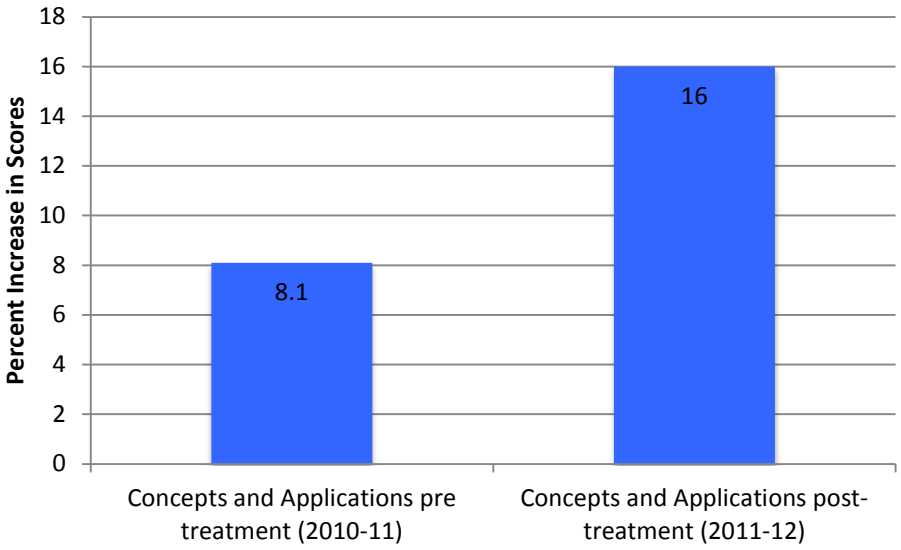

Figure 6. Percent Increase in AIMSweb Concepts and Application Scores Pre and Post-Treatment, (*N*=27).

The data from the AIMSweb Computation scores indicated that students in the pretreatment did better than the post-treatment by 6.7% (Figure 7).

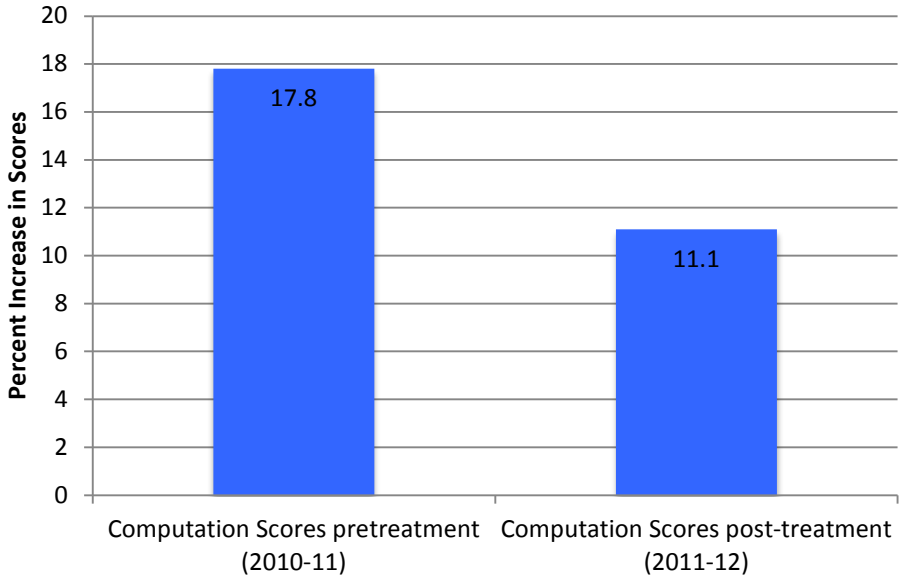

Figure 7. Percent Increase in AIMSweb Computation Scores Pre and Post-Treatment, (*N*=27).

The correlation between student motivation and student success was a valid point to address and will be addressed at Potomac School in the following years. Student motivation and willingness to work hard on the tests was key to student success in increasing their scores. The initial result in figure 8 show how 44% of the under motivated students had a decrease in their MAP scores where as only 6% of the highly motivated students had a decrease in their MAP test scores (Figure 9).

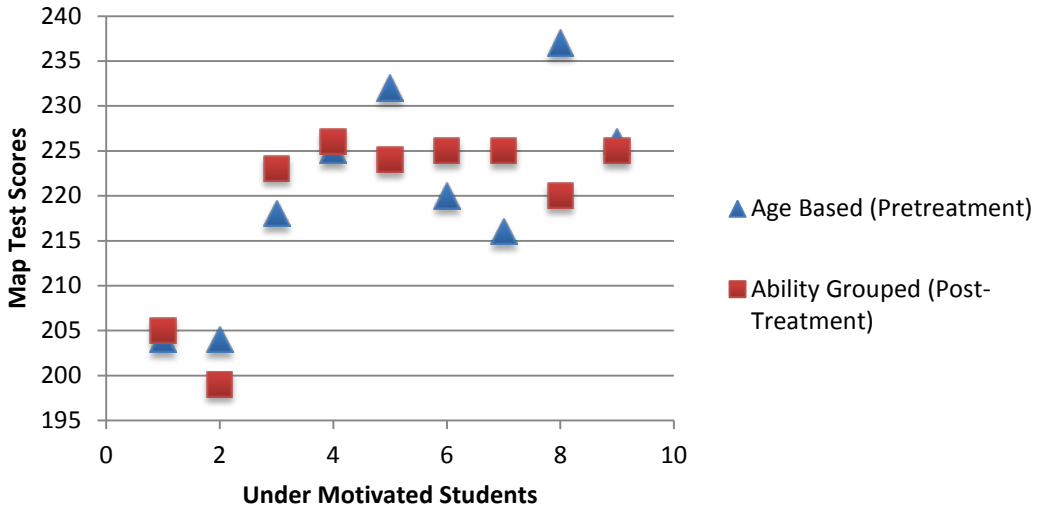

Figure 8. Comparison of Pretreatment and Post-Treatment MAP Test Scores From the Spring for Under Motivated Students, (*N*=9).

The highly motivated students (94%) had an increase in their MAP test scores. Only 6% of the students had a decrease in their score by 2 points. The rest of the students (89%) had at least a five point (status norm) or higher gain in their points. Sixty-one percent of the students had a ten or more gain in their points.

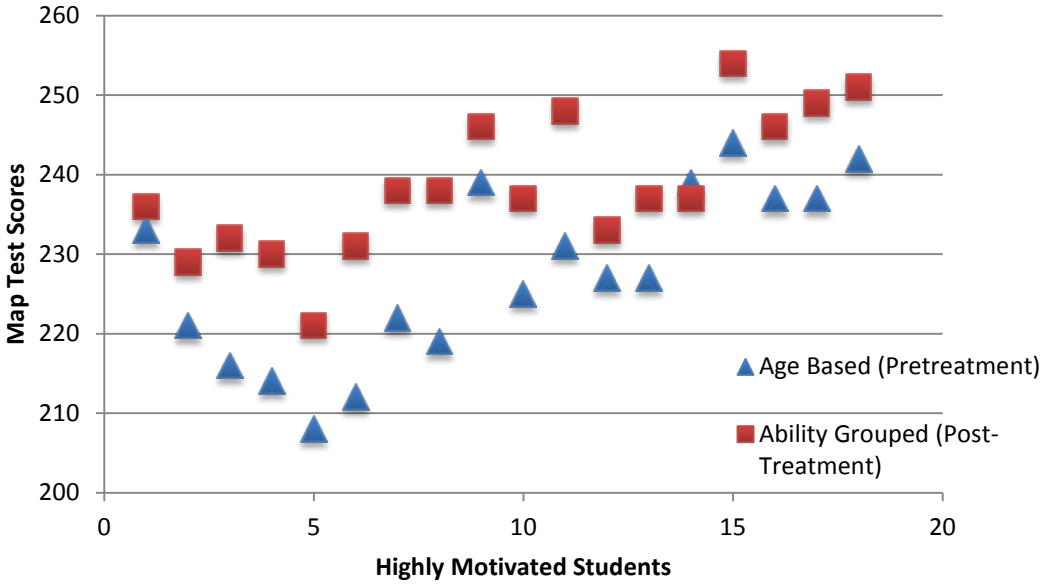

Figure 9. Comparison of Pretreatment and Post-Treatment MAP Test Scores From the Spring for Highly Motivated Students, (*N*=18).

The student surveys were taken during the fall and the spring of the 2011-2012 school year. An additional survey was taken in the winter but was not used for the final comparison. The survey results indicated that 50% of the students enjoyed math, which then increased to 75% during the post-treatment (*N*=32). Forty seven percent of the students said that they liked their math class last year (pretreatment) at the beginning of the 2011-12 school year. Then after being in the ability grouped math class during the treatment year the same question was asked and only 22% said they liked it last year (pretreatment). This shows that the students liked the ability grouped math class more than the age based math class by the end of the treatment year. Twenty-two percent of the students agreed that their math class was too easy last year during the initial survey but the final survey revealed that 66% of the students thought their math was too easy last year. Similar results came from the students saying that they felt like they had to wait on students to catch up in the pre (34%) and post (31%) treatment. There were 28% of the

students that were uneasy about math during the pretreatment that later dropped to 22% in the post-treatment.

INTERPRETATION AND CONCLUSION

When the students took the MAP and AIMSweb tests during the 2010-11 school year, they did not know what the scores would be used for. During the 2011- 2012 school year, the students knew their scores were taken into consideration and that they could potentially be moved into different ability math class depending on the score they received as well as teacher input. This gave some validity to the test and made students more aware of how the teachers used the test and they felt like they had control over what math class they were placed in. When the students were asked the question "the thought of being moved into a different math group keeps me motivated and working hard", 78% of the students agreed during the pretreatment and 88% of them agreed in the post-treatment.

With this knowledge came responsibility. Some students accepted that responsibility while others did not. The students that accepted the responsibility were able to move up into a different math class. They put in the extra time and work doing the things that the student needed to learn before placed in the upper math class. Nineteen percent of the students that did not increase their MAP test scores had a negative view of math. Twenty three percent said that they did not look forward to math class and 7% of these students also did not want to keep trying in math when it was hard.

The difference in the MAP test and AIMSweb test were very drastic. One was a timed test and the other was not. I have observed the students in my math class and have noticed that some of the gifted students may not be as good at timed tests, but when given the time to complete difficult problems they are able to figure them out. This variation in testing needs to be taken into consideration when dealing with this data.

Another interesting item that the data showed was that the AIMSweb concepts and applications scores went up but the AIMSweb computation scores went down pre to post-treatment. This may be a result of the teachers trying to make sure the students understand the new content they were covering and working less on the quick computation skills. The concepts and applications scores going up shows that the students are leaning how to apply the math information that they are gaining from their coursework.

The data also shows that individuals have varying results. If a student is more willing to spend the time in their math class to really learn the material and then be able to remember it come test time they will do much better on the test. Some students take these scores very personally and want to increase them by as many points as they possibly can. I witnessed this first hand with two students who spent a significant amount of time on the MAP test and they both scored much higher than the first time they took the test in the post-treatment year. If I had not given them their scores and showed them that I recorded them in a spreadsheet at the beginning of the post-treatment year, I do not know if I would have gotten the same results. We also talked about what these test scores mean for them when they go to high school. They were told that

depending on their scores they may be able to skip a class or two of math. Now it is goal of a couple of the students to skip at least Algebra 1 and possibly Geometry in high school.

VALUE

Working with the students and allowing them to see their growth or decline on these tests shows them the validity of the MAP and AIMSweb. I learned that just recording their scores and letting them see their scores change over time has increased motivation for most students. They now see how the tests are being used to help them learn. They also like to see an increase in their score from the last time and that motivated some students to a degree that is unbelievable. I had a sixth grade student who wanted to have the highest MAP test score in the school and she met her goal. If she had not been placed in an ability group math class I am not sure she would have met it because she would have not been exposed to the higher level curriculum. Placing students into ability groups has seemed to help most students, especially the above grade level students. During the pretreatment there were 44% of the students who said that they had high math ability. In the post-treatment that percentage increased to 53%. Confidence levels do not normally equate to increased performance. It just shows that the students think they are good at the math class that they are currently in. However, in a few cases the confidence levels do match up with increased performance. This seemed to be the case with the younger students who are placed in a math class that is at least one or more grade levels higher than their grade. I had several comments during the interviews that said, “I am not waiting around for other people to catch up.” The students

will also benefit from this type of grouping because they may be able to start in Geometry instead of Algebra 1 or in other cases be able to skip both Algebra 1 and Geometry in high school. Parents have benefited from this program as well because now their gifted math children are getting the extra push in a small rural public school setting.

Teachers are benefiting from the ability grouping because there are fewer students in a class and the abilities are relatively the same. The percentage of the students that liked a small class size during the pretreatment was 84% and then it rose to 94% in the post-treatment. Due to the small staff size, there are some math groups that are rather large and still have varying degrees of abilities.

Teachers were concerned about varying levels of grades and how students would feel about having students of all grades in their class but the data showed that 22% of the students were nervous to begin with and then that decreased to 16%. This seems like a very small concern now and the students are ok working with any age students in their math class. Twenty-eight percent of the students were nervous about switching from an age based math class to an ability grouped math class but that number decreased to 19% by the end of the post-treatment.

This was Potomac School's first year trying this and I think in order to see if it is really going to work we need to try it for several more years. From this action research project I have learned that student self-motivation and willingness to work through difficult problems will have a positive impact on test scores. I am going to continue to input the scores into a spreadsheet and show students the scores in order to increase their motivation to do well on them. In fact, I have had some fifth graders ask me to put their

scores into the spreadsheet so they can see how they do next year. The administrator has a spreadsheet of all the students' scores in the entire school that we will continues to add to in the future.

This was my first year of teaching math and I was asked to teach the top level of math in the middle school. This action research made me realize that the students need to have a hand in what they do in order to feel like they are learning for them not just the teachers. The students' scores seem to increase by larger numbers once they have a personal reason to do well on the test. Also, since I am teaching the top level it is up to me to make sure the students learn this material well enough for them to be able to skip a course in high school. I also need to make sure I keep pushing the students that excel in math and keep them challenged so they do not loose interest. In order to push these students I need to make sure I get to know them on a personal level so I know their limits. Overall, this action research has made me take a closer look at how I teach math and what information that I give to the students. I have learned that all information related to math should be given to the kids, good or bad in order to help them reach their full potential.

REFERENCES CITED

Cheung, C., & Rudowicz, E. (2003). Academic Outcomes of Ability Grouping Among Junior High School Students in Hong Kong. *Journal of Educational Research, 96*(4), 241. Retrieved from EBSCO*host*.

Chiu, D., Beru, Y., Watley, E., Wubu, S., Simson, E., Kessinger, R., & Wigfield, A. (2008). Influences of Math Tracking on Seventh-Grade Students' Self-Beliefs and Social Comparisons. *Journal of Educational Research, 102*(2), 125-136. Retrieved from EBSCO*host*.

Colangelo, N., Assouline, S. G., & Gross, M. U. (2004). *A nation deceived: How schools hold back America's brightest students.* Vol. 1 and 2.

Fiedler, E. D., Lange, R. E., & Winebrenner, S. (2002). In Search of Reality: Unraveling the Myths about Tracking, Ability Grouping, and the Gifted. *Roeper Review, 24*(3), 108. Retrieved from EBSCO*host*.

Gamoran, A. (1992). Is ability grouping equitable?. *Educational Leadership, 50*(2), 11. Retrieved from EBSCO*host*.

Goldring, E. B. (1990). Assessing the Status of Information on Classroom Organizational Frameworks for Gifted Students. *Journal of Educational Research, 83*(6), Retrieved from EBSCO*host*.

Hallam, S., Ireson, J., Lister, V., Chaudhury, I., & Davies, J. (2003). Ability Grouping Practices in the Primary School: a survey. *Educational Studies(03055698), 29*(1), 69. Retrieved from EBSCO*host*.

Hattie, J. C. (2002). Classroom composition and peer effects. *InternationalJournal of Educational Research, 37*(5), 449. doi:10.1016/S0883-0355(03)00015-6

McAllister, B., & Plourde, L. A. (2008). Enrichment curriculum: Essential for mathematically gifted students. *Education, 129*(1), 40-49. Retrieved from EBSCO*host*.

Oakes, J. (1985). *Keeping track: How schools structure inequality.* New Haven, CT: Yale University Press.

Oakes, J. A., Gamoran, & Page R. N. (1992). "Curriculum Differntiation: Opportunities, Outcomes, and Meanings." *In Handbook of research on Curriculum,* edited by P. W. Jackson. Washington, D.C.: American Educational research Association.

Olszewski-Kubilius, P. (2010). Special Schools and Other Options for Gifted STEM Students. *Roeper Review, 32*(1), 61-70. doi:10.1080/02783190903386892

Phillips, S. (2008). Are we holding back our students that possess the potential to excel?. *Education*, *129*(1), 50-55. Retrieved from EBSCO*host*.

Rogers, K. B. (2002). *Re-forming gifted education.* Scottsdale, AZ: Great Potential Press Inc.

Rubie-Davies, C. M. (2010). Teacher expectations and perceptions of student attributes: Is there a relationship?. *British Journal of Educational Psychology*, *80*(1), 121-135. Retrieved from EBSCO*host*.

Slavin, R. E. (1987). Grouping for Instruction in the elementary School. *Educational Psychologist*, *22*(2), 109. Retrieved from EBSCO*host*.

Tyler-Wood, T. L. (2000). An Effective Mathematics and Science Curriculum Option for Secondary Gifted Education. *Roeper Review*, *22*(4), 266. Retrieved from EBSCO*host*.

APPENDICES

APPENDIX A

MATH AND SCIENCE ATTITUDE SURVEY

Math and Science Attitude Survey

(https://docs.google.com/spreadsheet/viewform?formkey=dC1yZnI4RS15b19BSjV0em9LQm5iSkE6MQ)

Please note that your participation is voluntary, you may skip any question if you choose and you may end the survey at any time. Participation in this survey will not affect your class grade or standing.

Please tell me what you really think (be honest) by putting an X in the box corresponding to Strongly Agree, Agree, Undecided, Disagree, or Strongly Disagree. Please choose the best ONE. Thank you for your help!

1. Mathematics is enjoyable to me.

   Strongly Agree Agree Undecided Disagree Strongly Disagree

2. I liked the way our math class was last year. (Students were in a class based on their age)

   Strongly Agree Agree Undecided Disagree Strongly Disagree

3. I am nervous about this year's math class. (Students are in mixed aged classes)

   Strongly Agree Agree Undecided Disagree Strongly Disagree

4. Science is enjoyable to me.

   Strongly Agree Agree Undecided Disagree Strongly Disagree

5. I find ways to use mathematics in everyday life.

   Strongly Agree Agree Undecided Disagree Strongly Disagree

6. I find ways to use science in everyday life.

   Strongly Agree Agree Undecided Disagree Strongly Disagree

7. Mathematics is important in science.

   Strongly Agree Agree Undecided Disagree Strongly Disagree

8. Mathematics is just memorizing formulas and things.

   Strongly Agree Agree Undecided Disagree Strongly Disagree

9. Being in a class in which all students are at the same level is a good way for me to learn mathematics.

   Strongly Agree Agree Undecided Disagree Strongly Disagree

10. My math class last year was too easy.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

11. I feel like I will be challenged in my new math class this year.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

12. I feel challenged in my current science class.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

13. I am always waiting for other students to learn the math material so we can move on to a new topic.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

14. The pace in my math class is too fast. I feel like I cannot keep up.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

15. Mathematics makes me feel uneasy and confused.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

16. Communicating with other students helps me have a better attitude towards mathematics.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

17. I like a small class size for math.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

18. Science has math in it.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

19. I keep trying in math, even if the work is hard for me to do.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

20. I keep trying in science, even if the work is hard for me to do.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

21. I look forward to my math class.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

22. I look forward to my science class.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

23. I get very nervous doing math problems.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

24. I would be very nervous if there were older students in my math class.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

25. I would not feel smart if I were in in a class with younger students that knew the same information.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

26. I have low math ability.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

27. I have high math ability.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

28. I would feel smart if I were in the same class with older students that knew the same information.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

29. I like the idea of being able to move UP into another math group if my performance is great.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

30. I like the idea of being able to move DOWN into another math group if my math skills are lacking.

    Strongly Agree Agree Undecided Disagree Strongly Disagree

31. The thought of being moved into a different math group keeps me motivated and working hard.

Strongly Agree Agree Undecided Disagree Strongly Disagree

32. I typically get “lost” and can’t think of specific questions to ask.

Strongly Agree Agree Undecided Disagree Strongly Disagree

33. My parents or guardians make sure I do my homework assignments.

Strongly Agree Agree Undecided Disagree Strongly Disagree

APPENDIX B

STUDENT INTERVIEW QUESTIONS

Student Interview Questions

1. What did you like/dislike about your math class last year?
2. What do you like/dislike about your math class this year?
3. How are you being challenged in your math class this year?
4. What is the benefit of being in a class in which everyone is around the same ability?
5. What motivates you to do well in your math class/group?
6. Tell me something you would change (take out or add) with the math program.
7. Tell me how you feel about having students of all ages in your math class? (Tell me how you thought about at the beginning of the year compared to now.)
8. How has this ability group math class affected your science class? Explain.